State Water Resources Control Board

TO: **File Permit 20770B (A030049B) and License 13527A (A030049A)**

FROM: Zach Mayo, Engineering Geologist
Sacramento Valley Enforcement Unit
Division of Water Rights

DATE: April 14, 2020

SUBJECT: SUBTERRANEAN STREAM DETERMINATION, COYOTE VALLEY, LAKE COUNTY

This State Water Resources Control Board (State Water Board), Division of Water Rights (Division) staff memorandum contains an analysis of regional and local geology of Coyote Valley to determine if water within the Coyote Valley Basin alluvial aquifer meets the Garrapata four-part test for subterranean streams. Hidden Valley Lake Community Services District (HVLCSD) submitted a report prepared by its consultant, Wagner & Bonsignore, in support of HVLCSD's assertion that its source wells are not drawing water from a subterranean stream, and that report has been reviewed by Division staff as part of this analysis. Division staff also evaluated the surface and subsurface geology of Coyote Valley through published literature, geologic maps, and well completion reports obtained from the Department of Water Resources (DWR). As discussed in more detail in sections below, Division staff concludes that the water in the Coyote Valley Basin alluvial aquifer is not within the permitting authority of the State Water Board because there is insufficient evidence to reasonably infer that the Coyote Valley alluvial aquifer meets all the parts of the Garrapata four-part test for subterranean streams.

The evidence indicates the following:

1) There is evidence to suggest that there is not a clearly defined bed that would form a subsurface channel; therefore, the alluvium is not uniformly bound by bed and banks.
2) The known geologic units bounding the Coyote Valley alluvial aquifer are not relatively impermeable.
    a. The northern margin of the alluvium shows outcropping of Plio-Pleistocene olivine basalt and Plio-Pleistocene Cache Formation, and there is evidence to suggest that both of these units have producing groundwater extraction wells developed.
    b. Division staff found evidence that suggests that the Cache Formation is water bearing and underlies most of the alluvial sediments of Coyote

Approved 04/14/2020

Valley as indicated by published literature and interpretation of well completion reports.

c. The production of the alluvial aquifer varies greatly over the extent of Coyote Valley and although the HVLCSD wells demonstrate greater production, elsewhere in the valley the groundwater production of the alluvial aquifer is similar to the well production of the underlying olivine basalt and Cache Formation to the north.

INTRODUCTION

Pursuant to Water Code Sections 1200 and 1201, all water flowing in a natural channel, including subterranean streams flowing through known and definite channels, is public water of the state and is subject to appropriation and therefore, within the permitting authority of the State Water Board. In Decision 1639 (certified June 17, 1999), the State Water Board identified a four-part test to define what constitutes a subterranean stream flowing in a known and definite channel, which has since been referred to informally as the Garrapata four-part test for subterranean streams flowing through known and definite channels.

Division staff performed a subterranean stream analysis of the groundwater within the alluvial aquifer of Coyote Valley, which is located approximately four miles northeast of Middletown along Putah Creek in Lake County. Coyote Valley trends along a northwest to southeast axis and is approximately five miles long and 2.5 miles wide at the widest margin (Figure 1). Coyote Valley Basin is a groundwater basin recognized by the Department of Water Resources as a “very low priority” groundwater basin according to the Sustainable Groundwater Management Act Basin Prioritization for 2019.

HVLCSD owns and operates five groundwater extraction wells within the Coyote Valley Basin aquifer and extracts water through these wells under appropriative water right Permit 20770B and License 13527A issued by the State Water Board. At the time of its applications for these appropriative water rights in 1991, HVLCSD claimed that the water diverted through its wells is part of Putah Creek underflow, and therefore, was determined to be within the State Water Board’s permitting authority (Figure 3). At the time of permit issuance, the State Water Board did not dispute or investigate HVLCDS’s assertion that the wells were drawing water from Putah Creek underflow. Also, the State Water Board has stated in 1999 in Decision 1639 that underflow is a subset of a subterranean stream; however, “while subterranean streams include underflow, it is not necessary that groundwater be underflow to establish the existence of a subterranean stream flowing through a known and definite channel”. Therefore, since HVLCSD asserted that the wells were drawing water from underflow, its applications to appropriate water were approved by the State Water Board. HVLCSD has also claimed riparian water rights for underflow of Putah Creek at the same locations as their pumps and points of diversions under Permit 20770B and License 13527A.

On January 3, 2013, HVLCSD filed petitions to change the place of use and to remove conditions contained in water rights Licenses 13527A and Permit 20770B that require groundwater level monitoring and conditions that require pumping of groundwater into Putah Creek upstream of United States Geological Survey (USGS) Guenoc gaging station to supplement flows in Putah Creek during low flow periods.

On October 14, 2014, HVLCSD was issued Compliance Order No. 02_03_14R_004 by the Division of Drinking Water (DDW) stating that HVLCSD did not have a reliable and adequate supply of water for its existing customers because the State Water Board can curtail HVLCSD's post-1914 appropriative water rights during drought conditions, such as it did in years 2014 and 2015. The DDW compliance order included a moratorium on new service connections unless HVLCSD can demonstrate it has a reliable and adequate supply of water.

On May 9, 2019 HVLCSD provided the Division with a memo and a report prepared by their consultant, Wagner & Bonsignore. In this memo, HVLCSD states that the filing of the water rights applications for Putah Creek was done in 1991 out of an abundance of caution in order to meet the deadline to establish surface water right claims under the Putah Creek stream adjudication. The report provided by HVLCSD's consultants asserts that the groundwater aquifer in Coyote Valley is not a subterranean stream, and consequently, at least two of their wells do not require a post-1914 water right.

REVIEW OF HVLCSD REPORT

The memo and report submitted by HVLCSD, dated April 4, 2019, followed similar methodology, discussed below, as Division staff to conclude that at least two wells (Well GR-4 and Ag Well) operated by HVLCSD are not drawing water from a subterranean stream. Division staff reviewed the report and found the methodology to be logical and sound and found the analysis provided within the report to be an accurate representation of the available data within Coyote Valley.

The main points of the report are listed below:

- HVLCSD wells are drawing water from the alluvial aquifer of Coyote Valley and three of their wells may encounter Cache Formation (Well GR-2, Well GR-3, and Well GR-4).
- Water within the Coyote Valley alluvium may be bound by relatively impermeable bed and banks to the northwest but is not bound by relatively impermeable bed and banks to the northeast because the olivine basalt is shown to be water bearing and there is currently insufficient data to conclude that the Cache Formation is or is not water bearing.
- There is no evidence of a relatively well-defined subsurface channel because of the interbedded fine and coarse-grained strata that shows the variability of alluvial deposits present throughout Coyote Valley.
- Because the water within the alluvial aquifer of Coyote Valley does not meet all four parts of the Garrapata four-part test, the two wells operated by HVLCSD

(Well GR-4 and Ag Well) are not within the permitting authority of the State Water Board.

STAFF ANALYSIS

METHODS

The methods used by Division staff to analyze if there is enough evidence to reasonably infer if the water within the alluvium of Coyote Valley is part of a subterranean stream are similar to methods used by previous Division staff. Below is a list of these methods:

- A review of regional geology and local geologic information which includes formation analysis, formation thickness as inferred from stratigraphic analysis of published literature, and depositional analysis.
- Review of specific capacities to identify relative permeabilities of the Coyote Valley geologic formations.
- Comparison and analysis of geologic information and well completion reports to interpret subsurface lithology and thickness of alluvium and other geologic formations.
- Analysis of the Garrapata four-part test for subterranean streams and comparison of the geologic information with respect to the four parts of the test.

GARRAPATA FOUR-PART TEST FOR SUBTERRANEAN STREAMS

For groundwater to be classified as a subterranean stream flowing through a known and definite channel, the following physical conditions must exist (pursuant to State Water Board Decision 1639):

1. A subsurface channel must be present;
2. The channel must have relatively impermeable bed and banks;
3. The course of the channel must be known or capable of being determined by reasonable inference; and
4. Groundwater must be flowing in the channel.

Division staff will present information that pertains to the geology of Coyote Valley to perform an analysis of the geology and hydrogeology with respect to whether the water within the alluvial aquifer can be reasonably inferred to meet the four parts of the Garrapata four-part test. Specifically discussed will be the geologic units, hydrogeology, publicly available published literature, specific capacity of water wells in Coyote Valley and surrounding areas, and well completion reports within Coyote Valley and surrounding areas.

COYOTE VALLEY GEOLOGY

Division staff reviewed the geology of the Coyote Valley to determine which geologic formations are water bearing and if these are underlain by relatively impermeable formations. Division staff reviewed in detail quadrangle geologic maps available in

reports by Brice (1950) and Koenig (1963) which included Coyote Valley and surrounding areas. According to the geologic maps, Coyote Valley is a Quaternary alluvium filled valley that is bounded to the west and northwest by sediments of the Jurassic-Cretaceous Franciscan-Knoxville groups and undifferentiated Cretaceous rocks (Koenig, 1963). To the north, east, and southwest of Coyote Valley, Plio-Pleistocene Cache Formation outcrops along with Plio-Pleistocene olivine basalt (Brice, 1950 and Koenig, 1963). Basic intrusive rocks, predominantly serpentine, outcrops throughout the valley and are bounding Coyote Valley alluvial sediments to the south along with Upper Jurassic Knoxville group (Brice, 1950; Koenig, 1963; Appendix A, see Brice, 1953 F-F'). The Cache Formation and olivine basalt appear to be shallowly interfingered with the Cache Formation eventually underlying the olivine basalt at depth. Cache Formation, and possibly olivine basalt, appears to underly much of the alluvium of Coyote Valley (Brice, 1950; Upson and Kunkel, 1955; DWR, 1962). The Quaternary alluvium, olivine basalt, and Cache Formation are all in conformable contact which indicates that there is no gap in time or erosional surface between the alluvium and Cache Formation (Brice, 1953; Upson and Kunkel, 1955; and DWR, 1962).

QUATERNARY ALLUVIUM

The Quaternary alluvium within Coyote Valley consists of unconsolidated to semi-consolidated sinuous deposits of fine to coarse-grained floodplain and stream channel deposits, and of inconsistently stratified fine-grained material of alluvial fan, lacustrine, and colluvial deposits (DWR, 1962). The stream channel deposits consist of angular to rounded sand and gravel and are the most productive water bearing units in the alluvium (DWR, 1962). The flood plain deposits are considered to have low permeability; consist of fine-grained sand, silt, and clay; and generally, occur between stream deposits and colluvium (DWR, 1962). The lacustrine deposits were deposited during periods of fresh-water lake inundation and are generally fine-grained sand, silt, and blue clays that have low permeabilities (DWR, 1962). The thickness of the alluvium within Coyote Valley is variable but appears to be between 100 and 200 feet thick and possibly as much as 300 feet thick in places (Brice, 1953; DWR, 1962; and Upson and Kunkel, 1955).

The most productive wells within Coyote Valley are those that are owned and operated by HVLCSD and appear to be screened at variable intervals approximately 20 to 170-ft below ground surface in coarse-grained stream channel layers that are bounded between silty or sandy clay intervals (Figure 3; Appendix A). However, the stream channel deposits appear to be inconsistently stratified throughout the valley and most of the well completion reports appear to be screened in fine-grained alluvial deposits (Figure 5; Appendix A). Division staff did not find well completion reports that indicate wells that are as productive as HVLCSD wells, nor did Division staff find well completion reports for wells that encountered stream channel deposits as abundant as deposits encountered by HVLCSD wells.

PLIO-PLEISTOCENE OLIVINE BASALT

The Plio-Pleistocene olivine basalt flows are described as remnants of several overland lava flows that occurred over time and that they are nearly contemporaneous with Cache Formation deposition (Brice, 1953). The olivine basalt is highly fractured in places, quartz-bearing, vesicular, and ranges in thickness from 50 to 500 feet thick (Brice, 1953 and DWR, 1962). The outcrop of olivine basalt to the north of Coyote Valley is approximately 4 miles wide and 8 miles long. DWR describes the olivine basalt as being highly fractured and having a high permeability, and when the basalt occurs at or beneath the level of various valley floors within the Clear Lake quadrangle, it is within the zone of saturation and could potentially provide abundant quantities of water. DWR also describes the olivine basalt as a unit that is notable for accepting recharge for the groundwater basin by acting as a forebay for groundwater when the olivine basalt is within the zone of saturation. Therefore, based on DWR's description of the olivine basalt of the region, Division staff deduces that the olivine basalt bounding the Coyote Valley alluvium, especially to the north of Coyote Valley where Putah Creek's surface flow is on olivine basalt, could potentially be within the zone of saturation. Based on the Brice and Koenig geologic maps, Division staff also interprets that the olivine basalt is locally extensive and could potentially be a significant source of recharge to the groundwater within the alluvial aquifer of Coyote Valley. DWR describes the olivine basalt as being highly permeable and, given the size of the olivine basalt outcrop with respect to the size of Coyote Valley, the unit could be an area where long-term water storage is taking place and providing recharge to the alluvial aquifer when recharge to the alluvial aquifer is not being provided by Putah Creek surface flow (Appendix A).

PLIO-PLEISTOCENE CACHE FORMATION

The Cache Formation consists of continental deposits of semi-consolidated silts, gravels, and clays, with beds of tuffaceous sand, marl, limestone, and diatomite (Brice, 1953; DWR, 1962; and Koenig, 1963). The thickness of the Cache Formation ranges from 300 to as much as 6,500 feet thick within the Lower Lake quadrangle (Brice, 1953 and DWR, 1962). Stratigraphic sections for the Lower Lake quadrangle and upper Putah Creek basin differ with respect to which formations bound the Cache Formation at depth. The stratigraphic section presented by DWR suggests that Cache Formation is bounded by Pliocene Sonoma Volcanics consisting of flows of andesite and rhyolite with interbeds of sandy tuff and mudflows that are generally low in permeability but have some higher yields in the sandy tuffs. The stratigraphic section presented by Brice suggests that the Cache Formation is underlain by Paleocene Tejon Formation that is a white conglomeratic sandstone which Division staff assumes would have some level of permeability. Division staff interprets this to mean that the Cache Formation is in conformable contact with Sonoma Volcanics and in areas where Cache Formation is underlain by Tejon Formation there is an unconformable contact. In either scenario, if Cache Formation is underlain by Sonoma Volcanics or Tejon Formation, both units appear to be permeable and are likely not bounding the water that is within the Cache Formation.

Cache Formation is intercalated with olivine basalt and has many productive wells drilled within these formations to the northeast of Coyote Valley (Figure 2; Appendix A). DWR suggests that the groundwater in Coyote Valley is found in the Cache Formation and in the recent alluvium along buried stream channels of Putah Creek and that because the deposition of the Cache Formation and alluvium is heterogenous, that there is no evidence of any well-defined aquifer in the Coyote Valley basin. Collayomi Valley and Long Valley, south of Coyote Valley, are similarly situated and are depositional valleys that provide an illustrative proxy to Coyote Valley in that the Quaternary alluvium has been deposited in a heterogenous nature with buried stream channels and fine grained lacustrine, alluvial fan, and colluvial deposits with varying production of the groundwater wells (Figure 5 and DWR, 1962).

SPECIFIC CAPACITY OF WELLS

For the purpose of the analysis in this memorandum, the specific capacity (SC) of wells was calculated in order to qualitatively analyze the production of wells within representative units. SC is defined as the pumping rate of a well, typically measured in gallons per minute (gpm) divided by the distance of drawdown, typically in feet. The units of SC are gpm/ft. The representative units that are analyzed are the Quaternary Alluvium, the Plio-Pleistocene Cache Formation, and the Plio-Pleistocene olivine basalt. These three formations have the most well completion reports associated with them and offer the most information with respect to whether the groundwater in the alluvium within Coyote Valley can be shown to form a subterranean stream bounded by relatively impermeable bed and banks. The SC values of wells within these units were closely analyzed in order to determine if there is a reasonable inference that well production throughout the Coyote Valley alluvial aquifer is overwhelmingly more productive than that of the underlying Cache Formation or olivine basalt, which would indicate that the water within the alluvium is bound by relatively impermeable bed and banks. Typically, in order to obtain an accurate specific capacity, a well pump test will be performed continuously for 24 hours before recording the drawdown to allow the drawdown to stabilize (Driscoll, 1986). However, none of the well completion reports within Coyote Valley or the surrounding areas indicate that pump tests were performed for 24 hours. The tests were typically performed between two and eight hours. Also, the diameters of the wells vary greatly, and Division staff views this as problematic when comparing specific capacities of wells throughout Coyote Valley and the surrounding area. However, there are no other metrics available to Division staff to evaluate relative permeabilities of formations in Coyote Valley.

In general, the most productive wells within Coyote Valley and the surrounding area are the wells that are owned and operated by HVLCSD (Figure 3), which are screened in the quaternary alluvium. These wells have SC values that are on average two orders of magnitude greater than most of the wells developed in the Cache Formation or the olivine basalt (Table 1). Division staff located eight wells developed within the area of mapped olivine basalt that are within one to two orders of magnitude as productive as the most productive alluvial aquifer wells. The olivine basalt wells yield an average SC value of 0.6 gpm per foot of drawdown with the highest yielding 1.43 gpm per foot of

drawdown. For comparison, the most productive alluvial aquifer well that Division staff analyzed is HVLCSD's Ag well that has an SC value of 59 gpm per foot of drawdown (Appendix A, Well No. 32402; Table 1).

Published literature suggests that wells in Lower Lake that are producing water from Cache Formation have the potential to yield a minimum of 150 gpm and may yield as much as 200 gpm (Upson and Kunkel, 1955). However, Division staff could not locate these wells and they may no longer produce this amount or be productive at all. Division staff interprets that this is an indication that the Cache Formation is productive. Also, there are two wells to the northwest of Coyote Valley, 007478 and 002295, that are screened at 360-550 ft and 380-560 ft which is likely below the alluvium and may be within the Cache Formation.

Table 1: Specific Capacity

Well Number	Water Elevation	Geologic Unit	SC Value
007478	Not Logged	Quaternary Alluvium	N/A
002295	Not Logged	Quaternary Alluvium	N/A
264476	960	Quaternary Alluvium	16.48
375939 HVLCSD Well #3	931	Quaternary Alluvium	1.06
769936 HVLCSD Well #4	938	Quaternary Alluvium	2.27
32402 HVLCSD Ag well	945	Quaternary Alluvium	58.82
784498	904	Quaternary Alluvium	0.19
713807	950	Quaternary Alluvium	0.45
228005	965	olivine basalt	1.11
84195	1290	olivine basalt	1.43
e033469	900	olivine basalt	0.33
211175	1042	olivine basalt	0.7

WELL COMPLETION REPORTS

Division staff reviewed approximately 875 well completion reports obtained from DWR for wells completed within Coyote Valley and the surrounding areas. Division staff reviewed well completion reports for adjacent geologic units and alluvial valleys; however, those well completion reports and the geology therein will not be taken into consideration for this analysis with the exception of comparing Coyote Valley to Collayomi Valley and Long Valley as an illustrative comparison of the Quaternary alluvium cross section reviewed in published literature (Figure 5). Division staff chose

not to consider well completion reports for adjacent alluvial valleys because evaluating the alluvium thickness and contact to geologic units was uncertain in adjacent valleys, as it is in Coyote Valley, and did not reveal any valuable information that allowed Division staff to determine if the water within the Coyote Valley alluvium could be inferred to be part of a subterranean stream. Division staff's primary focus was on well completion reports that had detailed geologic descriptions of the subsurface Quaternary alluvium, Plio-Pleistocene Cache Formation, and Plio-Pleistocene olivine basalt.

In general, none of the well completion reports indicated precise or detailed changes in lithology nor did they call out contacts between formations (i.e. alluvium-Cache Formation contact). The information presented in many of the well completion reports is oversimplified and lacking detail, and Division staff had to interpret lithologic changes by assuming likely contact depth and the geographic location of the well. However, Division staff has interpreted that several well completion reports within the Quaternary alluvium have encountered Cache Formation and, in some instances, Cretaceous undifferentiated sedimentary units (Appendix A). This supports the assertion by Brice, Upson, and DWR that the alluvium in Coyote Valley is likely underlain by Cache Formation or olivine basalt. All the well completion reports developed within the Quaternary alluvium show that the screened intervals are within Quaternary alluvium with two exceptions (Table 2; Appendix A). Wells 002295 and 007478 are both drilled to approximately 600 ft below ground surface (bgs) and both wells are screened at two intervals (Figure 4; Appendix A). Well 002295 is screened at 180-340 ft bgs and 380-560 ft bgs, and well 007478 is screened at 180-340 ft bgs and 360-550 ft bgs. Both well completion reports offer poor descriptions of the subsurface geology and have logged most intervals as either clay or hard rock (Appendix A). Division staff interprets that these wells are likely drilling through the Quaternary alluvium and into deeper production units at the lower screened intervals. While the upper screened intervals could potentially be drawing water, at least partially, from Quaternary alluvium, the deeper screened intervals are likely deeper than the extent of alluvium and are likely developed into either Plio-Pleistocene Cache Formation or olivine basalt. Division staff interprets this to mean that while the water drawn from these wells is likely saturating the quaternary alluvium, the intent of drilling these wells and screening them at such depths is to reach water that exists in a productive unit below the alluvium.

As with the wells developed in Quaternary alluvium, all the wells developed to the north of Coyote Valley that are geographically located in mapped Plio-Pleistocene olivine basalt are screened at depth in intervals that are drawing water from either olivine basalt or Cache Formation. Division staff was unable to determine lithologic unit changes from the well completion reports for wells developed in the olivine basalt and assumes that some of the wells are drawing water from Cache Formation because of the interbedded nature of Cache Formation and olivine basalt as described in published literature.

Table 2: Wells with Screened Elevations

Well Number	Elevation	Water Elevation	Geologic Unit	Screened Interval Below Ground Surface	SC Value	Screened Elevation
007478	1010	Not Logged	Quaternary Alluvium	180-340 ft 360-550 ft	N/A	820-660 640-450
002295	1000	Not Logged	Quaternary Alluvium	180-340 ft 380-560 ft	N/A	820-660 620-440
264476	980	960	Quaternary Alluvium	50-100 ft	16.48	930-880
375939 HVLCSD Well #3	960	931	Quaternary Alluvium	80-170 ft.	1.06	880-790
769936 HVLCSD Well #4	960	938	Quaternary Alluvium	50-110 ft and 148-188 ft.	2.27	910-850 812-772
32402 HVLCSD Ag well	960	945	Quaternary Alluvium	20-32, 35-50, 54-74, 78-86, 96-106 ft	58.82	940-854
784498	920	904	Quaternary Alluvium	30-80 ft	0.19	890-840
713807	970	950	Quaternary Alluvium	45-85ft	0.45	925-885
228005	1300	965	olivine basalt	295-335 ft	1.11	1005-965
84195	1300	1290	olivine basalt	45-85 ft	1.43	1255-1215
e033469	1120	900	olivine basalt	140-220 ft	0.33	980-900
211175	1180	1042	olivine basalt	205-305 ft	0.7	975-875

SUBTERRANEAN STREAM ANALYSIS

GARRAPATA 4-PART TEST

In this section, Division staff applies the Garrapata four-part test to the geologic and hydrologic information presented in the previous section.

Subsurface Channel

The Quaternary alluvium of Coyote Valley is bound to the west and northwest by sediments of the Jurassic-Cretaceous Franciscan-Knoxville groups and undifferentiated Cretaceous rocks forming the west bank of the subsurface channel (Koenig, 1963). However, there is no evidence to suggest to what depth these formations bound the Quaternary alluvium. The east limb of the subsurface channel is comprised of olivine basalt and Cache Formation. Division staff interprets that the Cache Formation is likely underlying Coyote Valley at some depth and the presumption is that this formation is forming the bed of the subsurface channel. The Quaternary alluvium is irregular and poorly defined because the alluvial sediments within Coyote Valley have a heterogenous origin. Well completion reports for wells within Coyote Valley alluvium show a subsurface that is comprised of lacustrine fine-grained sediments, cemented to semi-cemented conglomeritic strata (which may be Cache Formation), fine to coarse-grained stream channel deposits, and fine-grained alluvial fan deposits (see Figure 5 as an illustrative proxy).

Division staff has interpreted published literature, geologic maps, and well completion reports and has determined that the available evidence suggests that there are formations to the north and south of Coyote Valley that would form the banks of a subsurface channel; however, there is no clearly defined contact between the alluvium and other formations that would form a bed of a subsurface channel.

For the purpose of this analysis, Division staff will presume that there are formations bounding the alluvium at some depth in order to continue evaluating the other parts of the Garrapata four-part test.

Impermeable Bed and Banks

Division staff analyzed approximately 875 well completion reports, multiple geologic maps, and multiple published papers discussing the hydrology of Coyote Valley and the surrounding geology. Division staff has determined that there is a reasonable amount of information available to suggest that the northwest of the Coyote Valley alluvial aquifer is at least partially bounded by impermeable bedrock at some depth because the rock that outcrops in this area is mapped as sediments of the Jurassic-Cretaceous Franciscan-Knoxville groups and undifferentiated Cretaceous rocks; however, Division staff cannot rule out the possibility that permeable olivine basalt or, more likely, Cache Formation is underlying the alluvium (Koenig, 1963). This interpretation is based on the small outcropping of Cache Formation mapped to the northwest of Coyote Valley and the well completion reports for wells 007478 and 002295 which indicate that there may be a productive formation below the Quaternary alluvium by screening an interval at depth that Division staff interprets as being below the extent of the Quaternary alluvium. Division staff has also analyzed several well completion reports that may be drilled to a depth where Cache Formation was encountered.

Division staff has determined that there is enough evidence to suggest that the water within the Coyote Valley alluvial aquifer is not bounded by relatively impermeable bed and banks to the north and east of Coyote Valley. There are outcrops of Plio-Pleistocene Cache Formation and Plio-Pleistocene olivine basalt mapped to the north and east of Coyote Valley and several descriptions in published literature suggest that these formations underlie much of Coyote Valley and are likely water bearing (Brice, 1953; Upson and Kunkel, 1955; DWR, 1962; Koenig, 1963).

DWR also describes the olivine basalt as being notable for accepting recharge for the groundwater basin by acting as a forebay for groundwater recharge. The assertion that the Cache Formation and olivine basalt may be water bearing is further supported by the presence of multiple wells drilled north of Coyote Valley within the olivine basalt and the well completion reports for these wells indicate that their screened intervals are within either olivine basalt or Cache Formation (Appendix A). There is no indication that any of the wells developed to the east of Coyote Valley are drilled through the olivine basalt formation. Division staff analyzed the SC values of each well within the Quaternary alluvium and found that there is abundant variability over the extent of Coyote Valley and even HVLCSD wells 32402 and 375939, which are approximately 1,100 feet apart, exhibit highly variable subsurface geology and SC values (Appendix A; Table 1). Also, when comparing the SC values of wells developed within the olivine basalt and Cache Formation to the east of Coyote Valley with most of the wells developed in the Quaternary alluvium of Coyote Valley, the values are similar. Division staff interprets this to mean that the olivine basalt and Cache Formation are likely not bounding the water within the Coyote Valley alluvial aquifer (Appendix A; Table 1). Also, because the SC values differ greatly over the alluvial aquifer wells, Division staff interprets this to mean that water likely moves rapidly through unconfined coarse-grained materials of stream channel deposits but that the overall productivity of the Coyote Valley alluvial aquifer is similar to that of the olivine basalt and Cache Formation and, as suggested by published literature, the alluvial aquifer may even be supported by the olivine basalt acting as a forebay and accepting recharge for groundwater (DWR, 1962).

Additional analysis performed by Groundwater Ambient Monitoring and Assessment (GAMA) Unit engineering geologist staff within the State Water Board's Division of Water Quality indicate that the water in the Coyote Valley alluvial aquifer is likely mostly sourced from the surrounding olivine basalt based on water quality evaluations, which provides additional evidence that the olivine basalt is not an impermeable unit that bounds the water within the alluvial aquifer. GAMA Unit staff reviewed information regarding the water quality within HVLCSD wells that are available through the GAMA Program and found that the HVLCSD wells contain "relatively elevated concentrations of hexavalent chromium (Cr6), above the Health Based Screening Level of 20 µg/L" (State Water Boards Division of Water Quality GAMA Unit Staff Review of the Subterranean Stream Determination for Coyote Valley, Lake County, February 2020). GAMA Unit staff further states that the "presence of Cr6 at these concentrations indicates that groundwater accessed by the HVLCSD wells is at least partially connected to the Olivine Basalt formation" and that "although the aquifer may be in

hydraulic connection with the Putah Creek seasonally (high water flow), the distance, local geology and presence of Cr6 in groundwater do not support an idea that the Putah Creek and associated sub-terranean stream is a sole source of water for the HVLCSD wells".

Course of the Channel

Division staff attempted to infer the course of the subsurface channel by interpreting geologic maps and well completion reports. Division staff concludes that the course of the subsurface channel is likely following the general east to southeast gradient of the Coyote Valley land surface as demonstrated in the topography information in the geologic maps. Well completion reports indicate that the alluvium in Coyote Valley is likely undulating and irregular and some of the well completion reports indicate that Cache Formation may have been encountered. Division staff concludes that the well completion reports do not refute the conclusion that the course of the subsurface channel is following the general east to southeast gradient of Coyote Valley.

Flowing Water

Division staff did not find evidence to support that there is water flowing through a known and definite channel even though Division staff presumes that a subsurface channel may be present. The bed and east bank of the subsurface channel is comprised of Cache Formation and olivine basalt, both of which are permeable as suggested from Division staff interpretation of well completion reports, published literature, and water quality analysis by GAMA Unit staff. Division staff attempted to infer a direction of flow by evaluating water elevation between well completion reports and found that there is not enough evidence to support that water is flowing. As stated before, there is evidence to suggest that groundwater may be sequestered to storage within olivine basalt to the north of Coyote Valley (DWR, 1962). Division staff deduces from this information that if there is water flowing through a subsurface channel, it is likely flowing into formations that may be bounding the alluvium but not bounding the water.

CONCLUSIONS

Division staff has determined that the information presented in this memorandum provides sufficient evidence to reasonably infer that there is no subsurface channel bed present and that the water within the alluvial aquifer of Coyote Valley is not bound by relatively impermeable bed and banks; therefore, the water within the alluvial aquifer of Coyote Valley does not meet all four parts of the Garrapata four-part test. Division staff interprets the published literature, geologic maps, and well completion reports as reasonable pieces of information that suggest the Cache Formation and olivine basalt is underlying a majority of the alluvial aquifer in Coyote Valley and that even if Division staff presumes that these formations do form a subsurface channel, they are not sufficiently impermeable and are not confining the water within the alluvial aquifer. Therefore, Division staff concludes that the water within the alluvial aquifer of Coyote

Valley is percolating groundwater and is not subject to the permitting authority of the State Water Board.

As presented in the review of the HVLCSD report, Division staff came to similar conclusions as the HVLCSD report. Division staff has concluded, as did the HVLCSD report, that there is enough evidence to suggest that the water within the alluvial aquifer of Coyote Valley is not bound by relatively impermeable bed and banks throughout the valley; however, Division staff concludes that the olivine basalt is not a bounding unit for water but rather is a unit that provides water storage and acts as a forebay for groundwater recharge when surface flows are not providing recharge. Division staff also concluded that there does appear to be enough evidence within published literature and interpretation of well completion reports to suggest that the Cache Formation is permeable and would likely not be bounding the water within the alluvial aquifer of Coyote Valley.

RECOMMENDATIONS

Based on the above analysis and conclusions, the water of the Coyote Valley aquifer is percolating groundwater and not within the permitting authority of the State Water Board. Division staff recognizes that HVLCSD and other water extractors that draw water from the Coyote Valley aquifer currently have a water right permit or license from the State Water Board or have filed Statements of Diversion and Use for riparian or pre-1914 water rights claims (Table 3) that are not required for a percolating groundwater source. In addition, there may be other groundwater extractors in Coyote Valley currently not known to the Division. Division staff also recognizes that the continued extraction of groundwater in Coyote Valley, although not showing significant impact on groundwater levels at this time nor likely to do so in the near future, could start to significantly overdraft the basin, deplete surface water flows in Putah Creek, and adversely impact senior water rights holders and public trust resources within and downstream of Coyote Valley if groundwater extractions occur unregulated or without any oversight or sustainability plan in place. Therefore, Division staff recommends the following:

1. The appropriative surface water rights held by HVLCSD (Permit 020770B and License 013527A) should be voluntarily or statutorily revoked.
2. Other water rights permits or licenses or Statements of Diversion and Use for water from the Coyote Valley aquifer should be voluntarily or statutorily revoked or inactivated.
3. If unregulated percolating groundwater extraction results in overdraft, the Department of Water Resources should re-evaluate the Coyote Valley aquifer to determine if the current basin prioritization of “very low priority” under SGMA (Sustainable Groundwater Management Act) should be revised to a higher priority.
4. HVLCSD and others that are extracting water from the Coyote Valley aquifer should consider forming a Groundwater Sustainability Agency (GSA), or some

other local management body, to monitor groundwater levels and ensure that current and future groundwater extractions are sustainable and not in jeopardy of critically over drafting the basin and impacting downstream senior water rights holders or public trust resources.

5. HVLCSD continue to monitor instream flows at the USGS Guenoc gaging station to assure that groundwater extraction is not negatively impacting surface flows, downstream water rights users, and public trust resources.

While a water right permit or license may not be required to extract water that has been determined to be percolating groundwater, the Division and the State Water Board has other regulatory mechanisms to evaluate and address public trust and senior water rights impacts that may occur due to unregulated groundwater extraction. The State Water Board reserves the right to take enforcement action for waste and unreasonable use and impacts to public trust resources resulting from unregulated groundwater extractions in Coyote Valley. Additionally, should the Coyote Valley basin be determined to be a higher priority basin in the future based on groundwater extractions, groundwater use in the basin will be subject to regulations under SGMA, including the formation of a GSA.

Table 3: Water Rights to Underflow of Putah Creek

WATER RIGHT ID	SOURCE	FACE VALUE (AF)	DIVERSION TYPE	WATER RIGHT TYPE (Priority Date)	OWNER
A030049A	Putah Creek Underflow	651	Direct Diversion	Licensed (12/16/1991)	HVLCSD
A030049B	Putah Creek Underflow	1649	Direct Diversion	Permitted (12/16/1991)	HVLCSD
S014734	Putah Creek Underflow	641	Diversion to Storage	Riparian Claim	HVLCSD
S014735	Putah Creek Underflow	604	Diversion to Storage	Riparian Claim	HVLCSD
S014736	Putah Creek Underflow	543	Diversion to Storage	Riparian Claim	HVLCSD
S022191	Putah Creek Underflow	724	Direct Diversion	Riparian Claim	HVLCSD
S014742	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
S014744	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
S014745	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
S014746	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
A024667A	Putah Creek Underflow	28	Diversion to Storage	Licensed (08/13/1974)	Sutter Home Vineyards
A024667B	Putah Creek Underflow	44.6	Direct Diversion	Licensed (04/22/1982)	Sutter Home Vineyards

REFERENCES

Brice, J.C., 1953 Geology of the Lower Lake quadrangle. California: California Division of Mines and Geology Bulletin 16. 72 p.

California Department of Water Resources. 1962. Reconnaissance Report on Upper Putah Creek Basin Investigation. Sacramento. Bulletin 99. 254p.

Driscoll, F.G. (1986) Groundwater and Wells. 2nd Edition, Johnson Division, St Paul, 1089.

Koenig, J.B., 1963. Geologic map of California: Santa Rosa Sheet: California Division of Mines and Geology, scale 1:250,000.

State Water Boards Division of Water Quality GAMA Unit Staff Review of the Subterranean Stream Determination for Coyote Valley, Lake County, February 2020

Upson, J.E., Kunkel, F. 1955. Groundwater of the Lower Lake-Middletown Area, Lake County, CA. United States Geologic Survey Water-Supply Paper 1297.

Figure 1:
Inset Map of Hidden Valley Lake Southern Lake County

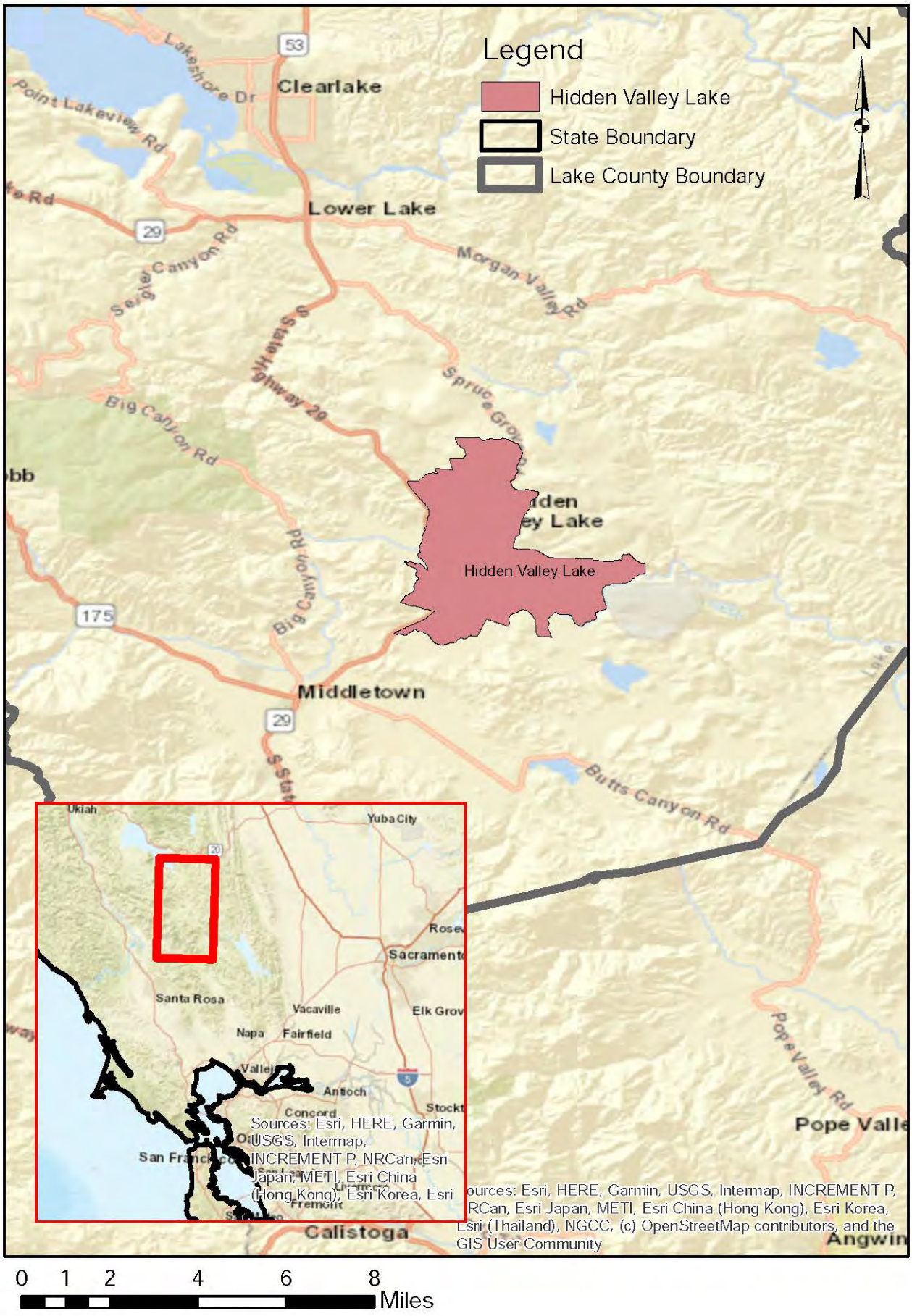
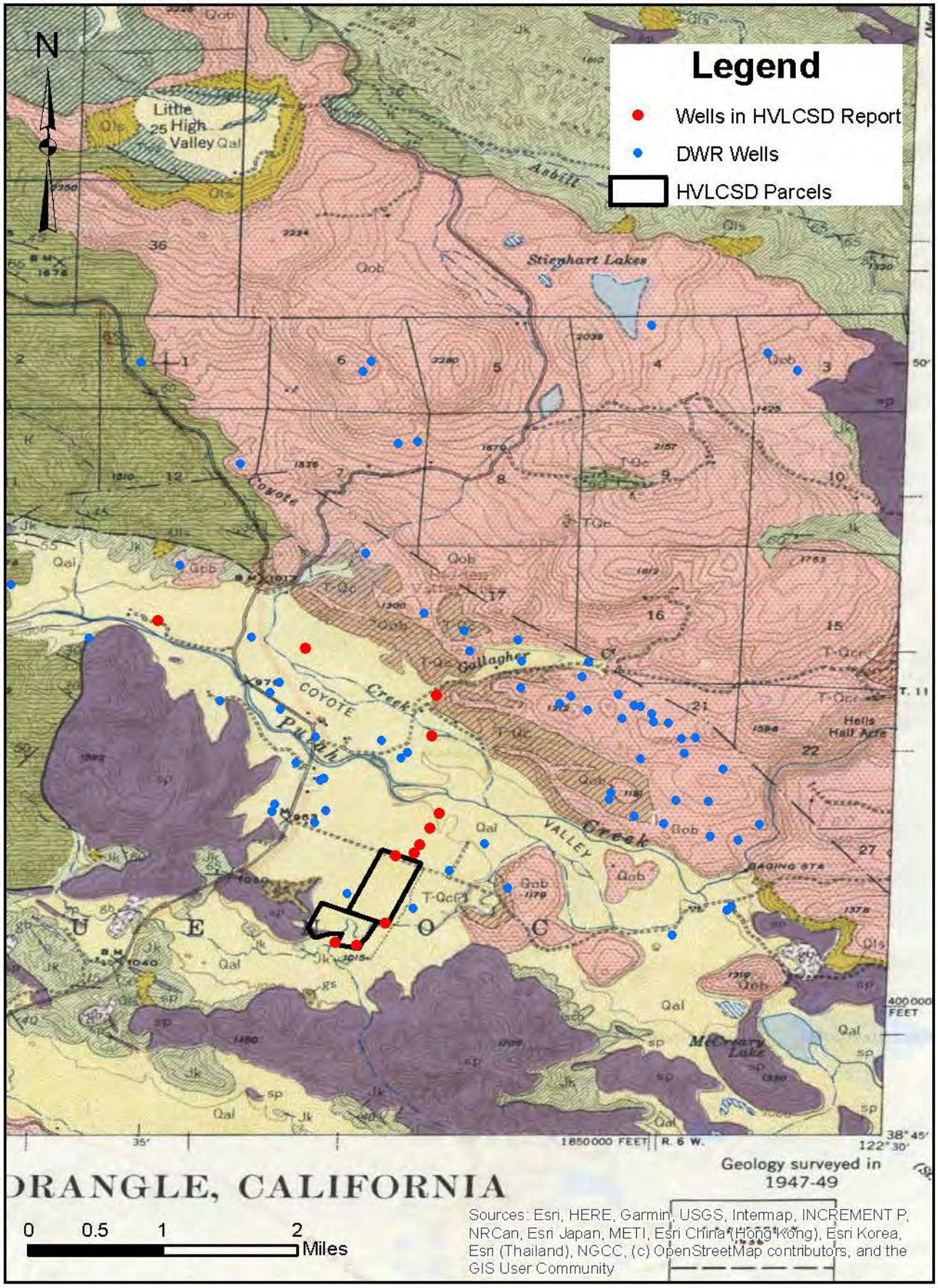
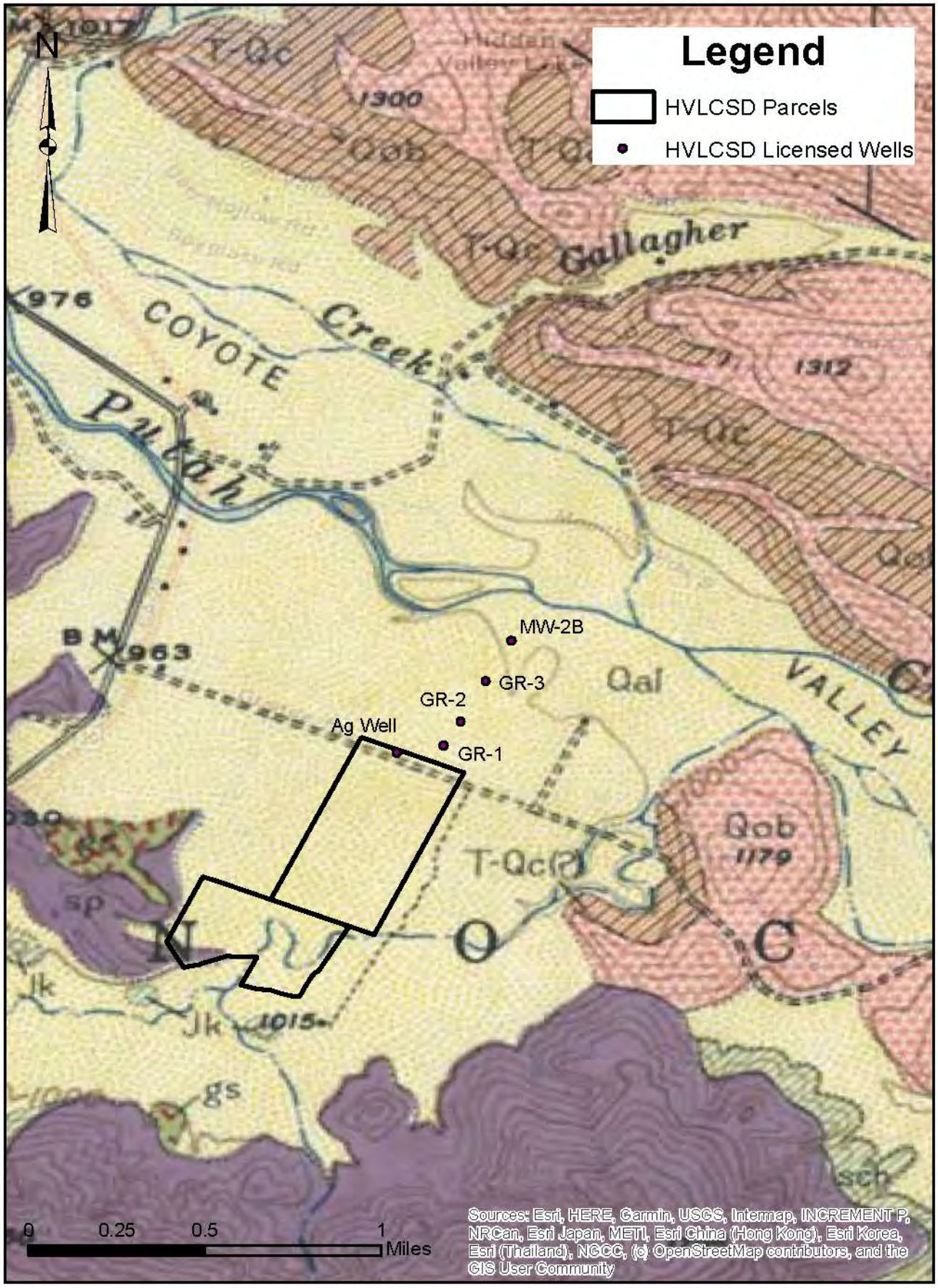


Figure 2:
Geologic Map of Coyote Valley with DWR Approximate Well Locations



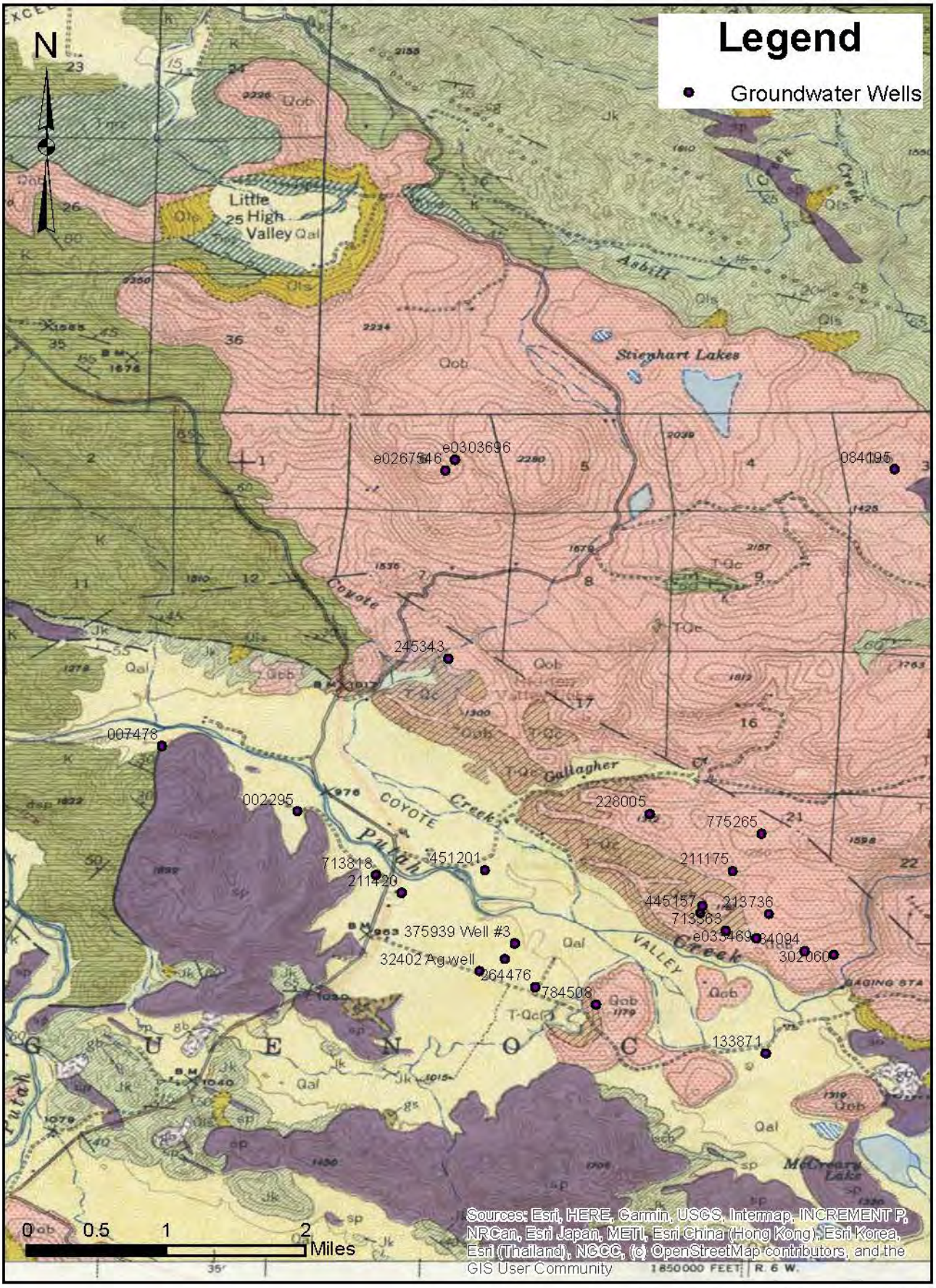
Modified from Koenig, 1963.

Figure 3:
Geologic Map of Coyote Valley with HVLCSD Licensed Wells



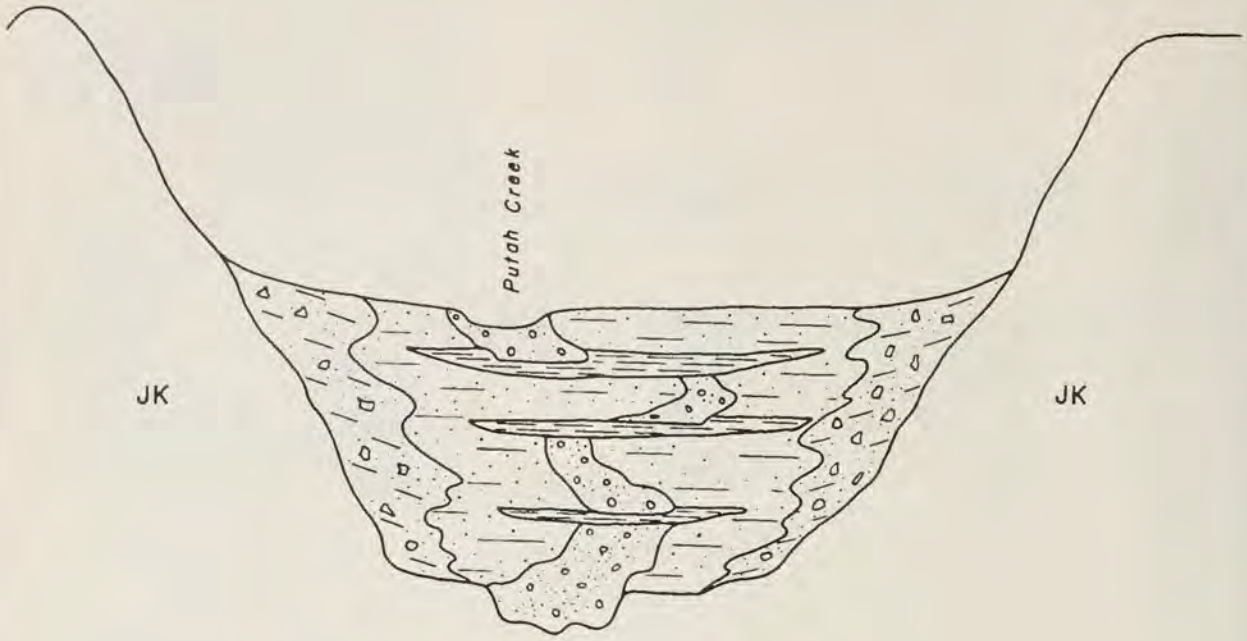
Modified from Koenig, 1963.

Figure 4:
Geologic Map of Coyote Valley with Representative Groundwater Wells



Modified from Koenig, 1963.

Figure 5: Diagrammatic Geologic Section of Stratified Materials in the Collayomi-Long Valley Groundwater Basin (to be used as a proxy for Coyote Valley)



LEGEND

- STREAM DEPOSITS — COARSE-GRAINED MATERIALS, GOOD PERMEABILITY
- LAKE DEPOSITS — FINE-GRAINED MATERIAL, LOW PERMEABILITY
- FLOOD PLAIN — MEDIUM-FINE-GRAINED MATERIAL, LOW PERMEABILITY
- SLOPEWASH — COARSE-TO FINE-GRAINED MATERIAL, POORLY SORTED, GENERALLY LOW PERMEABILITY
- JK — JURASSIC-CRETACEOUS BEDROCK, IMPERMEABLE

NOTE: GEOLOGIC SECTION NOT TO SCALE.

DIAGRAMMATIC GEOLOGIC SECTION OF
STRATIFIED MATERIALS IN THE COLLAYOMI-LONG VALLEYS
GROUND WATER BASIN

Appendix A

State of California

Well Completion Report

Form DWR 188 Complete 4/6/2018

WCR2018-002295

Owner's Well Number: DIAMOND RANCH #3 | Date Work Began: 08/18/2017 | Date Work Ended: 11/22/2017

Local Permit Agency: Lake County Health Services Department - Environmental Health Division

Secondary Permit Agency: | Permit Number: WE-4922 AG | Permit Date: 08/15/2017

Well Owner (must remain confidential pursuant to Water Code 13752)

Name: XXXXXXXXXXXXXXXXXXX

Mailing Address: XXXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXXX

City: XXXXXXXXXXXXXXXXXXX | State: XX | Zip: XXXXX

Planned Use and Activity

Activity: New Well

Planned Use: Water Supply Irrigation - Agriculture

Well Location

Address: 18545 S 29 HWY

City: MIDDLETOWN | Zip: 95461 | County: Lake

Latitude: Deg. Min. Sec. N | Longitude: Deg. Min. Sec. W

Dec. Lat.: 38.7968300 | Dec. Long.: -122.5772600

Vertical Datum: | Horizontal Datum: WGS84

Location Accuracy: | Location Determination Method:

APN: 014-250-11

Township: 11 N

Range: 07 W

Section: 24

Baseline Meridian: Mount Diablo

Ground Surface Elevation: 990

Elevation Accuracy: Unknown

Elevation Determination Method: GPS

Borehole Information

Orientation: Vertical | Specify:

Drilling Method: Reverse Circulation | Drilling Fluid: Bentonite

Total Depth of Boring: 600 Feet

Total Depth of Completed Well: 570 Feet

Water Level and Yield of Completed Well

Depth to first water: (Feet below surface)

Depth to Static Water Level: (Feet) | Date Measured:

Estimated Yield*: (GPM) | Test Type:

Test Length: (Hours) | Total Drawdown: (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	5	TOP SOIL
5	35	GRAVEL
35	60	CLAY
60	80	GRAVEL
80	100	CLAY
100	140	CLAY / HARD ROCK
140	160	CLAY
160	190	BLACK HARD ROCK
190	200	CLAY / HARD ROCK
200	210	CLAY
210	230	BLACK HARD ROCK
230	240	CLAY
240	250	CLAY, HARD ROCK
250	260	CLAY
260	290	BLACK HARD ROCK

290	300	CLAY
300	310	BLACK HARD ROCK
310	320	CLAY / HARD ROCK
320	370	CLAY
370	390	CLAY / HARD ROCK
390	430	CLAY
430	450	HARD ROCK
450	470	HARD ROCK / CLAY
470	480	CLAY
480	530	HARD ROCK
530	600	HARD ROCK / CLAY

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	60	Conductor or Fill Pipe	Low Carbon Steel	Grade: ASTM A53	0.375	30			
2	0	180	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	180	340	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	340	380	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	380	560	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	560	570	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	570	600	No Casing Installed	Other	N/A					NO CASING

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	60	Cement	10.3 Sack Mix		ANNULAR CEMENT SEAL
60	600	Filter Pack	Other Gravel Pack	4 X 16	GRAVEL PACK

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	60	36
60	600	20

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: WELL INDUSTRIES INC (Person, Firm or Corporation)

3282 HIGHWAY 32	CHICO	CA	95973
Address	City	State	Zip

Signed: *electronic signature received*	03/08/2018	812678
C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

				N						W

Latitude Deg/Min/Sec **Longitude Deg/Min/Sec**

TRS:

APN:

State of California

Well Completion Report

Form DWR 188 Complete 10/8/2018

WCR2018-007478

Owner's Well Number: DIAMOND 4 | Date Work Began: 08/28/2017 | Date Work Ended: 08/04/2018

Local Permit Agency: Lake County Health Services Department - Environmental Health Division

Secondary Permit Agency: | Permit Number: WE-4923 AG | Permit Date: 08/15/2017

Well Owner (must remain confidential pursuant to Water Code 13752)

Name: XXXXXXXXXXXXXXXXXXX

Mailing Address: XXXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXXX

City: XXXXXXXXXXXXXXXXXXX | State: XX | Zip: XXXXX

Planned Use and Activity

Activity: New Well

Planned Use: Water Supply Irrigation - Agriculture

Well Location

Address: 0 DIAMOND RANCH RD

City: MIDDLETOWN | Zip: 95461 | County: Lake

Latitude: Deg. Min. Sec. N | Longitude: Deg. Min. Sec. W

Dec. Lat.: 38.8036000 | Dec. Long.: -122.5913200

Vertical Datum: | Horizontal Datum: WGS84

Location Accuracy: | Location Determination Method:

APN: 014-230-111

Township: 11 N

Range: 07 W

Section: 13

Baseline Meridian: Mount Diablo

Ground Surface Elevation: 1010

Elevation Accuracy: Unknown

Elevation Determination Method: GPS

Borehole Information

Orientation: Vertical | Specify:

Drilling Method: Downhole Rotary Hammer | Drilling Fluid: Bentonite

Total Depth of Boring: 600 Feet

Total Depth of Completed Well: 560 Feet

Water Level and Yield of Completed Well

Depth to first water: (Feet below surface)

Depth to Static Water Level: (Feet) | Date Measured:

Estimated Yield*: (GPM) | Test Type:

Test Length: (Hours) | Total Drawdown: (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	50	COBBLE
50	260	BLACK ROCK - HARD
260	600	BLACK ROCK - HARD

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	50	Conductor or Fill Pipe	Low Carbon Steel	Grade: ASTM A53	0.375	30			
2	0	180	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	180	340	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	340	360	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	360	550	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	550	560	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	50	Cement	10.3 Sack Mix		ANNULAR CEMENT SEAL
50	560	Filter Pack	Other Gravel Pack	4 X 8	GRAVEL PACK

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	50	36
50	560	20
560	600	7.875

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: WELL INDUSTRIES INC
Person, Firm or Corporation

3282 HIGHWAY 32	CHICO	CA	95973
Address	City	State	Zip

Signed	*electronic signature received*	08/31/2018	812678
	C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

					N						W
Latitude Deg/Min/Sec						Longitude Deg/Min/Sec					

TRS:

APN:

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 084094

of Intent No.

Local Permit No. or Date

State Well No.

Other Well No. 11N06W18

(2) LOCATION OF WELL (See instructions):

County Lake Owner's Well Number

Well address if different from above Hidden Valley Lake

Township Range Section

Distance from cities, roads, railroads, fences, etc.

A.P. # 144-131-01

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic [X]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:

Rotary [X] Reverse [ ]
Cable [ ] Air [X]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:

Yes [X] No [ ] Size 3/8
Diameter of bore
Packed from 20 to 260 ft.

(7) CASING INSTALLED:

Steel [ ] Plastic [X] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	260	4"	c160 psi	220	260	1/8

(8) PERFORATIONS:

Type of perforation or size of screen

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing cement

(10) WATER LEVELS:

Depth of first water, if known ft.
Standing level after well completion 30 ft.

(11) WELL TESTS:

Was well test made? Yes [X] No [ ] If yes, by whom? driller
Type of test Pump [ ] Bailer [X] Air lift [ ]
Depth to water at start of test 30 ft. At end of test 250 ft
Discharge 30 gal/min after 2 hours Water temperature
ical analysis made? Yes [ ] No [X] If yes, by whom?
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth ft. Depth of completed well ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	20	red clay
20	30	volcanic ash
30	33	blue vol. rock
33	60	volcanic ash
60	90	fract. blue vol.
90	250	hard blue vol. rock
250	260	red vol.

Work started 11-27 19 79 Completed 11-29 19 79

WELL DRILLER'S STATEMENT: 00941

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED LARRY HERMAN by kathy read (Well Driller)

NAME FISCH-HERMAN DRILLING (Person, firm, or corporation) (Typed or printed)

Address 5001 Gravenstein Hwy. N.

City Sebastopol, Calif. Zip 95472

License No. 304138 Date of this report 12-10-79

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

11N/6W-3

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 084195

...e of Intent No. _____

...al Permit No. or Date _____

State Well No. _____

Other Well No. Water Co... Sec. 13/5...

(12) WELL LOG: Total depth _____ ft. Depth of completed well _____ ft.

from ft. to ft. Formation (Describe by color, character, size or material)

0 - 2 top soil

2 - 40 fract. red vol.

40 - 75 hard blue and red vol.

75 - 125 hard brn. vol.

(2) LOCATION OF WELL (See instructions):

County Lake Owner's Well Number _____

Well address if different from above _____

Township 11 N Range 6 W Section 3

Distance from cities, roads, railroads, fences, etc. Jerusalem Valley Rd

AP# 136-041-26

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☒

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☐

Other ☐

WELL LOCATION SKETCH

(5) EQUIPMENT:

Rotary ☒ Reverse ☐

Cable ☐ Air ☒

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size 3/8

Diameter of bore _____

Packed from 20 to 125 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	85	5"	c160 psi	45	85	1/8

(8) PERFORATIONS:

Type of perforation or size of screen

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.

Were strata sealed against pollution? Yes ☐ No ☐ Interval _____ ft.

Method of sealing cement

(10) WATER LEVELS:

Depth of first water, if known _____ ft.

Standing level after well completion 10 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? driller

Type of test Pump ☐ Bailer ☒ Air lift ☐ 80

Depth to water at start of test 10 ft. At end of test _____ ft

...harge 100 gal/min after 4 hours Water temperature _____

...mical analysis made? Yes ☐ No ☒ If yes, by whom? _____

Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

Work started 6-13-80 19__ Completed 6-14-80 19__

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED LARRY HERMAN by kathy baker (Well Driller)

NAME FISCH-HERMANDRILLING CO. (Person, firm, or corporation) (Type or print)

Address 5001 Gravenstein Hwy. N.

City Sebastopol, Calif. Zip 95472

License No. 304138 Date of this report 6-19-80

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

11N/06W-28M

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 133871

Notice of Intent No.

Local Permit No. or Date

State Well No.

Other Well No.

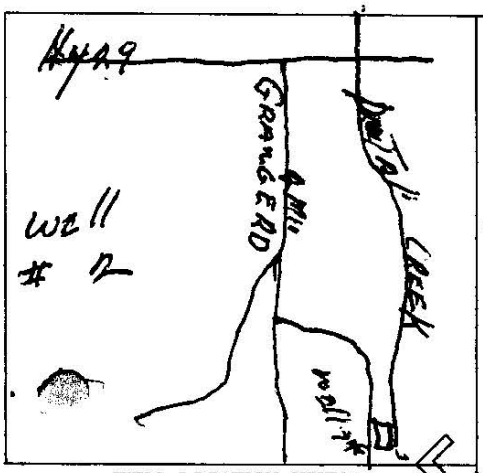
(2) LOCATION OF WELL (See instructions):

County LAKE Owner's Well Number

Well address if different from above LUCHETTI RANCH END GRANGE RD

Township MIDDLETOWN Range 6-W 11 N Section 27 28

Distance from cities, roads, railroads, fences, etc. 11N/6W-28
2½ MILES IN FROM GRANGE ROAD



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:
Rotary [ ] Reverse [ ]
Cable [X] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [ ] No [X] Size
Diameter of bore 12 3/4"
Packed from to ft.

(7) CASING INSTALLED:
Steel [X] Plastic [ ] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
+2	180	12¾	.198

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size
35	175	18 X 3"

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing

(10) WATER LEVELS:
Depth of first water, if known 30 ft.
Standing level after well completion 19 ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? Rain Bow
Type of test Pump [X] Bailer [ ] Air lift [ ]
Depth to water at start of test 18 ft. At end of test 18 ft
Discharge 800+ gal/min after 4 hours Water temperature Cold
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth 190 ft. Depth of completed well 190 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	35	Top Soil - Brown
35	60	Clay & Gravels - Brown
60	62	Gravel - Water
62	105	Blue Clay -
105	110	Rock -
110	135	Blue Gravel - Water
135	170	Soft Blue -
170	190	Boulders
150		Bed Rock -
		Well - pumped 400 GPM
		PI - 130'

NOT FOR PUBLIC USE
DO NOT USE
WATER CODE SEC 13752

MAR 23 1999

Work started May 6 19 99 Completed May 15 19 99

WELL DRILLER'S STATEMENT: 415

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

SIGNED (Well Driller)

NAME EUGENE LOUISOME
(Person, firm, or corporation) (Typed or printed)

Address PO BOX 65

City LOWER LAKE Zip 95457

License No. 461290 Date of this report MAY-17-99

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

11N/06W-20M

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

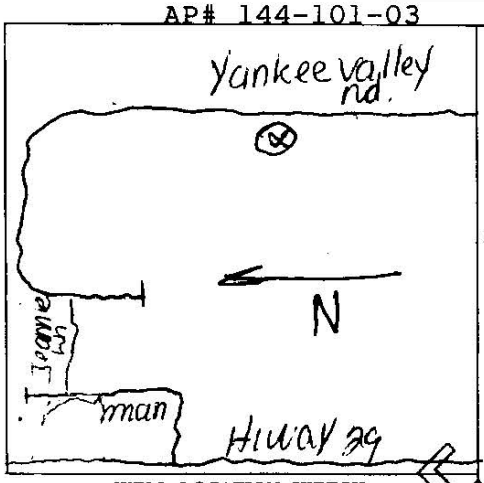
No. 211175

Notice of Intent No.
Local Permit No. or Date WE173

State Well No.
Other Well No.

(2) LOCATION OF WELL (See instructions):

County LAKE Owner's Well Number
Well address if different from above
Township 11N Range 6W Section Rancho Guenoc
Distance from cities, roads, railroads, fences, etc.
20802 Yankee Valley Road
Middletown, California
AP# 144-101-03



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic [X]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:

Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:

Yes [X] No [ ] Size pea
Diameter of bore 63/4, 97/8, 77/8
Packed from 22 to 306 ft.

(7) CASING INSTALLED:

Steel [ ] Plastic [X] Concrete [ ]

(8) PERFORATIONS:

Type of perforation or size of screen micro

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	306	5"	CL200	205	305	.032

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 22 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing cement on gravel pack

(10) WATER LEVELS:

Depth of first water, if known ft.
Standing level after well completion 138 ft.

(11) WELL TESTS:

Was well test made? Yes [X] No [ ] If yes, by whom? Weeks
Type of test Pump [ ] Bailer [ ] Air lift [X]
Depth to water at start of test 138 ft. At end of test 280 ft
Discharge 100+ gal/min after 2 hours Water temperature cool
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG:

Total depth 306 ft. Depth of completed well 306 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	8	Red clay and boulder
8	22	Gray rock
22	34	Maroon rock
34	98	Gray rock
98	124	Red rock
124	126	Gray rock
126	140	Brown rock
140	306	Volcanic conglomerate, fractured.

Work started 5-4- 19 90 Completed 5-10 19 90

JUL 09 1990

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Ward Thompson By: Don Sinclair
(Well Driller)
NAME WEEKS DRILLING AND PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)
Address P.O. Box 176-6100 Sebastopol Road
City Sebastopol, California Zip 95473
License No. C57-177681 Date of this report May 24, 1990

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

11N/06W-19M

ORIGINAL

File with DWR

FEB 13 1996

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

S½ Guenoc Village

Do not fill in

No. 211420

Notice of Intent No.

Local Permit No. or Date WE 1277

State Well No.

Other Well No.

(2) LOCATION OF WELL (See instructions):

County LAKE Owner's Well Number

Well address if different from above

Township 11N Range 7W 06W Section Rancho Guenoc 19

Distance from cities, roads, railroads, fences, etc.

18696 Putah Lane
Middletown
A.P. # 014-362-03

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic [ ]
Irrigation [ ]
Industrial [X]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:

Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:

Yes [ ] No [X] Size

Diameter of bore 9 7/8, 11"

Packed from 50 to 104 ft.

(7) CASING INSTALLED:

Steel [ ] Plastic [X] Concrete [ ]

(8) PERFORATIONS:

Type of perforation or size of screen microperf

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	94	6"	CL200	54	94	.032

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 50 ft.

Were strata sealed against pollution? Yes [ ] No [X] Interval ft.

Method of sealing cement on sandpack

(10) WATER LEVELS:

Depth of first water, if known ft.

Standing level after well completion 15' ft.

(11) WELL TESTS:

Was well test made? Yes [X] No [ ] If yes, by whom? Weeks

Type of test Pump [ ] Bailer [X] Air lift [ ]

Depth to water at start of test 15 ft. At end of test 79 ft

Discharge 15 gal/min after 2 hours Water temperature 64°

Chemical analysis made? Yes [ ] No [X] If yes, by whom?

Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG:

Total depth 104 ft. Depth of completed well 94 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	Embedded gravels in brown clay
2	104	Gravel and boulders

Work started 1-10 19 96 Completed 1-16 19 96

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed Ward Thompson By: Thurman Adams

(Well Driller)

NAME WEEKS DRILLING AND PUMP COMPANY

(Person, firm, or corporation) (Typed or printed)

Address P.O. Box 176-6100 Sebastopol Road

City Sebastopol, California Zip 95473

License No. C57-177681 Date of this report January 19,1996

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Sub Division

11N/06W-28M

Do not fill in

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

No. 213736

...ce of Intent No.

Local Permit No. or Date

State Well No.

Other Well No. 11N06W28

(1)

Addre

City

(2) LOCATION OF WELL (See instructions):

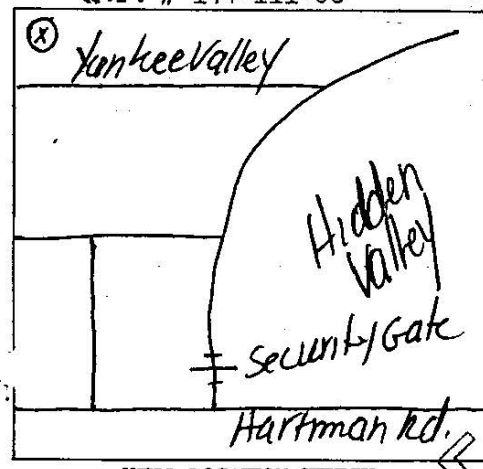
County Lake Owner's Well Number

Well address if different from above

Township 11N Range Rancho Quenoc 6W Section 28

Distance from cities, roads, railroads, fences, etc.

Yankee Valley Road, Hidden Valley
Middletown
A.P. # 144-111-06



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12.)

(4) PROPOSED USE:

Domestic ☒
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:

Rotary ☐ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☐ Size

Diameter of bore 10 5/8, 6 3/4, 6½

Packed from 20' to 261' ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	262	4½	CL200

(8) PERFORATIONS: saw cut

Type of perforation or slot of screen

From ft.	To ft.	Slot size
201	261	1/8x3

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.

Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.

Method of sealing cement on gravel pack

(10) WATER LEVELS:

Depth of first water, if known ft.

Standing level after well completion 131 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Weeks

Type of test Pump ☐ Bailer ☐ Air lift ☒

Depth to water at start of test 131 ft. At end of test 260 ft

...arge 30 gal/min after 1/2 hours Water temperature cool

Chemical analysis made? Yes ☐ No ☒ If yes, by whom?

Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 261 ft. Depth of completed well 262 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	27	Very hard red and brown rock
27	38	Very hard black rock with traces of red rock
38	79	Very hard black rock
79	92	Hard multicolored conglomerate rock
92	148	Hard black rock with red and green rock
148	189	Extremely hard blue-green rock
189	240	Red rock and red volcanic ash
240	261	Hard black and red rock

SEP 04 1986

Work started 11/7 19 85 Completed 11/8 19 85

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

00098

SIGNED Gerald Thompson By: Don Sinclair
(Well Driller)

NAME WEEKS DRILLING AND PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)

Address P.O. Box 176 - 6100 Sebastopol Road

City Sebastopol, California Zip 95472

License No. C57-177681 Date of this report November 12, 19...

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 228005

Notice of Intent No._____

Permit No. or Date_____

State Well No._____

Other Well No. 11N06W18

(2) LOCATION OF WELL (See instructions):

County Lake Owner's Well Number_____

Well address if different from above_____

Township Hidden Valley Lake Range_____ Section_____

Distance from cities, roads, railroads, fences, etc._____

AP# 144-063-01 Lot R-4-55

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☒
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:

Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size 3/8
Diameter of bore 6"
Packed from 20 to 335 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	335	4"	c160 psi

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size
295	335	1/4

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval_____ ft.
Method of sealing cement

(10) WATER LEVELS:

Depth of first water, if known_____ ft.
Standing level after well completion 220 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? driller
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test 220 ft. At end of test 310 ft
Discharge 100 gal/min after 2 hours Water temperature_____
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?_____
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG:

Total depth_____ ft. Depth of completed well_____ ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	10	red clay and boulders
10	70	blue volcanic rock
70	80	red volcanic rock
80	115	volcanic ash
115	270	blue volcanic rock
270	305	black volcanic w/ serpintine stringers
305	335	fractured chert

Work started 11-6 19 80 Completed 11-8 19 80

WELL DRILLER'S STATEMENT: 00941

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Larry Herman (Well Driller)

NAME FISCH HERMAN DRILLING CO. (Person, firm, or corporation) (Typed or printed)

Address 5001 Gravenstein Hwy. N.

City Sebastopol, Calif. Zip 95472

License No. 304138 Date of this report 11-14-80

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

11N 06W 07M

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 245343

State Well No.
Other Well No.

Notice of Intent No.
Local Permit No. or Date

(1)
Address
City

(2) LOCATION OF WELL (See instructions):
County Lake
Well address if different from above North Shore
Township Hidden Valley Lake Range 6W Section 7
Distance from cities, roads, railroads, fences, etc.
A.P. # 142- 122-10

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [X]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

WELL LOCATION SKETCH

(5) EQUIPMENT:
Rotary [X] Reverse [ ]
Cable [ ] Air [X]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size 3/8
Diameter of bore
Packed from 20 to 290 ft.

(7) CASING INSTALLED:
Steel [ ] Plastic [X] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	290	5"	c160 psi

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size
210	290	1/8

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing cement

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 150 ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? driller
Type of test Pump [ ] Bailer [X] Air lift [ ]
Depth water at start of test 150 ft. At end of test 260 ft
Discharge 25 gal/min after 2 hours Water temperature
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth ft. Depth of completed well ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	45	hard blue vol. rock
45	50	red vol.
50	70	blue vol.
70	100	red vol.
100	130	blue vol.
130	210	volcanic ash
210	245	fract. blue vol.
245	275	gray vol.
275	290	extreme hard gray vol. w/ embedded quartz

Work started 3-3 19 82 Completed 3-4 19 82

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED LARRY HERMAN by kathy baker (Well Driller)
NAME FISCH HERMAN DRILLING CO. 00941 (Person, firm, or corporation) (Typed or printed)
Address 5001 Gravenstein Hwy. N.
City Sebastopol, Ca. Zip 95472
License No. 399226 Date of this report 3-5-82

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

11N/06W-19M

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

Do not fill in

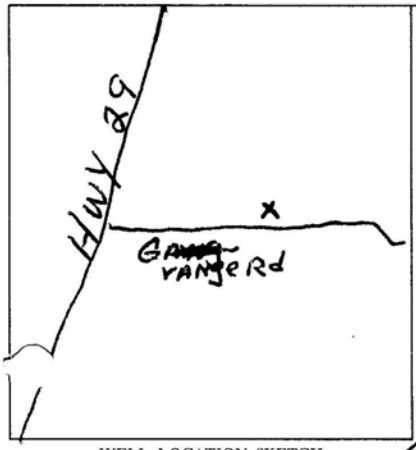
No. 264476

Notice of Intent No. _____
Local Permit No. or Date _____

State Well No. _____
Other Well No. _____

(1)
Address
City

(2) LOCATION OF WELL (See instructions):
County LAKE Owner's Well Number _____
Well address if different from above _____
Township 11N Range 6W Section ? 19
Distance from cities, roads, railroads, fences, etc. 50' North of Grange Rd 1 Mi. EAST of HWY 29 Middletown



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Municipal [ ]
Other [ ]
(Describe)

(5) EQUIPMENT:
Rotary [ ] Reverse [ ]
Cable [X] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [ ] No [X] Size 3/4 MINUS
Diameter of bore 12
Packed from 20 ft. to _____ ft.

(7) CASING INSTALLED:
Steel [X] Plastic [ ] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	100	8	188

(8) PERFORATIONS:
Type of perforation or size of screen Milled slot

From ft.	To ft.	Slot size
50	100	1/4 x 3 Double

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval _____ ft.
Method of sealing Cement

(10) WATER LEVELS:
Depth of first water, if known _____ ft.
Standing level after well completion 20 ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? Donken
Type of test Pump [X] Bailer [ ] Air lift [ ]
Depth to water at start of test 20 ft. At end of test 41 ft.
Yield 346 gal/min after 4 hours Water temperature Cool
Chemical analysis made? Yes [ ] No [X] If yes, by whom? _____
Was electric log made Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth 103 ft. Completed depth 100 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	4	Brown Soil
4	19	Brown Clay
19	51	Brown Clay + Gravel Mix
51	58	Muddy Brown Gravel
58	80	Brown Clay + Gravel Mix
80	95	Clayey semi cemented Gravel
95	100	Brown Clay + Gravel Mix

MAXIMUM Recommended Pumping RATE 300 GPM
MAXIMUM Recommended DRAWDOWN 50 Feet

JUN 1 1989

Work started 2/3 19 89 Completed 2/14 19 89

WELL DRILLER'S STATEMENT: 833
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed _____ (Well Driller)
NAME DAVE GIESE Well Drilling (Person, firm, or corporation) (Typed or printed)
Address 200 GOBBLE LN
City UKIAH CA ZIP 95482
License No. 304165 Date of this report 3/20/89

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

11N/06W-28M

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

ORIGINAL
File with DWR

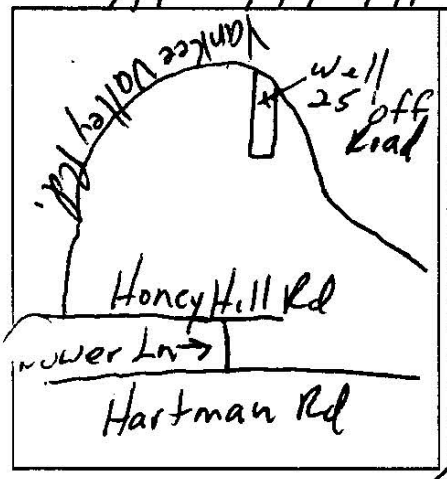
Do not fill in

No. 302060

Notice of Intent No. _____
Local Permit No. or Date WE-307

State Well No. _____
Other Well No. _____

(2) LOCATION OF WELL (See instructions):
County Lake Owner's Well Number _____
Well address if different from above _____
Township 11N Range 6W Section 28
Distance from cities, roads, railroads, fences, etc.
21486 Yankee Valley Rd, Middletown
AP# 144-141-007



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [X]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Municipal [ ]
Other [ ]
(Describe)

(5) EQUIPMENT:
Rotary [X] Reverse [ ]
Cable [ ] Air [X]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size 1/4
Diameter of bore 6 1/2
Packed from 250 to 290 ft.

(7) CASING INSTALLED:
Steel [ ] Plastic [X] Concrete [ ]

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia in.	Gage or Wall	From ft.	To ft.	Slot size
0	290	4 1/2	F480	250	290	18

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval _____ ft.
Method of sealing Grout Cement

(10) WATER LEVELS:
Depth of first water, if known 270 ft.
Standing level after well completion 145 ft.

(11) WELL TESTS:
Well test made? Yes [X] No [ ] If yes, by whom? Driller
Type of test Pump [ ] Bailer [ ] Air lift [X]
Depth to water at start of test _____ ft. At end of test _____ ft.
Discharge 30 gal/min after 2 hours Water temperature _____
Chemical analysis made? Yes [ ] No [X] If yes, by whom? _____
Was electric log made Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth _____ ft. Completed depth _____ ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	90	Boulders & Broken Volcanics
90	270	Hard Blue Volcanics
270	290	Green Sandy Rock

DEC - 0 1990

Work started NOV 1990 Completed NOV 1990

WELL DRILLER'S STATEMENT: 1562

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed Larry Herman (Well Driller)
NAME Larry Herman Drilling (Person, firm, or corporation) (Typed or printed)
Address 11321 HWY 29
City Lower Lake, Ca ZIP 95457
License No. 465071 Date of this report 11-15-90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

ORIGINAL
File with DWR

Page ___ of ___
Owner's Well No. ___
Date Work Began 7-12-96, Ended ___
Local Permit Agency Health Dept.
Permit No. WE-1330 Permit Date 7-10-96

JUL 30 1997

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 445157

DWR USE ONLY — DO NOT FILL IN
11N/06W-21M
STATE WELL NO./STATION NO.
LATITUDE ___ LONGITUDE ___
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 180 (Ft.) BELOW SURFACE

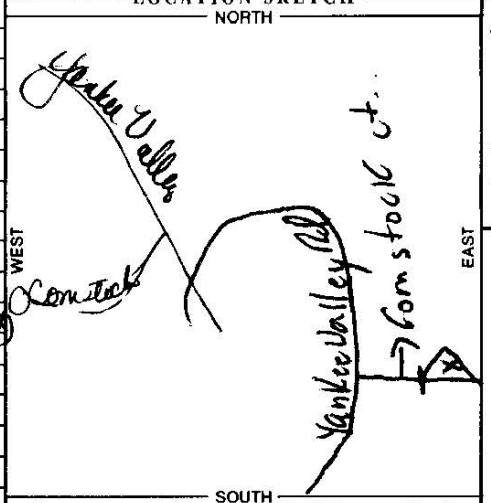
DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	65	Volcanic ASL
65	80	Red Volcanics
80	95	Red & Black Volcanics
95	140	Fractured Blue Volcanics
140	180	Hard Blue Volcanics
180	185	Fractured Red & Blue Volcanics
185	215	Volcanic ASL
215	250	Red Volcanics
250	275	Green Tuffs
		180' 2gpm
		215-230 15gpm
		230-245 30gpm
		245-260 50gpm
		260-275 100gpm

TOTAL DEPTH OF BORING 275 (Feet)
TOTAL DEPTH OF COMPLETED WELL 275 (Feet)

WELL LOCATION

Address 19175 Comstock Ct.
City Middletown
County Lake
APN Book 144 Page 111 Parcel 10
or Township 11N Range 06W Section 21
or Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
X Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD air rotary FLUID ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 100 (Ft.) & DATE MEASURED 7-17-96
ESTIMATED YIELD* 100 (GPM) & TEST TYPE air lift
TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	CASING(S) TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	9"								
20	275	7"								
0	100		X				PVC F480	4½	160	
100	215		X				" "	"	Sch 40	
215	275			X			" "	"	"	.118

DEPTH FROM SURFACE Ft.	to Ft.	ANNULAR MATERIAL TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE / SIZE)
0	20	X			
20	275				5/16 Pea

JUL 31 1997

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Larry Herman Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 13011 Hwy 29 CITY Lower Lake STATE Ca ZIP 95457
Signed Larry Herman (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 7-14-96 C-57 LICENSE NUMBER 465071

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

AUG 07 1997

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 451201

Page ___ of ___
Owner's Well No. ___
Date Work Began 7-2-97 , Ended 7-3-97
Local Permit Agency LAKE COUNTY HEALTH DEPARTMENT
Permit No. WE-1454 Permit Date 6-30-97

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO. 11N/06W + 19M
LATITUDE ___ LONGITUDE ___
APN/TRS/OTHER ___

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	1	Topsoil
1	25	cobbles, coarse sands, gravel and boulders
25	75	Tan blue coarse sands & gravel
75	85	Blue clay & gravel
85	91	Coarse blue sand
91	98	Blue gravels & coarse sand
98	100	Stiff blue clay

TOTAL DEPTH OF BORING 100 (Feet)
TOTAL DEPTH OF COMPLETED WELL 95 (Feet)

WELL LOCATION

Address 18850 Hartman Road
City Middletown
County Lake
APN Book 14 Page 260 Parcel 24-46
or Township 11N Range 06W Section 19
or Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH
Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
X Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Air/Mud Rotary FLUID Poly jel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 15 (Ft.) & DATE MEASURED 7-3-97
ESTIMATED YIELD 60+ (GPM) & TEST TYPE air lift
TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 94 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	100	9 7/8								
+1	95		X				PVC/F480	5½	CL200	
35	95			X						.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X	X		
20	100			X	3/8" pea gravel

AUG 22 1997

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WEEKS DRILLING AND PUMP COMPANY
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS P.O.BOX 176 CITY Sebastopol STATE California ZIP 95473

Signed Thurman Adams WARD THOMPSON BY: THURMAN ADAMS 7-11-97 177681
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

DWR USE ONLY — DO NOT FILL IN
11N/6W-20
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page ___ of ___
Owner's Well No. APR 0 4 2002
No. 713336
Date Work Began 1-2-01, Ended 1-9-01
Local Permit Agency Health Dept
Permit No. WE 2044 Permit Date 1-2-01

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD air rotary FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	50	Volcanic Ash & Clay
50	180	Sonoma Volcanics

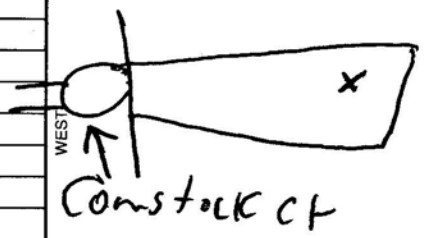
TOTAL DEPTH OF BORING 185 (Feet)
TOTAL DEPTH OF COMPLETED WELL 180 (Feet)

WELL LOCATION

Address 19238 Comstock Ct
City Middletown
County Lake
APN Book 144 Page 111 Parcel 09
Township 11N Range 6W Section 20
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH
Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 165 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 120 (Ft.) & DATE MEASURED 1-8-01
ESTIMATED YIELD * 30 (GPM) & TEST TYPE air lift
TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	9	X				PVC F480	4½	160	
20	160	7	X				" "	"	"	
160	180	7		X			" "	"	"	1/8

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	180			APR 17 #16 Pea	

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Larry Herman Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 13011 Hwy 29 CITY Lower Lake STATE Ca ZIP 95457
Signed Larry Herman (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 1-10-01 C-57 LICENSE NUMBER 465071

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

RECEIVED
JAN 1999

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

Page ___ of ___
Owner's Well No. #2
No. 713818
Date Work Began 1/13/99 Ended 1/21/99
Local Permit Agency LAKE COUNTY HEALTH DEPARTMENT
Permit No. WE1640 Permit Date 12/28/98

DWR USE ONLY — DO NOT FILL IN
11N/06W-19M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD MUD ROTARY FLUID POLY-JEL

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	5	Brown silty clay
5	11	Brown gravels
11	12	Brown sandy clay
12	18	Brown gravels
18	24	fractured brown rock
24	30	Brown shale
30	54	Brown gritty clay
54	60	fractured brown rock
60	69	Gritty green clay
69	100	Black shale with streeks of blue Gritty clay

TOTAL DEPTH OF BORING 100 (Feet)
TOTAL DEPTH OF COMPLETED WELL 100 (Feet)

WELL LOCATION

Address 18585 Gwenoc Lane
City Middletown, California 95461
County LAKE
APN Book 014 Page 270 Parcel 60
Township 11N Range 06W Section 19
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY X
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 11 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 18 (Ft.) & DATE MEASURED 1/21/99
ESTIMATED YIELD * 20 (GPM) & TEST TYPE Bail
TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 50 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	9 7/8								
20	100	7 7/8								
+3	99		X				PVC/F480	5 "	CL200	
40	100			X						.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	100			1yd	Pea gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WEEKS DRILLING AND PUMP COMPANY
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS P.O. Box 176 CITY Sebastopol STATE California ZIP 95473

Signed WARD THOMPSON BY: THURMAN ADAMS 1/26/99 177681
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page ___ of ___

MAY 2 1 2001

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 775265

DWR USE ONLY — DO NOT FILL IN
11N/06W-18 M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. #1
Date Work Began 4-4-01 Ended 4-10-01
Local Permit Agency LAKE COUNTY HEALTH DEPARTMENT
Permit No. WE2056 Permit Date 3-22-01

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD AIR ROTARY FLUID N/A

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	34	Red clay, boulders & cobble
34	196	Hard gray volc. Rock
196	221	Red & tan clay & conglomerate rock
221	340	Volcanic Conglomerate rock

TOTAL DEPTH OF BORING 340' (Feet)
TOTAL DEPTH OF COMPLETED WELL 335' (Feet)

WELL LOCATION

Address 20572 Honey Hill Road,
City Hidden Valley
County LAKE
APN Book 114 Page 07 Parcel 10
Township 11N Range 06W Section 18
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial
___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 175' (Ft.) & DATE MEASURED 4-10-01
ESTIMATED YIELD * 60 + (GPM) & TEST TYPE AIR LIFTED
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 320' (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	12¼								
20	340	8HB								
+2	335		X				PVC/F480 5"		CL200	
235	335			X						.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	340			X	PEA GRAVEL

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WEEKS DRILLING & PUMP COMPANY OCT 15
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS P.O. BOX 176, Sebastopol, Ca 95473 CITY STATE ZIP

Signed Ward Thompson WARD THOMPSON BY:THURMAN ADAMS 4-12-01 177681
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. 2

Date Work Began 8-24-01, Ended 8-28

Local Permit Agency Lake Co

Permit No. _____ Permit Date _____

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 784508

DWR USE ONLY — DO NOT FILL IN
11N/06W-30
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD Air Rotary FLUID Water

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	2	Road gravel
2	27	Brown Clay
27	57	Brown Clay w/ Gravel
57	103	Dark gray rock

* Casing Set 3 Ft in height above grade *

TOTAL DEPTH OF BORING 103 (Feet)

TOTAL DEPTH OF COMPLETED WELL 103 (Feet)

WELL LOCATION

Address 19573 Grange Rd

City Middletown

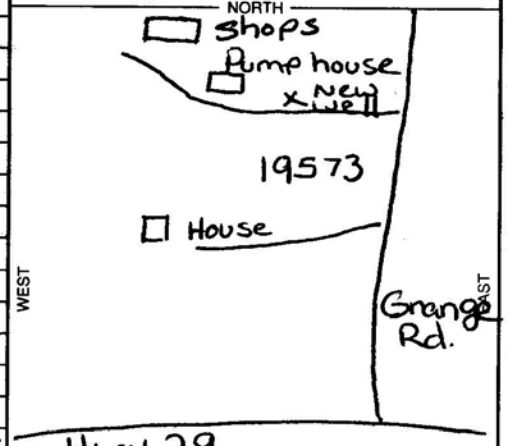
County Lake

APN Book 014 Page 370 Parcel 03

Township 11N Range 06W Section 30 ?

Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial

___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 27 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 39 (Ft.) & DATE MEASURED 8-27-01

ESTIMATED YIELD * 20 (GPM) & TEST TYPE Air Blew

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
3 ft Above	22	13	✓				Steel	6 5/8	.188	
22	60	8	✓				"	"	"	
60	100	8		✓			"	"	"	3/8 x 1
100	103	8	✓				Steel	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	22	✓			

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other _____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Rural Drilling Company (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

NOV 14 2001

ADDRESS P.O. Box 1617 CITY Laytonville STATE CA ZIP 95454

Signed _____ (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 9-5-01

C-57 LICENSE NUMBER 616592

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. e033469

DWR USE ONLY — DO NOT FILL IN

11N/06W-07

STATE WELL NO./ STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Owner's Well No. Well #1

Date Work Began 11/18/2005, Ended 11/23/2005

Local Permit Agency Lake Co Environ Health

Permit No. WE-2425 Permit Date 11/9/2005

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD AIR ROTARY FLUID N/A

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0	45	Stiff tan clay
45	70	Light brown sandy clay
70	101	Light brown sandy clay with gravel
101	125	Loose fractured rock
125	150	Gray rock
150	210	Volcanic rock
210	220	Red rock

TOTAL DEPTH OF BORING 220 (Feet)

TOTAL DEPTH OF COMPLETED WELL 220 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 18967 Comstock Court

City Middletown CA

County Lake

APN Book 144 Page 121 Parcel 030

Township 11N Range 06W Section 07

Latitude DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG"

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial

___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 130 (Ft.) & DATE MEASURED 11/23/2005

ESTIMATED YIELD * 30 (GPM) & TEST TYPE AIR DEVELOP

TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN 220 (Ft.)

May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	11								
20	220	8" HB								
+2	220		✓				PVC	5	CL200	
140	220			✓						.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	19	✓			
19	21		✓		
21	220			✓	3/8 pea gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Weeks Drilling & Pump
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. Box 176 ADDRESS Sebastopol CITY CA STATE 95473 ZIP

Signed Melissa A Lopez WELL DRILLER/AUTHORIZED REPRESENTATIVE

12/09/05 DATE SIGNED

177681 C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

D C

ORIGINAL
File with DWR

JUN 0 1 2015

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. e0267546

Page 1 of 1

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./ STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. WELL #1

Date Work Began 4/17/2015, Ended 4/28/2015

Local Permit Agency Lake County Environmental

Permit No. WE-3066 Permit Date 1/16/2015

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD AIR FLUID N/A

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0	43	Red ash and rock
43	62	Extra hard gray rock
62	83	Red lava rock and voids
83	131	Burgundy colored rock
131	141	Extra hard gray rock
141	176	Burgundy and purple rock
176	304	Hard gray, black and green rock
304	343	Gray, black, green and red rock
343	408	Extra hard blue/gray rock
408	472	Gray, black and green rock with water producing fractures from 447' to 451'
472	540	Extra hard blue/gray rock

TOTAL DEPTH OF BORING 540 (Feet)

TOTAL DEPTH OF COMPLETED WELL 532 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 15519 Spruce Grove Road

City Middletown CA

County Lake

APN Book 013 Page 060 Parcel 060

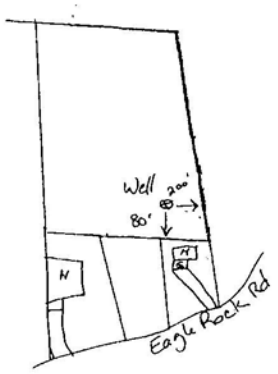
Township 11N Range 07W Section 10

Latitude 38 DEG. 49 MIN. 898 SEC. N

122 DEG. 33 MIN. 684 SEC. W

LOCATION SKETCH

NORTH



WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG"

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER N/A (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 310 (Ft.) & DATE MEASURED 4/28/2015

ESTIMATED YIELD 6 (GPM) & TEST TYPE Air Developed

TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN BTM (Ft.)

May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	11								
20	540	8								
+2	372		✓				PVC	5	SDR21	
372	532			✓			PVC	5	SDR21	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	1	✓			CONCRETE
1	25		✓		
25	532			✓	3/8 Pea Gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Weeks Drilling & Pump (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. Box 176 ADDRESS Sebastopol CITY CA STATE 95473 ZIP

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE

05/22/15 DATE SIGNED

177681 C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

File Original with DWR MAR 23 2016

State of California

Well Completion Report

No. e0303696

Page 1 of 1

Owner's Well Number #1

Date Work Began 01/13/2016 Date Work Ended 2/3/2016

Local Permit Agency Lake County Environmental

Permit Number WE-4664 Permit Date 12/16/15

DWR Use Only – Do Not Fill In

State Well Number/Site Number: 11N/06W-06

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	75	Red ash, cobbles and boulders
70	100	Gray ash and crushed rock
100	220	Gray volcanic rock
220	240	Gray volcanic rock with large fractures
24	280	Gray volcanic rock
280	370	Red volcanic rock with red and burgundy cinders
370	380	Tan ash and gray rock
380	420	Green ash and gray rock
420	550	Burgundy and red volcanic rock and cinders
550	592	Fractured gray volcanic rock
592	600	Shale clay

Total Depth of Boring 600 Feet

Total Depth of Completed Well 594 Feet

Well Location

Address 15591 Spruce Grove Road

City Middletown County Lake

Latitude 38 Deg. 50 Min. 100 Sec. N Longitude 122 Deg. 33 Min. 687 Sec. W

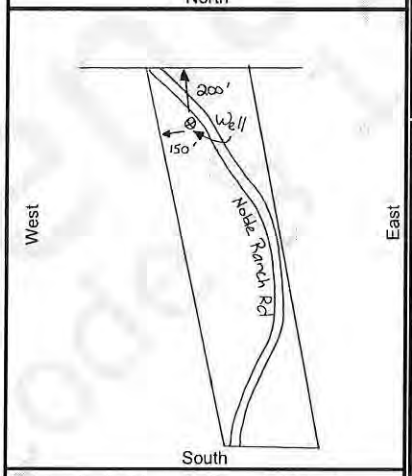
Datum Decimal Lat. Decimal Long.

APN Book 013 Page 060 Parcel 070

Township 11N Range 6W Section 6 ✓

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☑ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 550 (Feet below surface)

Depth to Static Water Level 270 (Feet) Date Measured 02/01/2016

Estimated Yield * 20 (GPM) Test Type Air Lift

Test Length 8.0 (Hours) Total Drawdown 580 (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	60	13						
60	600	10						
0	494		Blank	PVC Sch. 40	SDR21	6		
494	594		Screen	PVC Sch. 40	SDR21	6	Milled Slots	0.032

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	54	Cement	
54	58	Bentonite	
58	594	Filter Pack	3/8 Pea Gravel

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Weeks Drilling & Pump Co.
Person, Firm or Corporation

P.O. Box 176 Address Sebastopol City CA State 95473 Zip

Signed [signature] C-57 Licensed Water Well Contractor 3/11/16 Date Signed 177681 C-57 License Number

DWR 188 REV. 1/2006

GK-5

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 375939

File Stonehouse

WELL #3

State Well No.

Other Well No.

If Ir... No.
erm: ... or Date WE 561

WNER: Name Stonehouse Mutual Water Company
& Winzler & Kelly, 495 Tesconi Circle
Santa Rosa, CA ZIP 95401

OCATION OF WELL (See instructions): 14-270-66
Lake Owner's Well Number
ldress if different from above 18963 Grange Road
ip Middletown Range Section
o from cities, roads, railroads, fences, etc.

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☐
Other ☒
(Describe) Public

(12) WELL LOG: Total depth 205 ft. Completed depth 180 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	10	Brown sandy clay & sandy gravel with cobbles
10	115	Sandy gravel with conglomerate and boulders
115	120	Sand & gravel with conglomerate and boulders, small amounts of silty clays & sandy clay
120	165	Sandy & gravel with conglomerate and boulders
165	170	Conglomerate sand & gravel with boulders
170	180	Conglomerate brown clay with embedded rock
190	198	Brown clay
198	205	Tan sandy clay

WELL LOCATION SKETCH

QUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☐ No ☒ Size Evergreen
Diameter of bore 12¼" to 207
Packed from 50 to 180 ft.

ASING INSTALLED:
☒ Plastic ☐ Concrete ☐

...m	To ft.	Dia in.	Gage or Wall
	180	12	3/4 .025

(8) PERFORATIONS:
Type of perforation or slot of screen S.S. Screen

From ft.	To ft.	Slot size
80	180	.070

WELL SEAL:
surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 50 ft.
strata sealed against pollution? Yes ☐ No ☐ Interval ft.
od of sealing Sand Grout On Pack

) WATER LEVELS:
h of first water, if known ft.
ding level after well completion 29' ft.

) WELL TESTS:
well test made? Yes ☒ No ☐ If yes, by whom? Weeks
e of test Pump ☒ Bailer ☐ Air lift ☐
th t... at start of test 29 ft. At end of test 123 ft.
harge 100 gal/min after 6 hours Water temperature 67°
mical analysis made? Yes ☐ No ☒ If yes, by whom?
electric log made Yes ☒ No ☐ If yes, attach copy to this report

Work started 10-9 19 91 Completed 10-22 19 91

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed Ward Thompson (Well Driller)

NAME WEEKS DRILLING & PUMP CO. (Person, firm, or corporation) (Typed or printed)

Address P.O.B. 176

City Sebastopol, CA ZIP 95473

License No. C57-177681 Date of this report 11-14-91

RECEIVED
APR 23 1992
JAMES C. HANSON

NOT A PUBLIC USE WELL
NOT FOR PUBLIC USE
SEC. 13752
WATER CODE

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

s 188 (REV. 12-88) 84 94345

** 500 G.P.M. At 80' **

Grange Road Well #4

TOP OF CASING ELEV 956.89

RECEIVED MAR 1 0 2003

TRIPLICATE
Owner's Copy

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 769936

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. Well#4 4
Date Work Began 1/23/2003, Ended 2/26/2003
Local Permit Agency Lake Co Environ Health
Permit No. WE-2201 Permit Date 1/29/2003

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL — HORIZONTAL — ANGLE — (SPECIFY)
DRILLING METHOD MUD ROTARY FLUID Bentonite

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0 12	Tan clay
12 59	Sand and gravel, cobble and boulders
59 72	Clay
72 84	Sand and gravel
84 87	Clay
87 94	Sand and gravel
94 95	Clay
95 115	Sand and gravel and clay streaks
115 135	Clay
135 138	Sand and gravel
138 147	Clay with embedded gravel
147 167	Sand and gravel and streaks of clay
167 180	Clay with streaks of sand and gravel
180 189	Blue clay with embedded gravel and streaks of loose gravel
189 199	Clay with embedded rock
199 204	Hard serpentine
204 231	Stiff clay

TOTAL DEPTH OF BORING 231 (Feet)
TOTAL DEPTH OF COMPLETED WELL 206 (Feet)

WELL OWNER

Name Hidden Valley Com. Service District
Mailing Address 19400 Hardman Road
Middletown CA
CITY STATE ZIP

WELL LOCATION

Address 18963 Grange Road
City Middletown CA
County Lake
APN Book 014 Page 270 Parcel 67
Township — Range — Section —
Latitude — DEG. MIN. SEC. — DEG. MIN. SEC.

LOCATION SKETCH
NORTH / WEST / EAST / SOUTH
Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
✓ NEW WELL
MODIFICATION/REPAIR
— Deepen
— Other (Specify)
— DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG"

PLANNED USES (✓)
WATER SUPPLY
— Domestic ✓ Public
— Irrigation — Industrial
MONITORING —
TEST WELL —
CATHODIC PROTECTION —
HEAT EXCHANGE —
DIRECT PUSH —
INJECTION —
VAPOR EXTRACTION —
SPARGING —
REMEDIATION —
OTHER (SPECIFY) —

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER — (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 22 (Ft.) & DATE MEASURED 2/26/2003
ESTIMATED YIELD 100 (GPM) & TEST TYPE BAILED
TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 44 (Ft.)
May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 231	7 7/8								
50 218	22								
+3 206		✓				STEEL	14		
0 50				✓		S. STEEL	24		
50 110			✓			S. STEEL			.050
148 188			✓			S. STEEL			.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 50	✓			sand grout
50 206			✓	6 x 16 sand

ATTACHMENTS (✓)

— Geologic Log
— Well Construction Diagram
— Geophysical Log(s)
— Soil/Water Chemical Analysis
— Other —

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Weeks Drilling & Pump
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. Box 176 Sebastopol CA 95473
ADDRESS CITY STATE ZIP

Signed Melissa G. Lopez 03/05/03
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED

177681
C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

AG Well?

ORIGINAL

File Original, Duplicate and Triplicate with the ON MICROFILM (Sections 7076, 7077, 7078, Water Code)

REGIONAL WATER POLLUTION CONTROL BOARD No. 5 (Insert appropriate number)

WATER WELL DRILLERS REPORT

STATE OF CALIFORNIA

84

LOCATION NOT CHECKED
Do Not Fill In
No 32402

State Well No.
Other Well No. 11N/6W-30A1

(2) LOCATION OF WELL:

County LAKE Owner's number, if any—

R. F. D. or Street No. R6W, T11N, SEC. 29 ABOUT 1 MILE EAST OF JUNCTION HIGHWAY 53 AND GUENOC GRANGE ROAD IN COYOTE VALLEY. AND ABOUT 40 FT. SOUTH

(3) TYPE OF WORK (check):

New well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic [ ] Industrial [ ] Municipal [ ]
Irrigation [X] Test Well [ ] Other [ ]

(5) EQUIPMENT:

Rotary [ ]
Cable [X]
Dug Well [ ]

(6) CASING INSTALLED:

SINGLE [X] DOUBLE [ ]

From 0 ft. to 110 ft., 14 Diam., 10 Gage of Well

Type and size of shoe or well ring 5/8 X 4

Describe joint BUTT WELD

If gravel packed

Diameter of Bore	From ft.	to ft.

Size of gravel:

(7) PERFORATIONS:

Type of perforator used KNIFE

Size of perforations 2 1/2 in., length, by 3/8 in.

From	ft. to	ft.		Perf. per row		Rows per ft.
30	32		9	1 1/2		
35	50		11	11		
54	74		11	11		
78	86		11	11		
96	106		11	11		

(8) CONSTRUCTION:

Was a surface sanitary seal provided? [ ] Yes [X] No To what depth ft.

Were any strata sealed against pollution? [ ] Yes [X] No If yes, note depth of strata

From ft. to ft.

Method of Sealing

(9) WATER LEVELS:

Depth at which water was first found 15 ft.

Standing level before perforating 12 ft.

Standing level after perforating 12 ft.

(10) WELL TESTS:

Was a pump test made? [X] Yes [ ] No If yes, by whom? HUTTON - SULLIVAN

Yield: 1000 gal./min. with 17 ft. draw down after 6 hrs.

Temperature of water Was a chemical analysis made? [ ] Yes [X] No

Was electric log made of well? [ ] Yes [X] No

(11) WELL LOG:

Total depth 110 ft. Depth of completed well 110 ft.

Formations: *Describe by color, character, size of material, and structure.*

0 ft. to	10 ft.	SOIL
10 "	15 "	GRAVEL (DRY)
15 "	32 "	" (WATER-BEARING)
32 "	35 "	BROWN CLAY
35 "	50 "	GRAVEL 1/4" TO 1"
50 "	54 "	BROWN CLAY
54 "	74 "	GRAVEL (SAND TO 3")
74 "	78 "	SAND
78 "	86 "	GRAVEL (1/4" TO 5")
86 "	96 "	BROWN CLAY
96 "	106 "	GRAVEL
106 "	110 "	HARD PAN

CONFIDENTIAL
Section 7076.1, Water Code

FOR OFFICIAL USE ONLY

Work started AUG 10 19 51. Completed AUG 14 '51

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME HUTTON - SULLIVAN (Person, firm, or corporation) (Typed or printed)

Address UPPER LAKE

[SIGNED] J. R. Sullivan Well Driller

License No. 12749 Dated 8-15-51, 19

DWR FORM NO. 246 (REV. 5-54)

GR-2

ICATE
's Copy

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 177233

State Well No.
Other Well No.

VNER: Name Stonehouse Mutual Water Co.
/o William Hamann, P. O. Box 471
iddletown, CA Zip 95461

CATION OF WELL (See instructions): Owner's Well Number #2
Lake
ess if different from above Grange Road
Middletown Range Section
ames cities, roads, railroads, fences, etc.

RECEIVED
MAR - 7 1991
JAMES C. HANSON

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☒
Other ☐

WELL LOCATION SKETCH

IPMENT:
☐ Reverse ☐
☐ Air ☐
☐ Bucket ☐

(6) GRAVEL PACK: Monterey Sand
Yes ☒ No ☐ Size 8 x 16
Diameter of bore 12¾ - 18"
Packed from 53 ft. to 120 ft.

NG INSTALLED:
Plastic ☐ Concrete ☐

(8) PERFORATIONS:
Type of perforation or slot or screen: Rosana Moss SuperFlo

To ft.	Dia. in.	Case or Wall	From ft.	To ft.	Slot size
120	23/4	.250	70	115	.050

LL SEAL:
ion sanitary seal provided? Yes ☒ No ☐ If yes, to depth 53 ft.
ers sealed against pollution? Yes ☐ No ☐ Interval ft.
of sealing Send grout on pack

ATER LEVELS:
st water, if known ft.
level after well completion 22' ft.

ELL TESTS:
test made? Yes ☒ No ☐ If yes, by whom? To be tested
test: Pump ☒ Bailer ☐ Air lift ☐
ld at start of test 23 ft. At end of test 70 ft.
2 gal/min after 4 hours Water temperature Cool
analysis made? Yes ☐ No ☒ If yes, by whom?
ric log made? Yes ☒ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 292 ft. Depth of completed well 120 ft.

from ft.	to ft.	Formation (Describe by color, character, size of material)
0	7	Topsoil
7	22	Conglomerate boulders and gravel
22	51	Conglomerate boulders, cobbles, and gravel
51	58	Conglomerate gravels, cobbles & traces of brown clay
58	74	Gravels and cobbles
74	113	Conglomerate boulders, cobbles, and gravels
113	117	Brown clay
117	150	Brown sandy clay with cemented gravel
150	160	Brown clay
160	178	Brown sandy clay with streaks of gravel
178	184	Brown clay & cemented boulders
184	192	Brown clay
192	205	Brown clay with streaks of gravel
205	208	Brown clay
208	219	Brown clay with seams of cemented gravel
219	248	Blue clay with layers of cemented gravel
248	260	Brown clay
260	263	Blue clay
263	265	Streaks of small blue gravel
265	282	Blue clay with streaks of cemented gravel
282	293	Cemented conglomerate

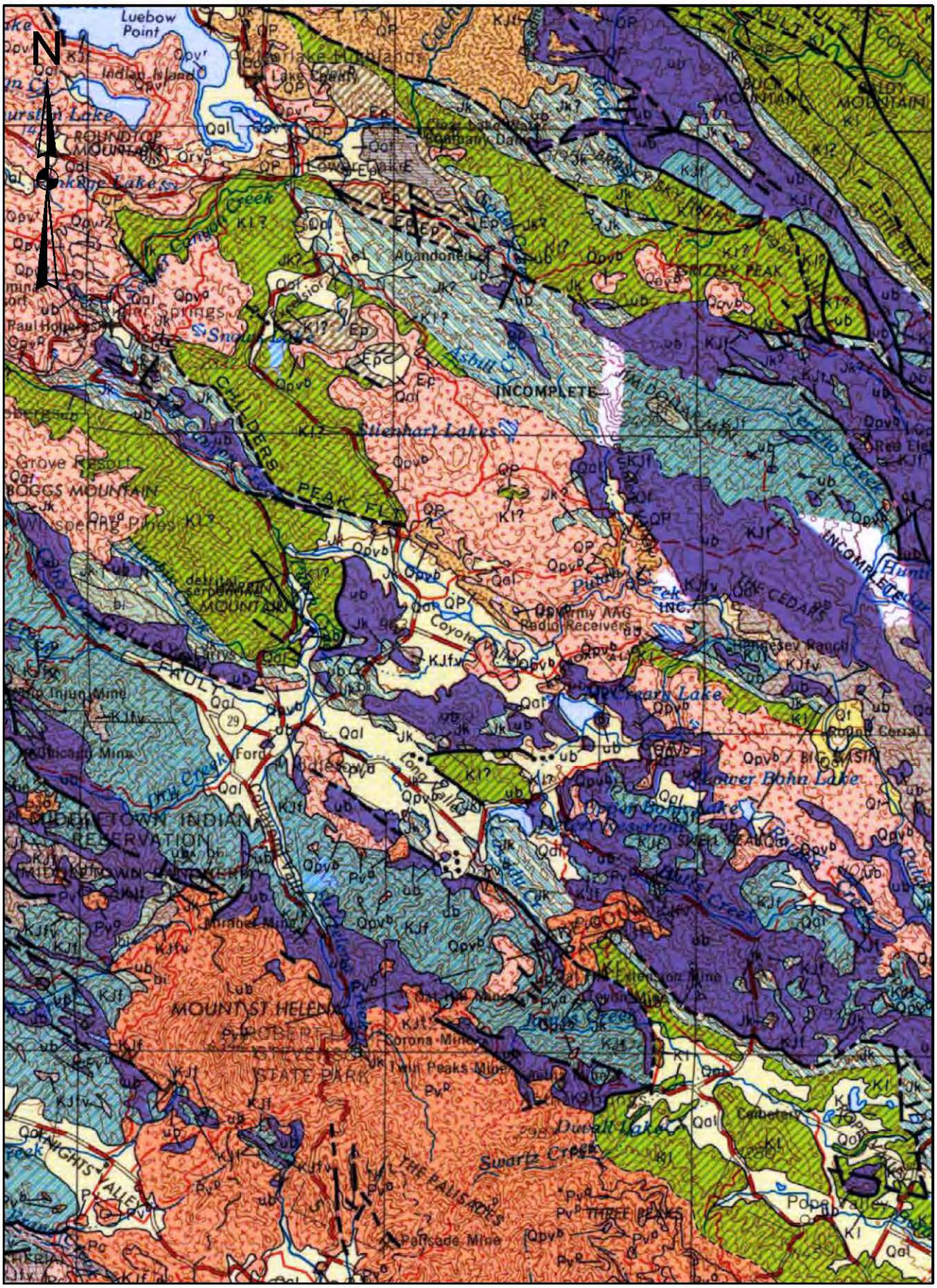
Work started 5/1/ 1985 Completed 5/15 1985

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Gerald C. Thompson, By: Ward Thompson
(Well Driller)
NAME WEEKS DRILLING AND PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)
Address P. O. Box 175
City Sebastopol, CA Zip 95472
License No. C57-177681 Date of this report May 20, 1985

e (REV. 7-74) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Geologic Map of Coyote Valley and Surrounding Area
Modified from Koenig, 1963



DIVISION OF MINES AND GEOLOGY
Ian Campbell, *State Geologist*

STATE OF CALIFORNIA
Edmund G. Brown, *Governor*
THE RESOURCES AGENCY
Hugo Fisher, *Administrator*

DEPARTMENT OF CONSERVATION
DeWitt Nelson, *Director*

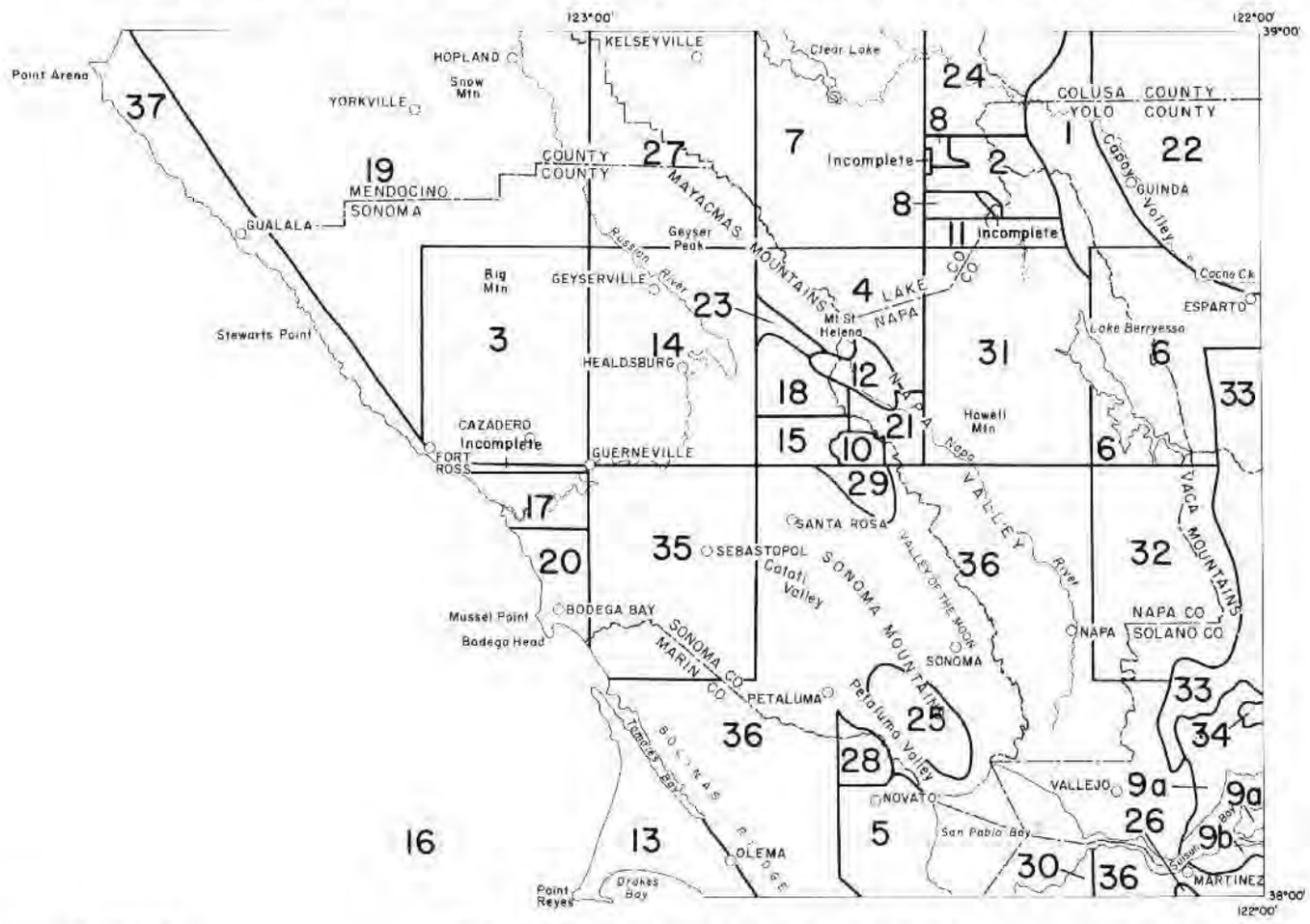
EXPLANATORY DATA

SANTA ROSA SHEET
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION

Compiled by James B. Koenig 1963

(Third Printing, 1976)

INDEX TO GEOLOGIC MAPPING
USED IN THE COMPILATION OF THE SANTA ROSA SHEET



1. Anonymous, Geologic maps of the west side of the Sacramento Valley, California, scale approx. 1:100,000, unpublished, 1953-55.
   Anonymous, Geologic maps of part of the Vaca Mountains, California, scale 1:62,500, unpublished, 1953-54.
2. Averitt, Paul, 1945, Quicksilver deposits of the Knoxville district, Napa, Yolo, and Lake Counties, California: California Div. Mines Report 41, pp. 65-89, Plate VI, scale 1:48,000.
   Borglin, Edgar K., The geology of part of the Morgan Valley quadrangle, California, scale 1:62,500, University of California, Berkeley, unpublished M.A. thesis, 1947.
3. Bailey, Edgar H., Geologic map of the Cazadero area, scale 1:62,500, U. S. Geological Survey, unpublished, 1958-1961.
4. Bailey, Edgar H., 1946, Quicksilver deposits of the western Mayacmas district, Sonoma County, California: California Div. Mines Report 42, pp. 199-230, Plate 29, scale 1:62,500.
   Yates, Robert G., and Hilpert, Lowell S., 1946, Quicksilver deposits of eastern Mayacmas district, Lake and Napa Counties, California: California Div. Mines Report 42, pp. 231-286, Plate 29, scale 1:62,500.
   Carter, William H., Geology of the northeast corner of the Calistoga quadrangle, scale 1:62,500, University of California, Berkeley, unpublished M.A. thesis, 1948.
5. Berkland, James O., Geology of the Novato quadrangle, California, scale 1:24,000, San Jose State College, master's thesis in progress, 1963.
6. Boyd, Harold A., Geology of the Capay quadrangle, California, scale 1:62,500, University of California, Berkeley, unpublished Ph.D. thesis, 1956. (Kl-Ku contact from Anonymous–see item 1. Details of Qc after James M. Kirby and T. H. Crook, Geological map, Winters-Capay area, Yolo and Solano counties, California, scale 1:31,680, Standard Oil Company of California, unpublished, 1934.)
7. Brice, James C., 1953, Geology of the Lower Lake quadrangle: California Div. Mines Bull. 166, Plate 1, scale 1:62,500. (Qal and QP modified by J. E. Upson and Fred Kunkel, 1955, Ground water of the Lower Lake-Middletown area, Lake County, California: U. S. Geol. Survey Water-Supply Paper 1297, Plate 1, scale 1:125,000. Modifications by Ira E. Klein–see item 24.)
8. California Div. Forestry, University of California, and U. S. Dept. of Agriculture, 1955, Upland soils of Lake County: California Forest and Range Experiment Station, Cooperative Soil-Vegetation Survey Project, map, scale 1:125,000. (Adapted for state map use by California Div. Mines and Geology.)
   California Dept. Water Resources, 1962, Reconnaissance report on upper Putah Creek basin investigations: Bull. no. 99, Plate 4, scale 1:118,000.
9a. Carpenter, E. J., and Cosby, S. W., 1930, Soil survey of the Suisun area, California: U. S. Dept. of Agriculture, in cooperation with University of California Agriculture Experiment Station, series 1930, no. 18, map, scale 1:62,500. (Interpreted for state map use by California Div. Mines and Geology.)
9b. Carpenter, E. J., and Cosby, S. W., 1939, Soil survey, Contra Costa County, California: U. S. Dept. of Agriculture, in cooperation with University of California Agriculture Experiment Station, series 1933, no. 26, scale 1:62,500. (Interpreted for state map use by California Div. Mines and Geology.)
10. Chesterman, Charles W., Geologic map of a portion of the Calistoga quadrangle, scale 1:15,840, California Div. Mines and Geology, unpublished, 1957.
11. Conrey, Bert L., Geology of a southern portion of the Morgan Valley quadrangle, California, scale 1:62,500, University of California, Berkeley, unpublished M.A. thesis, 1947.
12. Crutchfield, William H., Jr., The geology and silver mineralization of the Calistoga district, Napa County, California, scale 1:35,000, University of California, Berkeley, unpublished M.A. thesis, 1953.
13. Galloway, Alan J., Geologic maps of the Pt. Reyes Peninsula, scale 1:24,000, Calif. Academy of Sciences, San Francisco, work in progress, 1963.
14. Gealey, William K., 1950, Geology of the Healdsburg quadrangle: California Div. Mines Bull. 161, Plate 1, scale 1:62,500. (Pliocene and Quaternary units modified by G. T. Cardwell, 1958, Geology and ground water in the Santa Rosa and Petaluma Valley areas, Sonoma County, California: U. S. Geol. Survey Water-Supply Paper 1427, Plate 1, scale 1:62,500; and G. T. Cardwell, 1961, Geology and ground water in the Russian River Valley areas, and in Round, Laytonville and Little Lake Valleys, Sonoma and Mendocino Counties, California: U. S. Geol. Survey Open File Report, Fig. 2, scale 1:62,500.)
15. Goss, Charles R., Geology of the southwest corner of the Calistoga quadrangle, scale 1:31,680, University of California, Berkeley, unpublished M. A. thesis, 1948. (Modified by Cardwell, 1958–see item 14.)
16. Hanna, G. Dallas, 1952, Geology of the continental slope off central California: Proc. Calif. Acad. Sci., 4th series, v. 27, pp. 325-358.
    Chesterman, Charles W., 1952, Descriptive petrography of rocks dredged off the coast of central California: Proc. Calif. Acad. Sci., 4th series, v. 27, pp. 359-374.
    Uchupi, Elazar, Continental margin from Cedros Island, Baja California, to San Francisco, California, University of Southern California, unpublished Ph.D. thesis, 1962.
17. Higgins, Charles G., The lower Russian River, California, scale 1:31,680, University of California, Berkeley, unpublished Ph.D. thesis, 1950. (Qm by Francis H. Bauer, Marine terraces between Salmon Creek and Stewarts Point, Sonoma County, California, scale 1:31,680, University of California, Berkeley, unpublished M.A. thesis, 1952. Ub north of Jenner by William Crawford, University of California, Berkeley, Ph.D. thesis in progress, 1963. Qal and Qt by Cardwell, 1961–see item 14. Modifications by James B. Koenig, California Div. Mines and Geology, 1961.)
18. Hurlbut, Elvin M., Geology of a portion of the Calistoga quadrangle, scale 1:62,500, University of California, Berkeley, unpublished M.A. thesis, 1948.
19. Irwin, William P., 1960, Geologic reconnaissance of the northern Coast Ranges and Klamath Mountains, California: California Div. Mines Bull. 179, Pl. 1, scale 1:500,000.
    Dibblee, Thomas W., Jr., Reconnaissance geologic maps of the Point Arena, Hopland and Ornbaun quadrangles, scale 1:62,500, unpublished, 1950.
    Higgins, Charles G., 1960, Ohlson Ranch Formation, Pliocene, northwestern Sonoma County, California: Calif. Univ. Pubs. Geol. Sci., v. 36, pp. 199-232, Map 1, scale 1:47,260.
    Data for alluviated valleys by California Div. Water Resources, 1956, Geology, hydrology and water quality of alluviated areas in Mendocino County and recommended standards of water well construction and sealing: Water Quality Investigations Report no. 10, Pl. 3, scale 1:62,500, and Pl. 7-4, scale 1:62,500 and 1:48,000; and by Cardwell, 1961–see item 14. Miscellaneous additions by E. H. Bailey, written communication, 1963.
20. Johnson, F. A., 1943, Petaluma region: *in* California Div. Mines Bull. 118, pp. 622-627, Fig. 277, scale 1:250,000.
    Johnson, F. A., Geology of the Merced Pliocene Formation north of San Francisco Bay, California, scale 1:62,500, University of California, Berkeley, unpublished Ph.D. thesis, 1934. (Qm after Bauer–see item 17. Modifications by James B. Koenig, California Div. Mines and Geology, 1961.)
21. Johnston, Stedwell, The geology of a portion of the Calistoga quadrangle, California, scale 1:62,500, University of California, Berkeley, unpublished M.A. thesis, 1948.
22. Kirby, James M., 1943, Rumsey Hills area: *in* California Div. Mines Bull. 118, pp. 601-605, Fig. 265, scale approx. 1:220,000. (Modified by Anonymous–see item 1. Great Valley units by Franklin H. Olmsted and George H. Davis, 1961, Geologic features and ground-water storage capacity of the Sacramento Valley, California: U. S. Geol. Survey Water-Supply Paper 1497, Plate 2, scale 1:250,000.)
23. Koenig, James B., Reconnaissance geologic map of part of the Calistoga quadrangle, California, scale 1:24,000, California Div. Mines and Geology, reconnaissance mapping for the State Geologic Map, 1961.
24. Lawton, John E., Geology of the north half of the Morgan Valley quadrangle and the south half of the Wilbur Springs quadrangle, scale 1:48,000, Stanford University, unpublished Ph.D. thesis, 1956.
    Klein, Ira E., Geologic map of the north half of the Morgan Valley quadrangle and part of the Lower Lake quadrangle, scale 1:62,500 and 1:31,680, unpublished, 1953.
25. Louke, Gladys, Geologic map of parts of the Sonoma Mountains and Petaluma Valley, California, scale 1:62,500, unpublished, 1960.
    Cebull, S. E., The structure and stratigraphy of portions of the Mare Island, Sears Point and Richmond quadrangles, California, scale 1:24,000, University of California, Berkeley, unpublished M.A. thesis, 1958.
    Morse, Roy R., and Bailey, T. L., 1935, Geological observations in the Petaluma district, California: Geol. Soc. America Bull., vol. 46, pp. 1437-1456, Plate 127, scale 1:31,680.
    Additions and modifications by Robert L. Rose, Geologic map of the Sears Point area, scale 1:24,000, unpublished, 1959; and by Harold D. Woods, Geology of the Sears Point landslide, Sonoma County, California, scale approx. 1:40,000, University of Southern California, unpublished report, 1952.
26. Lutz, George C., 1951, The Sobrante Sandstone: Calif. Univ. Pubs. Geol. Sci., v. 28, pp. 367-406, Fig. 3, scale 1:30,000.
    Schmidt, Otto M., San Ramon Sandstone in the Pacheco syncline, California, scale 1:12,000, Stanford University, unpublished M.S. thesis, 1958.
27. McNitt, James R., Geologic map of the Kelseyville quadrangle, California, scale 1:62,500, California Div. Mines and Geology, work in progress, 1963. (Cenozoic volcanic rocks in part after C. A. Anderson, 1936, Volcanic history of the Clear Lake area, California: Geol. Soc. America Bull., vol. 47, pp. 629-664, Plate 2, scale approx. 1:112,000.)
28. Rose, Robert L., Geologic map of the Burdell Mountain area, California, scale 1:24,000, San Jose State College, in progress, 1963.
29. Rose, Robert L., Geologic maps of part of the Kenwood, Santa Rosa and Sonoma quadrangles, California, scale 1:24,000, San Jose State College, unpublished, 1953-55.
30. Sheehan, J. R., The structure and stratigraphy of northwestern Contra Costa County, California, scale 1:24,000, University of California, Berkeley, unpublished M.S. thesis, 1956.
    Cebull, S. E.–see item 25.
31. Taliaferro, N. L., Geologic map of the St. Helena quadrangle, California, scale 1:62,500, University of California, Berkeley, unpublished geologic summer field class mapping, 1947. (Pliocene and Quaternary units in part by Kunkel and Upson, 1960–see item 36. Minor additions by Parry Reiche, Geology of the Snell damsite on Putah Creek, scale 1:1,200, U. S. Bureau of Reclamation, Region II, unpublished, 1946.)
32. Taliaferro, N. L., Geologic map of the Mt. Vaca quadrangle, California, scale 1:24,000, University of California, Berkeley, unpublished geologic summer field class mapping, 1951. (Pliocene and Quaternary units in part by Kunkel and Upson, 1960–see item 36. Kl-Ku contact by Standard Oil Company of California, unpublished geologic data.)
33. Thomasson, H. G., Jr., Olmsted, Franklin H., and LeRoux, E. F., 1960, Geology, water resources, and usable ground-water storage capacity of part of Solano County, California: U. S. Geol. Survey Water-Supply Paper 1464, Plate 1, scale 1:62,500. (Qc from Kirby and Crook–see item 6. Ep by Standard Oil Company of California, unpublished geologic data.)
34. Tolman, Frank B., 1943, Potrero Hills gas field: *in* California Div. Mines Bull. 118, pp. 595-598, Fig. 263, Sketch showing geology of Potrero Hills (modified from maps by Cordell Durrell and Mason Hill), scale approx. 1:40,000. (Modifications by Standard Oil Company of California, unpublished geologic data.)
35. Travis, Russell B., 1952, Geology of the Sebastopol quadrangle, California: California Div. Mines Bull. 162, Plate 1, scale 1:62,500. (Pliocene and Quaternary units modified by Cardwell, 1958–see item 14.)
36. Weaver, Charles E., 1949, Geology of the Coast Ranges immediately north of San Francisco Bay region, California: Geol. Soc. America Memoir 35, Plates 6, 7, 9-12, scale 1:62,500 (also California Div. Mines Bull. 149, Plates 1, 3, 5, 9, 11, 13, 15, scale 1:62,500).
    Kunkel, Fred, and Upson, J. E., 1960, Geology and ground water in Napa and Sonoma Valleys, Napa and Sonoma counties, California: U. S. Geol. Survey Water-Supply Paper 1495, Plate 2, scale 1:62,500.
    Clement, William G., Gravity investigation of the northern San Francisco Bay area, scale 1:250,000, Stanford University, Ph.D. thesis in progress, 1963 (concealed faults through San Pablo Bay).
    Modifications and additions by Gladys Louke, unpublished geologic maps, scale 1:62,500, 1960; Harold J. Gluskoter, Geology of a portion of western Marin County, California, scale 1:24,000, University of California, Berkeley, unpublished Ph.D. thesis, 1962; Cardwell, 1958–see item 14; Robert L. Rose, unpublished geologic maps, scale 1:24,000, 1953; C. F. Tolman, 1931, Geology of upper San Francisco Bay region with special reference to a salt water barrier below confluence of Sacramento and San Joaquin Rivers: California Div. Water Resources Bull. 28, Appendix D, pp. 309-359, Plate D-9, scale 1:80,000; Philip F. Fix and C. Melvin Swinney, 1949, Quicksilver deposits of the Oakville district, Napa County, California: California Div. Mines Report 45, pp. 31-46, Plate 3, scale 1:2,400; and James O. Berkland, written communication, 1963.
37. Wentworth, Carl, Geologic map of the Gualala coastal area, Fort Ross to Schooner Gulch, Sonoma and Mendocino Counties, California, scale 1:24,000, Stanford University, Ph.D. thesis in progress, 1963.
    Dibblee, Thomas W., Jr.–see item 19.
    Modifications and additions by Standard Oil Company of California, unpublished geologic data. Qm in part by Bauer–see item 17; and by California Div. Water Resources–see item 19, Plate 6, scale approx. 1:80,000.

For a complete list of published geologic maps of this area see Division of Mines and Geology Special Reports 52 and 52-A.

STRATIGRAPHIC NOMENCLATURE—SANTA ROSA SHEET

AGE	STATE MAP SYMBOL	STATE MAP UNIT State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES (The formally named formations grouped within an individual State Map Unit are listed in stratigraphic sequence from youngest to oldest.)
CENOZOIC / QUATERNARY / Recent	Qs	**RECENT DUNE SAND**	Dune sand and associated beach deposits.
	Qal	**RECENT ALLUVIUM**	Stream and valley alluvium. Artificial fill. Mud flats and salt marsh deposits bordering San Pablo Bay.
	Qsc	**RECENT RIVER AND MAJOR STREAM CHANNEL DEPOSITS IN THE GREAT VALLEY**	River silts and sands (deposits along channels and natural levees of major streams).
	Qf	**RECENT ALLUVIAL FAN DEPOSITS IN THE GREAT VALLEY**	Alluvial-fan deposits (Pleistocene and Recent).
	Qb	**RECENT BASIN DEPOSITS IN THE GREAT VALLEY**	Sediments deposited during flood stages of major streams in areas between natural levees and alluvial fans. Sacramento-San Joaquin River delta mud, loam, muck and peat.
		RECENT VOLCANIC ROCKS:	
	Qrv	**UNDIFFERENTIATED**	Andesite and basalt.[1]
	Qrv^r	**RHYOLITIC**	Olivine dacite.[1]
	Qrv^b	**BASALTIC**	Basalt.[1]
	Qrv^p	**PYROCLASTIC**	Basaltic lapilli and other ejecta, forming cinder cone south of Clear Lake.[1]
QUATERNARY / Pleistocene	Qt	**QUATERNARY NONMARINE TERRACE DEPOSITS**	River and stream terrace sands, silts and gravels. In Big Valley, near Kelseyville, these deposits form a thin veneer over diatomaceous silts and gravels of the Cache Formation. Includes older alluvium on west side of Sonoma Valley.
	Qm	**PLEISTOCENE MARINE DEPOSITS AND MARINE TERRACE DEPOSITS**	Millerton Formation—*fossiliferous sands, clays and gravels* (on Tomales Bay and near Carquinez). Marine and nonmarine deposits on wave-cut terraces along coast.
	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Red Bluff Formation—*poorly-sorted reddish-brown sands and gravels, and minor clay beds* (may include post-Red Bluff stream terrace gravels). Montezuma Formation—*gravels, sands and clays*. Huichica Formation—*clay and silt, and gravelly and sandy clay, with reworked pumice and tuff near base*. Unnamed silts, clays, sands, gravels, and minor peat deposits (in part called Older Alluvium in alluviated valleys).
		PLEISTOCENE VOLCANIC ROCKS:	
	Qpv^r	**RHYOLITIC**	Rhyolite flows and tuffs of Cobb Mountain.[1] Rhyodacite.[1] Silicic dacite.[1] Obsidian (in part Recent).[1]
	Qpv^a	**ANDESITIC**	Andesite.[1]
	Qpv^b	**BASALTIC**	Basalt and olivine basalt, largely quartz-bearing (basal flows intercalated with the Cache Formation; may be in part Pliocene).[1]
	Qpv^p	**PYROCLASTIC**	Rhyolitic tuff of the Cache Formation, stratigraphically below quartz-bearing basalts (Qpv^b).
Pleistocene	QP	**PLIOCENE-PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Cache Formation—*silts, gravels, and clays, with beds of tuffaceous sand, marl, limestone, and diatomite*. Glen Ellen Formation—*poorly sorted silts, gravelly clays, and sands and gravels, with basal reworked tuff beds*. (Includes Older Alluvium of Travis, 1952, and upper part of the Sonoma Group of Gealey, 1950. Lower section of the Glen Ellen Formation is interbedded with the Merced Formation and with the Sonoma Group.) Unnamed silts, sandy clays, sands, and gravels bordering Lake Berryessa, and near Hopland. Unnamed conglomerates, siltstones, and lenses of limestone and coal, along Little Sulphur Creek (includes lagoonal or marine lenses).
	✳	**QUATERNARY AND/OR PLIOCENE CINDER CONES**	Quaternary cinder cone south of Clear Lake.
	Pc	**UNDIVIDED PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Alluvial and lacustrine sand, silt, gravel, diatomite, and gravelly clay, largely tuffaceous. (Considered to be part of the Sonoma Group: see Pv, Pv^p).
	Puc	**UPPER PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Tehama Formation—*fluviatile and lucustrine (?) silt, clay, silty sand with sand and gravel lenses, and basal beds of reworked tuff*. (May locally include correlatives of the Red Bluff Formation.)
	Pu	**UPPER PLIOCENE MARINE SEDIMENTARY ROCKS**	Merced Formation—*fossiliferous marine sandstone, siltstone, silty clay, with interbedded gravels and with basal tuff beds* (grades into nonmarine beds eastward along Petaluma and Santa Rosa Valleys, where it interfingers with rocks of the Sonoma Group; age ranges from middle Pliocene to early Pleistocene). Ohlson Ranch Formation—*marine sandstone, siltstone, and conglomerate, and fluviatile or lacustrine conglomerate* (middle to late(?) Pliocene age).
	Pmlc	**MIDDLE AND/OR LOWER PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Wolfskill Formation—*sandstone, conglomerate and andesitic tuff* (in vicinity of Port Chicago). Petaluma Formation—*sandstone, conglomerate and clay shales of fluviatile, lacustrine and estuarine origin* (Petaluma Valley area). Orinda Formation—*conglomerate, sandstones, clays, ostracodal limestone* (west of Pinole). (These three formations may be in part contemporaneous—Weaver, 1949.)
	Pml	**MIDDLE AND/OR LOWER PLIOCENE MARINE SEDIMENTARY ROCKS**	Siltstone, diatomaceous siltstone, sandstone, and claystone (on Pt. Reyes; early Pliocene age).
		PLIOCENE VOLCANIC ROCKS:	
	Pv	**UNDIFFERENTIATED**	Sonoma Group[2]—*andesite, basalt and rhyolite flows, tuffs and breccias, agglomerates, minor pumice and obsidian, with associated water-laid sediments of volcanic origin*. (Probably of middle and late Pliocene age. Interfingers in part with the Merced Formation and with the Glen Ellen Formation: see Pu and QP.)
	Pv^r	**RHYOLITIC**	Rhyolite of the Sonoma Group,[2] including the St. Helena Rhyolite—*rhyolitic flows and tuffs, perlite, pumice and obsidian, with interbedded agglomerate, sands, clays, and gravels*.
	Pv^a	**ANDESITIC**	Andesite flows, tuffs, breccias, and agglomerates of the Sonoma Group.[2]
	Pv^b	**BASALTIC**	Basalt flows and breccias of the Sonoma Group.[2]
	Pv^p	**PYROCLASTIC**	Tuffs, tuff breccias, agglomerates, water-laid sands, gravels, diatomaceous clays and silts, minor pumice and perlite, and interbedded flows of the Sonoma Group.[2] Nomlaki Tuff Member of the Tehama Formation—*pumiceous dacitic tuff* (along the border of Sacramento Valley). Lawlor Tuff—*andesitic tuffs and gravels* (in Los Medanos Hills; early to middle Pliocene). Pinole Tuff—*andesitic tuff and interbedded sand, gravel and clay* (in vicinity of Pinole; early to middle Pliocene).
TERTIARY / Miocene	Mu	**UPPER MIOCENE MARINE SEDIMENTARY ROCKS**	San Pablo Group—*marine sandstones, tuffs and shales* consisting of: Neroly Sandstone—*fine- to coarse-grained sandstone, with thin shale beds*; Cierbo Sandstone—*sandstone, white tuff, and gray tuffaceous shale*; Briones Sandstone—*quartz sandstone and local conglomerate lenses*, and Hercules Shale Member of Briones Sandstone—*siliceous and bituminous shale*.
	Mm	**MIDDLE MIOCENE MARINE SEDIMENTARY ROCKS**	Monterey Group—*six alternating shale and sandstone units:* Rodeo Shale—*siliceous and chalky shale*; Hambre Sandstone—*brown-gray sandstone and minor sandy shale*; Tice Shale—*chalky bituminous shale*; Oursan Sandstone—*sandstone and tuffaceous sandstone*; Claremont Shale—*shale with minor grit lenses*; Sobrante Sandstone—*fine- to coarse-grained sandstone*. "Monterey Shale"—*siliceous shales, glauconitic sandstone, and bedded chert* (on Pt. Reyes).[3]
	Ml	**LOWER MIOCENE MARINE SEDIMENTARY ROCKS**	Point Arena Beds—*foraminiferal clay shales, bituminous sandstone, cherty shale* (may be in part of middle Miocene age). Gallaway Beds—*sandy shales, mudstones and sandstones* (on Pt. Arena; may be in part Oligocene).[4] Sandstone, mudstone, shale, and minor volcanic rock of early Miocene age, near Fort Ross.[5]
Oligocene	Φ	**OLIGOCENE MARINE SEDIMENTARY ROCKS**	San Ramon Formation—*silty shale, and interbedded sandstone and conglomerate*. (Considered by many paleontologists to be earliest Miocene, rather than Oligocene.)

STRATIGRAPHIC NOMENCLATURE—Continued

AGE	STATE MAP SYMBOL	STATE MAP UNIT State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES (The formally named formations grouped within an individual State Map Unit are listed in stratigraphic sequence from youngest to oldest.)
CENOZOIC / TERTIARY / Eocene	E	**EOCENE MARINE SEDIMENTARY ROCKS**	Markley Formation—*sandstone, sandy shale and clay shale* (includes Jameson Shale Member); Nortonville Shale—*clay shales and siltstones;* Domengine Formation—*clay shales and massive sandstone* (includes "Ione-type" quartzitic sandstone of Tolman, 1943); Capay Formation—*clay shales and siltstones, basal conglomerate.* Unnamed sandstones and shales in Conn Valley, in Potrero Hills, and in vicinity of Vacaville. Sandstone, mudstone, and conglomerate of middle and late Eocene age north of Fort Ross, and of probable Late Cretaceous to Oligocene(?) age east of Point Arena.[5]
CENOZOIC / TERTIARY / Paleocene	Ep	**PALEOCENE MARINE SEDIMENTARY ROCKS**	Martinez Formation—*micaceous sandstone, gray foraminiferal shale, glauconitic sandstone* (includes "Lower Meganos(?)" shales and sandstone of Tolman, 1943, in the Potrero Hills). Vine Hill Sandstone—*massive, glauconitic sandstone* (same as lower part of "Martinez Formation"). Unnamed massive conglomerate and siltstone on Pt. Reyes.[3] Sandstone, conglomerate, and mudstone of Paleocene and possibly Late Cretaceous age, north of Fort Ross.[6]
CENOZOIC / TERTIARY / Undivided	Tc	**TERTIARY NONMARINE SEDIMENTARY ROCKS**	Unnamed siltstone, claystone, sandstone, and minor conglomerate of fluviatile, lacustrine and partially-marine origin, in the English Hills area. Includes detritus from Putnam Peak Basalt; age estimated to be Oligocene(?) to Pliocene(?)—Thomasson, Olmsted and LeRoux, 1960.
		TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:	
	Ti^b	**BASALTIC**	Hornblendite and "Solano" diabase of Weaver, 1949, on Sulphur Springs Mountain (pre-middle Eocene; probably Mesozoic).
	Ti^r	**RHYOLITIC**	Rhyolitic plugs, northeast of Santa Rosa.
	Ti^a	**ANDESITIC**	Sulphur Springs Mountain Andesite—*altered reddish-buff, shallow-intrusive andesite* (post-Knoxville and pre-middle Eocene).
		TERTIARY VOLCANIC ROCKS:	
	Tv^b	**BASALTIC**	Putnam Peak Basalt—*dense, black, vesicular basalt* (age estimated to be Oligocene(?) to Pliocene(?)—Thomasson, Olmsted and LeRoux, 1960). Skooner Gulch Basalt—*flow breccia and amygdaloidal basalt* (also called Iversen Basalt by Weaver, 1944; Eocene to Miocene in age). Unnamed black spilite at Black Point.[9]
	Tv^p	**PYROCLASTIC**	Vent breccia, west of Petaluma (post-Franciscan and pre-Merced, Johnson, 1943).
MESOZOIC / CRETACEOUS	K	**UNDIVIDED CRETACEOUS MARINE SEDIMENTARY ROCKS**	Unnamed graywacke sandstones, shales, conglomerates, and mildly metamorphosed equivalents, in the coastal belt east of the San Andreas Fault zone. (Now considered by E. H. Bailey, oral communication, 1963, to be equivalent to the upper part of the Franciscan Formation.)
MESOZOIC / CRETACEOUS	Ku	**UPPER CRETACEOUS MARINE SEDIMENTARY ROCKS**	Gualala Group, of Weaver—*sandstone, conglomerate, and shale* (restricted herein to those beds of known Late Cretaceous age). "Chico Formation"—*massive to thin-bedded sandstones and shales and minor conglomerate.* Forbes, Guinda, Funks, Sites, Yolo and Venado Formations—*green, gray, tan, and black shales, massive to thin-bedded buff and gray sandstones and siltstones, and conglomerate lenses.* Unnamed sandstones, shales and conglomerates in the Vaca Mountains, including "Salt Creek Conglomerate." Novato Conglomerate—*massive cobble and pebble conglomerate* (possibly of Early Cretaceous age). Unnamed arkosic sandstone, quartzitic sandstone, and thin-bedded shales, in vicinity of Novato. Includes rocks of probable Early Cretaceous age in hills west of Oakville.
MESOZOIC / CRETACEOUS	Kl	**LOWER CRETACEOUS MARINE SEDIMENTARY ROCKS**	Rocks of the Shasta Series, including the "Horsetown" and "Paskenta" Formations—*shales, siltstones, sandstones, conglomerates, and local detrital serpentine.* Unnamed massive conglomerates and minor shales north and west of Healdsburg and in vicinity of Cazadero and Jenner. (Areas shown as Kl(?) may include rocks of Late Cretaceous or Jurassic age.)
MESOZOIC / CRETACEOUS	KJf	**FRANCISCAN FORMATION**	Franciscan Formation—*graywacke, shale, conglomerate, chert, minor lenses of limestone, and glaucophane schists and related metamorphic rocks.* Locally may include basalt, greenstone and diabase, or peridotite and dunite bodies, largely serpentinized. (May include rocks of the Knoxville Formation locally.) Areas shown as KJf glaucophane schist or KJf schist are major zones of glaucophane schist and related metamorphic rocks of the Franciscan Formation.
MESOZOIC / CRETACEOUS	KJfv	**FRANCISCAN VOLCANIC AND METAVOLCANIC ROCKS**	Greenstone, basalt, and diabase of the Franciscan Formation.
MESOZOIC / CRETACEOUS	grt	**TONALITE (QUARTZ DIORITE) AND DIORITE**	"Bodega Diorite"—*quartz diorite, granodiorite and diorite* (Pt. Reyes, Tomales Point, and Bodega Head).
MESOZOIC / CRETACEOUS	bi	**MESOZOIC BASIC INTRUSIVE ROCKS**	Gabbro and diorite (closely associated with serpentine, and with diabase intrusive bodies of the Franciscan Formation).
MESOZOIC / CRETACEOUS	ub	**MESOZOIC ULTRABASIC INTRUSIVE ROCKS**	Serpentine, peridotite, dunite, and pyroxenite, and minor amounts of silica-carbonate rock derived from alteration of serpentine.
MESOZOIC / UNDIVIDED JURASSIC	Jk	**KNOXVILLE FORMATION**	Knoxville Formation—*shale, siltstone, sandstone, and conglomerate, with local limestone lenses; detrital serpentine in Knoxville area.* Rocks of the Knoxville Formation largely are recognized on the presence of the fossil pelecypod *Buchia piochii.* (Areas shown as Jk(?) may include rocks of the Franciscan Formation, or other rocks of Early Cretaceous age.)
MESOZOIC / UNDIVIDED JURASSIC	m ls	**PRE-CRETACEOUS METAMORPHIC ROCKS, UNDIFFERENTIATED, ls = LIMESTONE AND/OR DOLOMITE**	Quartzite and mica schist (considered to be "Sur Series" by Weaver, 1949). Crystalline limestone (considered to be "Sur Series" by Weaver, 1949).

NOTES

1. Part of the Clear Lake Volcanic Series of Brice, 1953.
2. Also called Sonoma Volcanics. Described by V. C. Osmont, 1904, Calif. Univ. Pub., Dep't. Geol. Bull., v. 4, pp. 39-87, as consisting of Mark West Andesite, Sonoma Tuff, and St. Helena Rhyolite. These are no longer considered mappable units, except for the St. Helena Rhyolite in the southern part of Napa Valley and along the east side of Sonoma Valley (Kunkel and Upson, 1960, p. 24).
3. Includes part of the Laird Sandstone of Weaver, 1949.
4. This unit was named Gallaway Beds by C. E. Weaver, 1943, Calif. Div. Mines Bull. 118, pp. 628-632. However, in 1944, Weaver, Univ. Washington Pubs. Geol., V. 6, p. 4, renamed this the Gallaway Formation, and designated the lower 350 feet of coarse-grained sandstone as the Skooner Gulch Formation of Oligocene(?) age.
5. Considered by Weaver, 1943, to be part of the Gualala Group of Late Cretaceous age, but separated herein on the basis of mapping by Carl Wentworth, Stanford University, Ph.D. thesis in preparation, 1963.
6. Underlies Paleocene rocks formerly assigned to the Gualala Group, and is possibly of Cretaceous age.

View southeast along the San Andreas Fault Zone, which separates rocks of the Franciscan Formation (mainland, left) from the quartz diorite pluton exposed on Bodega Head (right center) and Tomales Point (top of photo, center). The San Andreas Fault Zone, here approximately two miles wide, extends for over 650 miles across California. The 1906 San Francisco earthquake caused displacement of the land surface in the fault zone, with a maximum of about 20 feet of lateral displacement recorded near Olema. Physical features caused by repeated fault movement during the geologic past include the steep escarpment at the juncture of Bodega Head with the sand beach tying it to the mainland; and the trench-like form of Tomales Bay (top of photo, center).

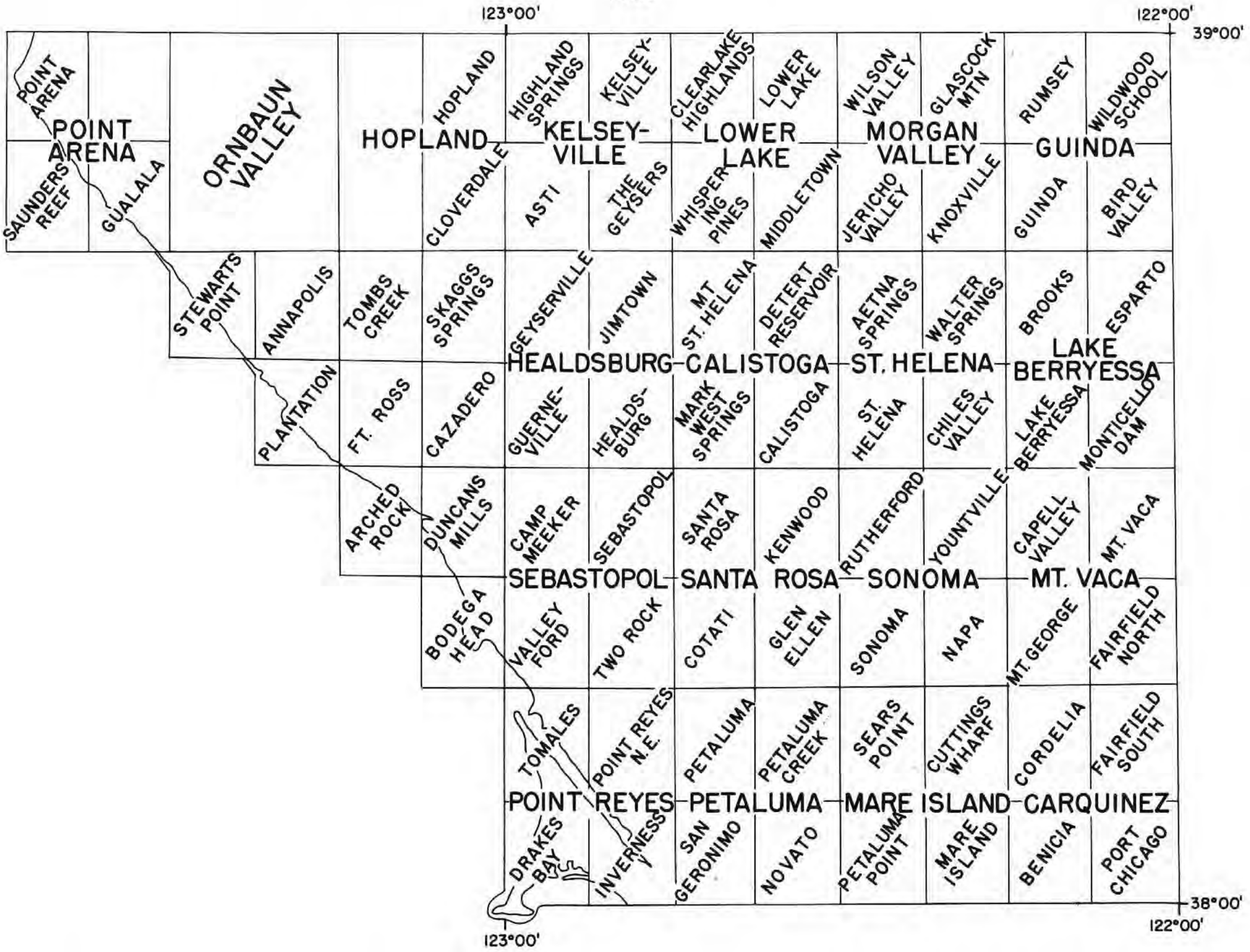
Photo by Aero Photographers, Sausalito, 1959

TOPOGRAPHIC QUADRANGLES

WITHIN THE SANTA ROSA SHEET

AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY

1963



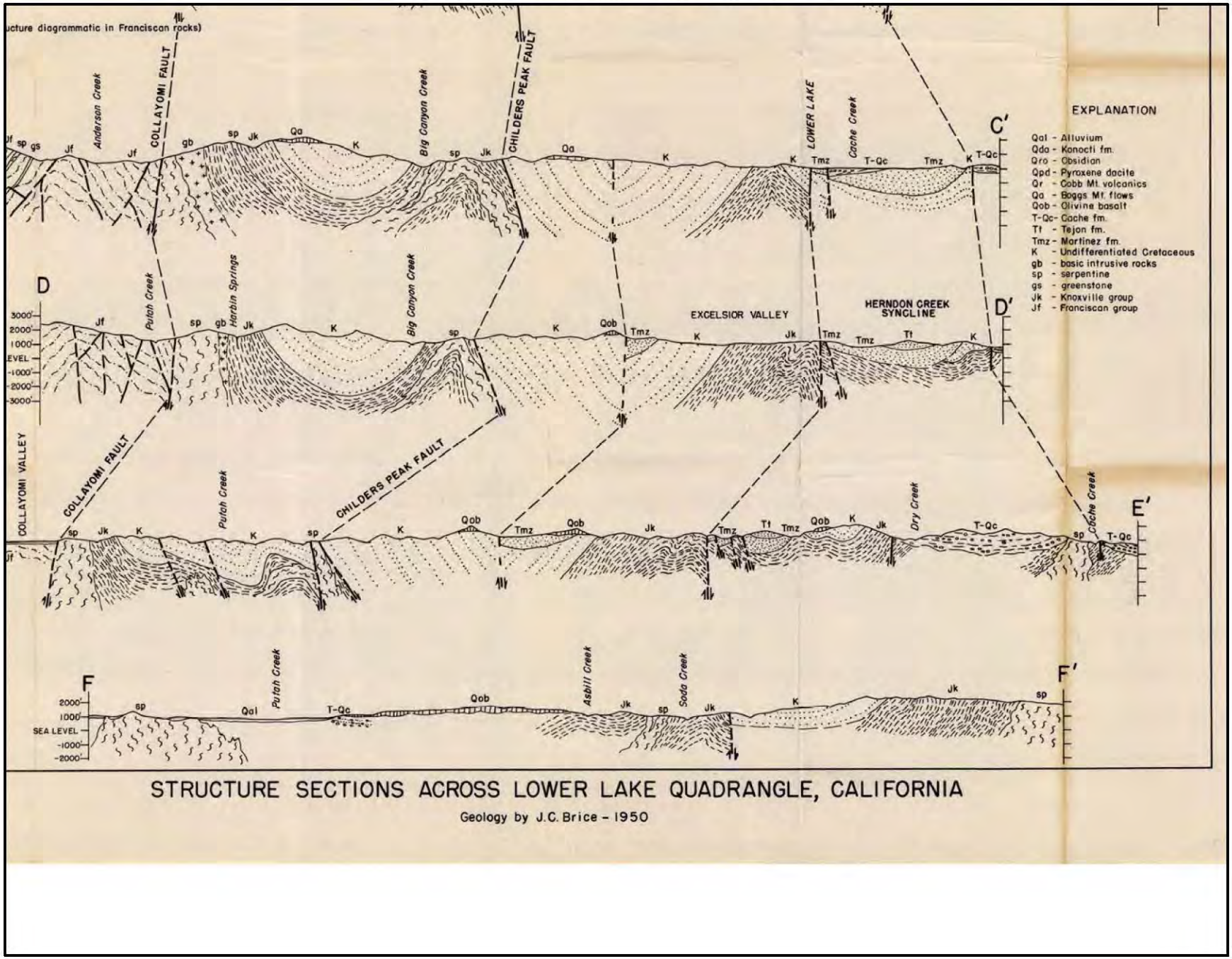
View northwest across Clear Lake (Santa Rosa and Ukiah map sheets). The lake, it is believed, was formed by a lava flow damming pre-existing stream valleys. Mt. Konocti (upper left), composed of Pleistocene dacite and andesite, rises nearly 3000 feet above the lake. Beyond Mt. Konocti is alluvium-filled Big Valley. The hills west of Big Valley and along the north shore of Clear Lake are principally composed of rocks of the Franciscan Formation. Borax Lake (dark patch, right center) was the first commercial source of borax in California. Beyond Borax Lake lies Sulphur Bank Point, famous for mercury and sulphur production. The plain in the foreground is formed by sediments of the Cache Formation, capped by basalt, dacite, and obsidian, and bordered by alluvium. Volcanic activity in this area probably continued into Recent time. *Photo by Aero Photographers, Sausalito, 1959*

39673-C-650 1-76 ZH △ OSP

Location Map of Cross Section Lines F-F'
Modified from Brice, 1953

0 40 80 160 240 320
Miles

Cross Section F-F'
Modified from Brice, 1953



STRUCTURE SECTIONS ACROSS LOWER LAKE QUADRANGLE, CALIFORNIA

Geology by J.C. Brice - 1950