STATE OF CALIFORNIA CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY STATE WATER RESOURCES CONTROL BOARD

DIVISION OF WATER RIGHTS

ORDER WR 2020-0101-DWR

In the Matter of the Status of the Water Within the Coyote Valley Basin Aquifer in Lake County

BY THE DEPUTY DIRECTOR FOR WATER RIGHTS:

1. Applicable Law

In Decision 1639 issued in 1999, the State Water Resources Control Board (State Water Board) provided clarification regarding the legal classification of groundwater, as follows:

The California Water Code defines the water that is subject to appropriation and is thus subject to the SWRCB's permitting authority. Water Code section 1200 states:

"Whenever the terms stream, lake or other body of water occurs in relation to applications to appropriate water or permits or licenses issued pursuant to such applications, such term refers only to surface water, and to subterranean streams flowing through known and definite channels."

(Emphasis added.)

Groundwater which is not part of a subterranean stream is classified as "percolating groundwater." The distinction between subterranean streams and percolating groundwater was set forth by the California Supreme Court in 1899 in Los Angeles v. Pomeroy (1899) 124 Cal. 597 [57 P. 585]. In Los Angeles v. Pomeroy, the court stated that it is undisputed that subterranean streams are governed by the same rules that apply to surface streams. (Id. at 632 [57 P. at 598].) Percolating groundwater is not subject to the Water Code sections that apply to surface streams. Thus, the SWRCB has permitting authority over subterranean streams but does not have permitting authority over percolating groundwater.

Absent evidence to the contrary, groundwater is presumed to be percolating groundwater, not a subterranean stream. (*Id.* at 628 [57 P. at 596].) The burden of proof is on the person asserting that groundwater is a subterranean stream flowing through a known and definite channel. (*Ibid.*) Proof of the existence of a subterranean stream is shown by evidence that the water flows through a known and defined channel. (*Id.* at 633-634 [57 P. at 598].) In *Los Angeles* v. *Pomeroy*, the court stated:

"'Defined' means a contracted and bounded channel, though the course of the stream may be undefined by human knowledge; and the word 'known' refers to knowledge of the course of the stream by reasonable inference." (*Id.* at 633 [57 P. at 598].)

A channel or watercourse, whether surface or underground, must have a bed and banks which confines the flow of water. (*Id.* at 626 [57 P. at 595].) Although in *Los Angeles* v. *Pomeroy* the court stated that the bed and banks of a subterranean stream must be impermeable1 (*Id.* at 631 [57 P. at 597]), all geologic materials are permeable to some degree. Therefore, if the rock forming the bed and banks is relatively impermeable compared to the aquifer material filling the channel, a subterranean stream exists.

In summary, for groundwater to be classified as a subterranean stream flowing through a known and definite channel, the following physical conditions must exist:

- 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.

(State Water Board Decision D-1639, pp. 3-4.)

2. In North Gualala Water Company v. State Water Resources Control Board (2006) 139 Cal.App.4th 1577, 1585-1586, 1606, the court held that the four-part test set forth in Decision 1639 is consistent with the language and intent of Water Code section 1200's subterranean streams provision.

3. **Need for Determination**

Hidden Valley Lake Community Services District (HVLCSD) serves drinking water to the community of Hidden Valley Lake in southern Lake County. HVLCSD was issued a water right permit by the Division of Water Rights (Division) in 1994 (which was subsequently split into a water right license and a

permit) for four wells drawing water from the Coyote Valley Basin aquifer (Department of Water Resources Bulletin 118 Basin 5-18) based on HVLCSD's assertion at the time that the groundwater aquifer was part of the underflow (or subterranean stream) associated with Putah Creek and therefore, within the permitting authority of the State Water Board.

The Division of Water Rights issued Notices of Water Unavailability (e.g., curtailment) to HVLCSD in 2014 and 2015, due to the then-ongoing drought and HVLCSD's relatively lower-priority water rights in the Putah Creek watershed. As a result of the curtailment, the State Water Board's Division of Drinking Water (DDW) found that HVLCSD's water supply was inadequate and unreliable, since future curtailments could result in inadequate supply for health and human safety. DDW imposed a service connection moratorium on HVLCSD though a compliance order issued in October 2014.

In May 2019, HVLCSD submitted a technical report to DDW and the Division asserting that its water sources (the Coyote Valley Basin aquifer) for two points of diversion under its water right permit and license were not part of a subterranean stream and therefore, were not under the permitting authority of the State Water Board and do not require a permit or license.

4. Technical Analysis and Findings

Division staff reviewed the HVLCSD technical report and other available geological reports and information to conduct a basin-wide analysis for the Coyote Valley aquifer to determine if it meets the four-part test for a subterranean stream flowing within a known and definite channel contained in Decision 1639.

Based on review of available information, Division staff issued a technical memorandum dated April 17, 2020 (Attachment A to this Order) documenting the information considered, technical analyses, and the following conclusions:

- 1. The Coyote Valley aquifer is bound by rock formations that make up the banks of a channel; however, there is no evidence that these formations form a subsurface channel bed.
- 2. Even if Division staff presumes that the alluvium is bounded by both bed and banks, the geologic formations are not relatively impermeable when compared to the alluvium.
- 3. Because the bounding units are not relatively impermeable compared to the alluvium, the water within the quaternary alluvium is not bound.
- 4. The alluvial aquifer within Coyote Valley fails parts one and two of the four-part test provided in Decision 1639.

5. The water within Coyote Valley is determined to be percolating groundwater and is not within the permitting authority of the State Water Board

BASED ON THE FOREGOING INFORMATION, IT IS HEREBY ORDERED:

- 1. The State Water Resources Control Board, Division of Water Rights shall treat the water in the alluvium of Coyote Valley Basin (Department of Water Resources Bulletin 118 Basin 5-18), underlying Putah Creek, in Lake County, as shown in Attachment B, as percolating groundwater and not water that is part of a subterranean stream flowing through a known and definite channel.
- 2. Nothing in this Order is intended to or shall be construed to limit or preclude the State Water Board from exercising its authority under any statute, regulation, ordinance, doctrine, or other law, including, but not limited to, the authority to take enforcement action against any party for waste or unreasonable use or unreasonable method of use of water in violation of Article X of the California Constitution.
- 3. Nothing in this Order shall excuse parties that extract or seek to extract groundwater from the Coyote Valley Basin aquifer from meeting any more stringent requirements that are imposed, or may be imposed hereafter, by applicable legally binding legislation, regulations, policies or water right permit requirements.

STATE WATER RESOURCES CONTROL BOARD

Erik Ekdahl, Deputy Director Division of Water Rights

Dated: JUL 1 0 2020

Order WR 2020-0101-DWR - Attachment A





Zach Mayo

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:

- 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

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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 aguifer 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 aguifer when recharge to the alluvial aguifer 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 guadrangle (Brice, 1953) and DWR, 1962). Stratigraphic sections for the Lower Lake guadrangle 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 aguifer 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 aguifer (Appendix A; Table 1). Also, because the SC values differ greatly over the alluvial aguifer wells, Division staff interprets this to mean that water likely moves rapidly through unconfined coarsegrained materials of stream channel deposits but that the overall productivity of the Coyote Valley alluvial aguifer 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.
- 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

	Table 5. Water Rights to Officerilow of Putari 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

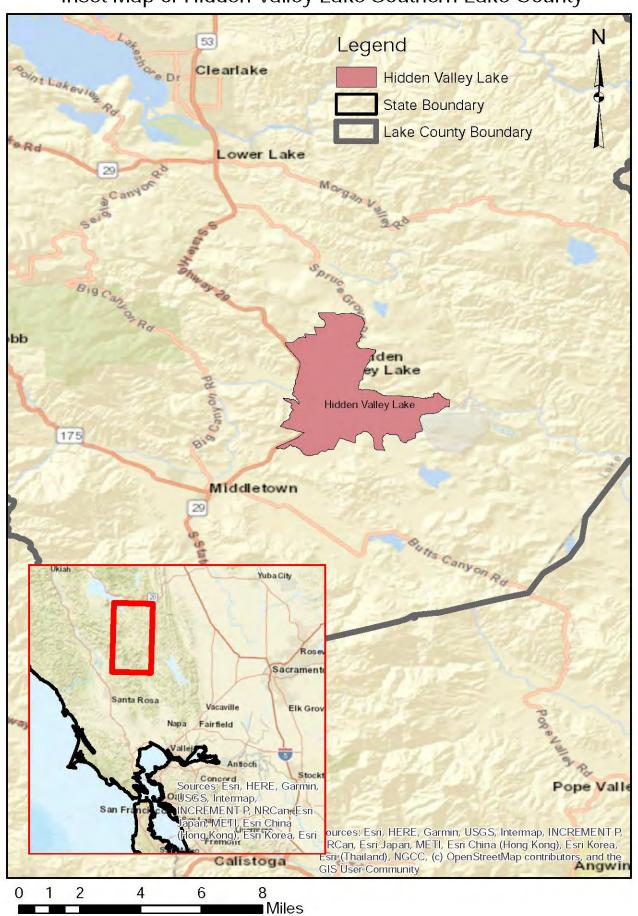


Figure 2: Geologic Map of Coyote Valley with DWR Approximate Well Locations

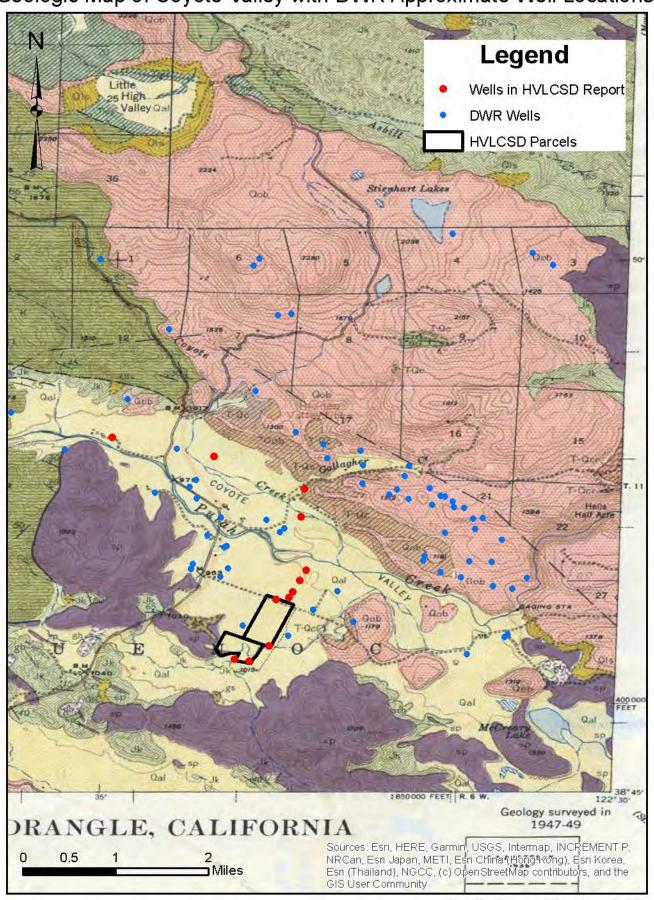
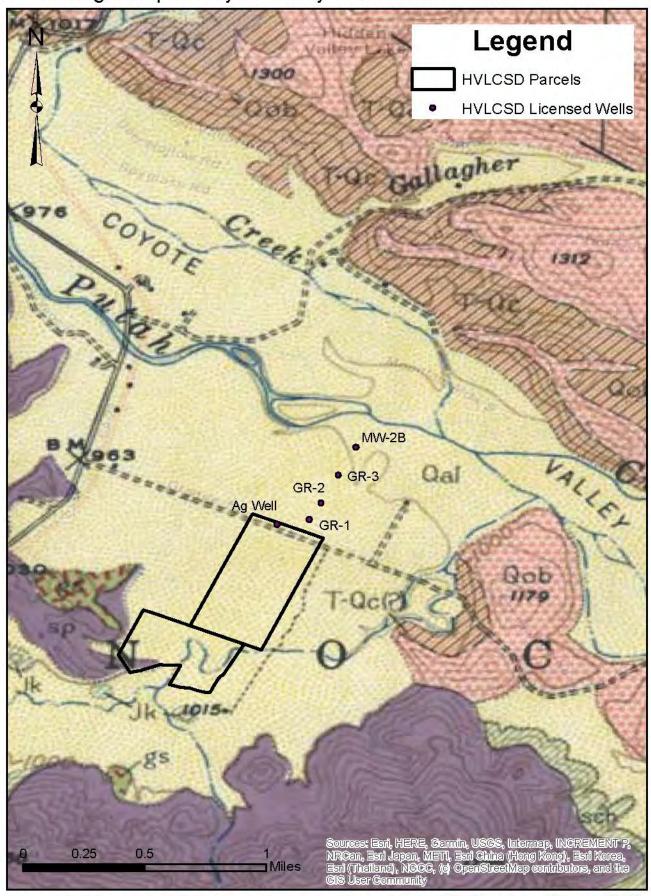
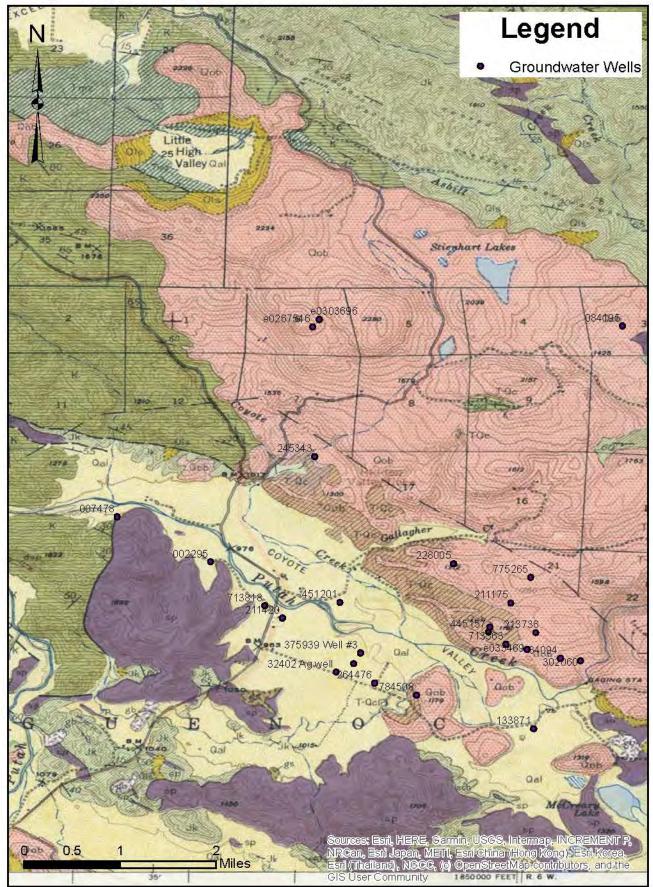


Figure 3: Geologic Map of Coyote Valley with HVLCSD Licensed Wells



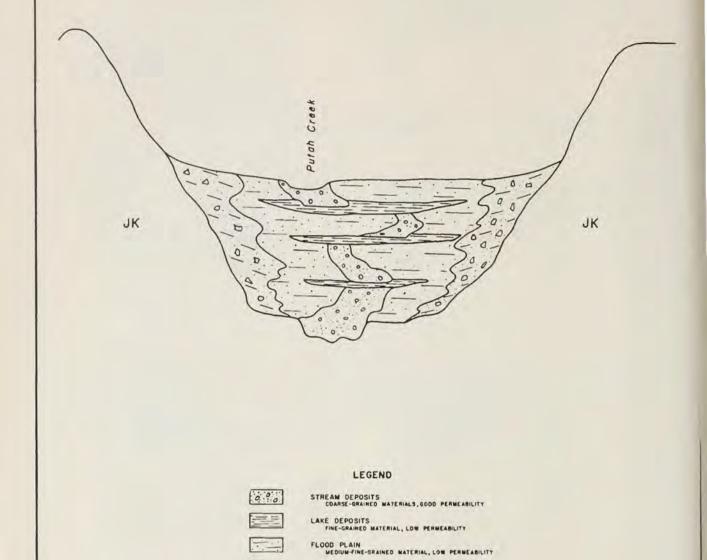
Modified from Koenig, 1963.

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)



NOTE: GEOLOGIC SECTION NOT TO SCALE.

JURASSIC-CRETACEOUS BEGROCK, IMPERMEABLE

0 B B

JK

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

SLOPEWASH COARSE-TO FINE-GRAINED MATERIAL, POORLY SORTED, GENERALLY LOW PERMEABILITY

Appendix A

State of California

Well Completion Report Form DWR 188 Complete 4/6/2018 WCR2018-002295

Owner's Well Num	nber DIAMOND RANCH #3 Date Work Bega	n 08/18/2017 Date Work Ended 11/22/2017						
Local Permit Ager	ncy Lake County Health Services Department - Environment	al Health Division						
Secondary Permit	t Agency Permit Numb	per WE-4922 AG Permit Date 08/15/2017						
Well Owner	(must remain confidential pursuant to Wat	ter Code 13752) Planned Use and Activity						
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx							
Mailing Address	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Activity New Well						
	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Planned Use Water Supply Irrigation - Agriculture						
City XXXXXXX		Zip XXXXX						
City XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
Well Location								
Address 1854	5 S 29 HWY	APN 014-250-11						
City MIDDLE	TOWN Zip 95461 County Lak							
Latitude	N Longitude	W Range 07 W						
Deg.	Min. Sec. Deg. Min.	Sec. Sec. Baseline Meridian Mount Diablo						
Dec. Lat. 38.79	068300 Dec. Long122.5772600	Ground Surface Elevation 990						
Vertical Datum	Horizontal Datum WGS84	Elevation Accuracy Unknown						
Location Accurac	Location Determination Method	Elevation Determination Method GPS						
render rendere i com inclination from	TO SOLUTION SERVICES AND SPECIAL SERVICES AND SPECIAL SERVICES AND SPECIAL SPECIAL SERVICES AND SPECIAL SPECIA							
	Borehole Information	Water Level and Yield of Completed Well						
Orientation Ver	rtical Specify	Depth to first water (Feet below surface)						
Drilling Method	Reverse Circulation Drilling Fluid Bentonite	Depth to Static						
		Water Level (Feet) Date Measured						
Total Depth of Bo	oring 600 Feet	Estimated Yield* (GPM) Test Type Test Length (Hours) Total Drawdown (feet)						
Total Depth of Co	ompleted Well 570 Feet	*May not be representative of a well's long term yield.						
	Geologic Log	- Free Form						
Depth from Surface		Description						
Feet to Feet								
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							

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 #		m Surface o 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

Э	Annular Material							
Depth from Surface Fill Fill Type Details Feet to Feet		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	Observ	/ations:
-------	--------	----------

	Borehole Specifications						
	from face o Feet	Borehole Diameter (inches)					
0	60	36					
60	600	20					

	Certification S	Statement		
I, the under	signed, certify that this report is complete and acc	urate to the best of m	y knowledge a	and belief
Name	WELL IND	JSTRIES INC		
	Person, Firm or Corporation			
	3282 HIGHWAY 32	CHICO	CA	95973
	Address	City	State	Zip
Signed	electronic signature received	03/08/2018	81	12678
	C-57 Licensed Water Well Contractor	Date Signed	C-57 Lice	ense Numbe

DWR Use Only						
CSG # State Well Number Site Code Local \	Well Number					
	W					
Latitude Deg/Min/Sec Longitude Deg/N	/lin/Sec					
TRS:						
APN:						

State of California

Well Completion Report Form DWR 188 Complete 10/8/2018 WCR2018-007478

Owner's Well Numb	er DIAMOND 4	Date Work Began	08/28/2017	Date Work Ended 08/04/2018		
Local Permit Agenc	y Lake County Health Servic	es Department - Environmental	Health Division			
Secondary Permit A	gency	Permit Number	WE-4923 AG	Permit Date 08/15/2017		
Well Owner (must remain confider	Planned Use and Activity				
Name XXXXXX	(XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			Activity New Well		
Mailing Address	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			Planned Use Water Supply Irrigation -		
	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			Agriculture		
City XXXXXXXX	XXXXXXXXXXX	State XX	Zip XXXXX			
		Well Loca	ation			
Address 0 DIAM	MOND RANCH RD			APN 014-230-111		
City MIDDLETO	DWN Zip	95461 County Lake	0	Township 11 N		
Latitude	N	Longitude	W	Range 07 W		
Deg.	Min. Sec.	Deg. Min.	Sec.	Section 13		
Dec. Lat. 38.803	3000	Dec. Long122.5913200		Baseline Meridian Mount Diablo Ground Surface Elevation 1010		
Vertical Datum		rizontal Datum WGS84		Ground Surface Elevation 1010 Elevation Accuracy Unknown		
Location Accuracy		Determination Method		Elevation Determination Method GPS		
Loodinoi 7 loodi doy						
	Borehole Informati	on	Water L	evel and Yield of Completed Well		
Orientation Verti	cal	Specify	Depth to first wate	er (Feet below surface)		
Drilling Method [Downhole Rotary Drilling F	Fluid Bentonite II	Depth to Static	5E 80 E00 00		
_ <u>H</u>	ammer		Water Level	(Feet) Date Measured		
Tatal Davids of David			Estimated Yield*	(GPM) Test Type		
Total Depth of Bori		70 sandataa	Test Length (Hours) Total Drawdown (feet) *May not be representative of a well's long term yield.			
Total Depth of Con	pleted Well 560	Feet	may not be repre	oontall o of a front o long term yield.		
Geologic Log - Free Form						
Depth from			Description			
Surface Feet to Feet			Description			
0 50	COBBLE					

50

260

260

600

BLACK ROCK - HARD

BLACK ROCK - HARD

	Casings									
Casing #		m Surface o Feet	Casing Type	Material	Casings Specifications	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						
Sur	from face o Feet	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						
I.	Borehole Diameter (inches)	Depth from Surface Feet to Feet					
	36	50	0				
] _	20	560	50				
	7.875	600	560				

	Certification S	Statement				
I, the under	signed, certify that this report is complete and acc	urate to the best of my	y knowledge a	nd belief		
Name	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	81	2678		
	C-57 Licensed Water Well Contractor	Date Signed	C-57 Lice	ense Number		

	DWR Use Only					
CSG # State Well Number			Site Code	Local Well Number		
Lat	Latitude Deg/Min/Sec		Longitud	W W e Deg/Min/Sec		
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 WAIER WELL	DRILLERS REPORT State Well No.
Local Permit No. or Date	Other Well No. # No. # 18
	(12) WELL LOG: Total depthft. Depth of completed wellft.
	from ft. to ft. Formation (Describe by color, character, size or material)
(2) LOCATION OF WEY	_
(2) LOCATION OF WELL (See instructions):	-
Well address if different from above. Well Number Lake	0 - 20 ted clax
Township Range Section	-
Distance from cities, roads, railroads, fences, etc.	20 - 30 wolcanic ash
	- 10
A.P. # 144-131-01	30 _ 33 blue vel. rock
(3) TYPE OF WOR	K: 33 60 Volcanic ash
New Well ₹ Deepening	
Reconstruction	00 - 00 fract, blue vol.
Reconditioning	
Horizontal Well	□ 250 hard blue vol. rock
Destruction (Describe destruction materials and	250 260 red vol
procedures in Item 127 (4) PROPOSED US	A 230 - 200 100 101 101
Domestic Domestic	
Irrigation	7 1- V 25 V
Industrial	
Test Well	
Stock	All 1 - 1 PA S
Municipal	
WELL LOCATION SKETCH Other	-CV
(5) EQUIPMENT: (6) GRAVED PACK:	
Rotary A Reverse No Size	
Cable Air Air Air Air	
Other Bucket D Ruket from 20 200	_i
(7) CASING INSTALLED: (8) PERFORATIONS:	(4)
Steel Plastic X Concrete Type of perfection or size of screen	-
From To Dia. Case or From To Soft	-
ft. ft(\int \text{in.} \text{Wall} ft. \text{size}	_
0 260 4 6 6160 220 260 178	
psi	-
	_
(9) WELL SEAL:	-
Was surface sanitary seal provided? Yes X No I If yes, to depth 20	
Were strata sealed against pollution? Yes No 🖹 Interval Method of sealing Cement	Work started 11-27 19 79 Completed 11-29 19 79
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT: 00941
Depth of first water, if known Standing level after well completion.	It. This well was drilled under my jurisdiction and this report is true to the best of my
Standing level after well completion	Signed LARRY HERMAN by kathy read
Was well test made? Yes □ No □ If yes, by whom? driller	SIGNED
Type of test Pump Bailer Air lift Depth to water at start of test 30	WANE
30 2	Address 3001 Gravenscelli Hwy. N.
ical analysis made? Yes No If yes, by whom?	Sebastopol, Calif. 2ip 95472
Was electric log made? Yes No Was fi yes, attach copy to this report	License No. 304138 Date of this report 12-10-79

M/cw-3
Do not fill in
No. 084195

ORIGINAL

STATE OF CALIFORNIA

File with DWR

THE RESOURCES AGENCY **DEPARTMENT OF WATER RESOURCES**

Other Well Manage (2) LOCATON SETTIN OF WELL (See instructions): Count Owner's Well Number. (2) LOCATON SETTIN OF WELL (See instructions): Count Owner's Well Number. (3) TYPE OF WORK New Well 2 Described of Described of the Colon, character, size or nuterial) Delatons from cities, coals, sallowsh, former, etc. Textucker. (4) PROPOSED 14 Described of Described of Described of the Colon of the Col	of Intent No WAIEI	WELL DRILLERS	REPORT Sta	ite Well No. COVE	
(2) LOCATION OF WELL (See instructions): Owner! Well Number: Owner! Owner! Well Number: Owner! O	al Permit No. or Date		Ot	her Well Notes	Tial
County C	=	-		Lo _C	vec
County C		(12) WEI	L LOG: Total depth	ft. Depth of completed	well ff.
(2) LOCATION OF WELL (See instructions): Owner's Well Momber O 2 top soll Very desiration above. O 3 top soll Very desiration above. O 40 fract. red vol. Instruction cities, roads, railroads, fraces, etc. Instruction cities, roads, railroads, fraces, etc. Instruction cities, roads, railroads, fraces, etc. Instruction Reconstitution Beconstruction					
County Will address if different from above. To enable No. No. No. 136 - O. - 36 No. Section 2 - 40 fract. redd vol. 136 - O. - 36 No. No.			VANDED III		
County Will address if different from above. To enable No. No. No. 136 - O. - 36 No. Section 2 - 40 fract. redd vol. 136 - O. - 36 No. No.	/AV LOCATION OF WHILE	=		id Man-	
WELL LOCATION SETCH WELL LOCATION SETCH O Section 3 O 2 top soll Z 40 fract, red vol. Distribute limit limit and red vol. (3) TYPE OF WORK, New Well 2 Desponing Becombining Becombi	(2) LOCALING OF WELL (See instructions):				
Deteroring of the property o	100 MM 200 Capacity (100 Capac	o -	2 top soil		
Distance from cities, roads, nalroads, fences, etc. 2	11.1	2	· \		
WELL LOCATION SECTOR WELL LOCATION SECTOR (a) TYPE OF WORK: New Well & Deepening Reconditioning Horizontal Well Destruction (Boundard Horizontal Well Destruction Horizontal Well Horizontal W	Township // / Range Lo Section	3	10 fract, red	₩ ₀₁ . —	
Competed		1 11 11	111		
Stock Description Descri	not 121 all all sesue	7,000	75 hard Wille	and red vol.	
New Well & Deepening Reconstruction	HT 136-041-26	/ 40 -	3 /mar a 64.00		
New Well & Deepening Reconstruction					
Reconstruction	(3) TY 1	E OF WORK:			25 10,000
WELL LOCATION SKETCH WELL LOCATION SKETCH Other Other Other From From Reverse Basic & Congret Tope of perfoling or when of screen From Reverse Plastic & Congret Tope of perfoling or when of screen From Reverse Plastic & Congret Tope of perfoling or when of screen From Reverse Plastic & Congret Tope of perfoling or when of screen From Reverse retata scaled scaning updition? Yes No If yes, by whon? Standing level after well completion Tope of test Pump	New Wel	Deepening 75	25 nard brn.	VOI.	22565 2000 <u> </u>
WELL LOCATION SKETCH Other	Reconstru	etion 🗆 -		100	
WELL LOCATION SKETCH Other procedures in Item L. (4) PROPOSED DST Domestic Industrial	Recondition		→ ⊗ />		
WELL LOCATION SKETCH (4) PROPOSED USE Domestic Industrial To Well Stock Municipal (5) ROUPMENT: (6) GRAVELPACK: Cotable Air Depth of box Depth Depth		_ <	~~~		
destruction materials policy procedures in item (4) PROPOSED UST		- 11121	1110	6	*
WELL LOCATION SKETCH	destruction	materials and			14.
Domestic Irrigation Irrig	200		(A)		
WELL LOCATION SKETCH Well Stock Municipal Cable Bucket Conduct Cond	1.00	DPOSED USE	110 A	<u>~)</u>	
Industrial	Domestic				
WELL LOCATION SKETCH Ober (5) EQUIPMENT: Rotary Reverse b	Irrigation				
WELL LOCATION SKETCH WELL LOCATION SKETCH Other GO GRAYD PACK: Rotary Revence Bucket Story Other To Other To Other To Dia Galve or from 20 to 125 From To Dia Galve or Front fit. From To Dia Galve or Front fit. From To Dia Galve or Front fit. Was surface sanitary seal provided? Yes No If yes, to depth 20 ft. Were strata sealed sealing cement Were strata sealed sealing cement Were trata sealed sealing cement Were trata sealed sealing cement Work started 19 Completed 19 WELL TESTS: Well To State and this report is true to the best of my showledge with the work backer Type of test Pump 10 10 Baller State fit so whom? At lift 10 20 20 11 12 11 11 11 11 11 11 11 11 11 11 11	Industrial	1111 0 102-	, ,		
WELL LOCATION SKETCH WELL LOCATION SKETCH Other GO GRAYD PACK: Rotary Revence Bucket Story Other To Other To Other To Dia Galve or from 20 to 125 From To Dia Galve or Front fit. From To Dia Galve or Front fit. From To Dia Galve or Front fit. Was surface sanitary seal provided? Yes No If yes, to depth 20 ft. Were strata sealed sealing cement Were strata sealed sealing cement Were trata sealed sealing cement Were trata sealed sealing cement Work started 19 Completed 19 WELL TESTS: Well To State and this report is true to the best of my showledge with the work backer Type of test Pump 10 10 Baller State fit so whom? At lift 10 20 20 11 12 11 11 11 11 11 11 11 11 11 11 11	Tes Well		<u> </u>		
WELL LOCATION SKETCH Other Cother			V (1/V ¢		
WELL LOCATION SKETCH (5) EQUIPMENT: (6) GRAVEL PACK: Rotary B Reverse 1			- (> 0)		
(6) GRAVE PACK: Rotary		· ~ ~	(5/A) -		
Rotary					
Cable Air X Bucket Report on 20					· ·
Other Bucket Repersion 29 to 125 (7) CASING INSTALLED: (8) FERFORATIONS: Steel Plastic Conclude Type of perfection or vice of screen	Rotary Reverse D Reverse No M Size	(C)	<u> </u>		
Control Casing Installed: Control Type of perfection or see of screen Casing Control Type of perfection or see of screen Casing C	Cable Air Transfer of bore	Θ	50000 10000		
Steel Plastic Concrete Type of permitting or size of screen -	Other Bucket Packed from 20	W 125 W	9 200		
From ft. ft. Qia. Galse of ft. ft. Size — — — — — — — — — — — — — — — — — — —	(7) CASING INSTALLED: (8) PERFORATIONS:	- Wo -			
From ft. din. Wall ft. size — — — — — — — — — — — — — — — — — — —	Steel Plastic Concrete Type of perforation or size	e of screen			3326 3
ft. ft. in. Wall ft. ft. size of the state of test ft. was surface sanitary seal provided? Yes No If yes, to depth 20 ft. Were strata scaled against pollution? Yes No If yes, to depth 20 ft. Work started 19 Completed 19 Completed 19 Completed 19 Completed 19 Work started 19 Completed 19 Work started 19 Completed 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 HERMAN by kathy baker SIGNED FISCH—HERMAN DRILLING CO. NAME FISCH—HERMAN DRILLING CO. NAME FISCH—HERMAN DRILLING CO. NAME Sebastopol, Calif. 795472 Total analysis made? Yes No If yes, by whom? City 204128 City 204128 6-19-80		-			
O 85 5 C160 45 85 1/8 - psi - (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 No Interval ft. Method of sealing Cement No Interval ft. Method of sealing Cement No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. Method of sealing Cement No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval ft. More strata sealed against pollution? Yes No Interval No Interval Interval No Interval		Size			`
PS1		118		** *	
Completed Comp	- Nosi	W 1.			-00000
Were strata sealed against pollution? Yes No If yes, to depth 20 ft. Method of sealing Cement (10) WATER LEVELS: Depth of first water, if known ft. (11) WELL TESTS: Was well test made? Yes No If yes, by whom? Air lift 80 ft. Depth to water at start of test Punp 10 ft. Depth to water at start of test No If yes, by whom? Water temperature hical analysis made? Yes No If yes, by whom? No If yes,		<u> </u>			
Were strata sealed against pollution? Yes No If yes, to depth 20 ft. Method of sealing Cement (10) WATER LEVELS: Depth of first water, if known ft. (11) WELL TESTS: Was well test made? Yes No If yes, by whom? Air lift 80 ft. Depth to water at start of test Punp 10 ft. Depth to water at start of test No If yes, by whom? Water temperature hical analysis made? Yes No If yes, by whom? No If yes,		<u> </u>			
Were strata sealed against pollution? Yes No Interval ft. Method of sealing Cement No Interval ft. Method of sealing Cement No Interval ft. Method of sealing Cement Work started 19 Completed 19 Work started 19 Completed 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 Fisch - Herman Driller No If yes, by whom? Air lift 80 More started 19 Completed 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 Fisch - Herman Driller Dri	(9) WELL SEAL:	-			
Method of sealing Cement Work started 19 Completed 19 (10) WATER LEVELS: Depth of first water, if known fit. Standing level after well completion fit. (11) WELL TESTS: Was well test made? Yes No If yes, by whom? Air lift 80 Depth to water at start of test 10 ft. At end of test ft hours Water temperature hical analysis made? Yes No If yes, by whom? Water temperature No If yes, by whom? Sebastopol, Calif. 204128 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 FISCH—HERMAN by kathy baker FISCH—HERMAN DRILLLING CO. NAME 500 Prison Firm victure in The large princed. Address Sebastopol, Calif. 204128	Was surface sanitary seal provided? Yes 🔁 No 🗌 If yes, to	depthft			
(10) WATER LEVELS: Depth of first water, if known Standing level after well completion (11) WELL TESTS: Was well test made? Yes No If yes, by whom? driller Type of test Pump 10 10 ft. At end of test ft. Depth to water at start of test 100 gal/min after 4 hours Water temperature hical analysis made? Yes No If yes, by whom? Water temperature No If yes, by whom? At end of test ft. Depth to water at start of test No If yes, by whom? At end of test ft. At end of test ft. Depth to water at start of test No If yes, by whom? Sebastopol, Calif. Zip 95472 City 204128 6-19-80		/alft	6 12 80	6-14	80_
Depth of first water, if known Standing level after well completion (11) WELL TESTS: Was well test made? Yes No If yes, by whom? Air lift 80 Depth to water at start of test Depth to water at start of test LARRY HERMAN by kathy baker FISCH—HERMANDRILLING CO. NAME FISCH—HERMANDRILLING CO. NAME 500 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Method of sealing CEINETIC	Work started	19	Completed	19
Standing level after well completion ft. (11) WELL TESTS: Was well test made? Yes No If yes, by whom? driller Type of test Pump 10 Kn. At end of test If the start of test	(10) WATER LEVELS:	WELL DR	ILLER'S STATEMENT:		
Standing level after well completion. (11) WELL TESTS: Was well test made? Yes No If yes, by whom? driller Type of test Pump 10 10 ft. At end of test ft. Signed LARRY HERMAN by kathy baker FISCH-HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Signed Larry HERMAN Driller LING CO. NAME Solution Signed Larry HERMAN Driller Ling Driller	Annual Control of the	2 mis well will	3 1 7: (and this report is true to	the best of my
Was well test made? Yes 2 No If yes, by whom? Air lift 80 NAME FISCH-HERMANDERILLING CO. Depth to water at start of test 100 ft. At end of test ft. At end of test ft. At end of test ft. Address Sebastopol, Calif. 204128 6-19-80	Standing level after well completion	ft. knowledge ar	RY HERMAN by	kathy baker	
Type of test Pump 10 Bailer Air lift 0 NAME NAME 10 Bailer At end of test 10 Bailer At end of te	MANAGE TO A STATE OF THE PARTY	driller Signed	/Well I		
Depth to water at start of testft. At end of testft Address Sebastopol, Calif. Sebastopol, Calif. Sebastopol Sebastopol Calif. Sebastopol Sebastopo	Type of test Pump - Bailer		FISCH_HERMÄNDF	KILLING CO.	
hical analysis made? Yes No is If yes, by whom? No is If yes, by whom? No is If yes, by whom? Address Sebastopol, Calif. Zip 304128 6-19-80			En Person firm or corporat	ion) (Typed or primed)	
nical analysis made? Yes No E If yes, by whom? City 204128 6-19-80	t annual protect at the additional States and account of the contract of the c	Address			- 4770
204128 6-19-80		emperature	Sebastopol, Ca		
	Was electric log made? Yes No If yes, by whom? Was electric log made? Yes No If yes, attach copy to		304138 Da	te of this report 6-19	-80

//N/06W-28M

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No. 133871

ORIGINAL

File with DWR

STATE OF CALIFORNIA

THE RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

State Well No._

Local remnit No. or Date	Other Well No.
	(19) WELL LOC. (2)
	(12) WELL LOG: Total depth/90ft. Depth of completed well/90ft.
	from ft. to ft. Formation (Describe by color, character, size or material)
	0 -35 /opsoil - Brown
2) LOCATION OF WELL (See instructions):	
County Lt Mr. Common's Well Now has	65 - 60 CTAY to CANUE S- BROWN
Well address if different from above PARCH END GRANGE RD	-
ownship MiDD 12 16 W Mange 6- WILN Section 2728	60-62 GANVE / 100 150
Distance from cities, roads, railroads, fences, etc. 11N/6W - 28	-
21/2 MILES IN FROM GRANGE POAD	60 -100 Chev -
	- 0
	105 - 110 Rock-
(3) TYPE OF WORK	
New Well Deepening	1100 120 110
	THE CONTRACT OF THE PARTY OF TH
S De	
	23 - 170 CATI B/4E-
Horizontal Well] [11] -
Destruction (Describe destruction materials and	180 100 10 10 AS
we'll procedures in Item 12	~ - @ C C
(4) PROPOSED DEC	150 - BEDNADOK-
Domestic Domestic	A - 1
Irrigation	
Industrial	Drain- Dumbert Hoo Gpm
Test Well	
Stock	
- ITI	
Municipal	
WELL LOCATION SKETCH Other	1 - 2 ,
5) EQUIPMENT: (6) GRAVEL PACK:	
otary Reverse No Size	
able Air Inductor of bore	- <u>(a))</u> -
ther Bucket Packed from to	8//// -
7) CASING INSTALLED: (8) PERFORATIONS:	
eel Plastic Concrete Type of perhaping or size of screen	- /
From To Dia. Cape of From To Sha	- /
ft. ft. Wall ft. size	_
180 198 35 175 16 31	/
780 1800 350 77	
WELL CEAL	
9) WELL SEAL:	- MALO OZ 1008
Vas surface sanitary seal provided? Yes No I If yes, to depthft.	
Vere strata sealed against pollution? Yes No X Intervalft	
fethod of sealing	Work started 1956 Completed 1959
10) WATER LEVELS: Depth of first water, if known	WELL DRILLER'S STATEMENT: 4/5
	This det was different ander my parisaction and russ report is true to the best of my
11) YUNY Y MINORO	
11) WELL TESTS: (as well test made? Yes \(\sum \) No \(\sum \) If yes, by whom?	Vell Driller)
ype of test Pump Bailer Air lift	NAME BUGENE LOUISONE
epth to water at start of test 18 ft. At end of test 18 ft.	(Person, firm, or corporation) (Typed or printed)
bischarge good gal/min after 4 hours Water temperature 0/1	Address DOBOX 65
he analysis made? Yes No If yes, by whom?	City LOWEN KAKE - Zip 95457
Vas electric log made? Yes No Y If yes, attach copy to this report	License No. 191290 Date of this report MAY- 17-99
START THE PROPERTY PROTECTION IS AN ARM OF THE START WITHOUT THE START OF THE START	PRODUCTION STANDARD DEPOSITOR DESCRIPTION DE LA CONTRACTION DE LA
THE TOO LIES, 1978) IF ADDITIONAL STACE IS NEEDED, USE	NEXT CONSECUTIVELY NUMBERED FORM

11 ~ 106w - 20 M Do not fill in

ORIGINAL

File with DWR

STATE OF CALIFORNIA

THE RESOURCES AGENCY **DEPARTMENT OF WATER RESOURCES** WATER WELL DRILLERS REPORT

No. 211175

Notice of Intent No.	WATER WELL D	RILLERS REPORT State Well No
Local it No. or Date WE173		Other Well No
	-	(12) WELL LOG: Total depth 306 ft. Depth of completed well 306 ft.
	20	from ft. to ft. Formation (Describe by color, character, size or material)
(2) LOCATION OF WELL (See instru	ctions):	0-8 Red clay and boulder
	Well Number	8 - 22 Gray rock
Well address if different from above	20 <u>20 </u>	22 - 34 Maroon kock
Township 11N Range 6W	Section	34 - 98 Gray rock
Distance from cities, roads, railroads, fences, etc.	Guenoc	98 - 124 Red Kock
20802 Yankee Val		124 - 126 Gray Yock 126 - 140 Brown Yock
Middletown, Cali AP# 144-101-03	<u>cornia</u>	140 - 306 Volcanic conglomerate,
	(3) TYPE OF WORK:	f fractured.
Vankee Valley	New Well X Deepening	
yankee valley	Reconstruction	
(8)	Reconditioning	
17	Horizontal Well	(1) - (1) - (1)
1)	Destruction [(Describe	10- 111
11	destruction materials and procedures in Item 12	- 6
1	(4) PROPOSED USE	
11	Domestic	2 - 1 9
N Same	Irrigation	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Industrial	V 102-10
man	Tes Well	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
HIWAY 29	Stock)
The state of the s	Municipal	-01
WELL LOCATION SKETCH	Other	, - SV
(5) EQUIPMENT: (6) GRAVE	() (()).	
Rotary X Reverse N	(C.END)	
Cable ☐ Air ☐ The er of i	22 w 306	
Other Bucket Packed from. (7) CASING INSTALLED: (8) PERFO		
Steel Plastic & Concrete Type of perfe	micro or size of screen	<u> </u>
	111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-
from To Dia Gage of From ft. Wall ft.	ft. Sleet	-
0 308 5 CL200 20	305 2032	-
	1 1/2/2	•
	13. 11 11 11 11 11 11 11 11 11 11 11 11 11	-
(9) WELL SEAL:	137	-
	If yes, to depth 22 ft.	- JUL 09 1990
APPENDING AND AN AND AND AND AND AND AND AND AND	lo K Intervalft.	
	avel pack	Work started 5-4- 19 90 Completed 5-10 19 90
(10) WATER LEVELS: Depth of first water, if known	ft.	WELL DRILLER'S STATEMENT: This well was drilled under my jurisdiction and this report is too so the best of my knowledge and helief
Standing level after well completion	138 ft.	The state of the s
(11) WELL TESTS:	Weeks	SIGNED Ward Thompson By Don Sinclair
Was well test made? Yes Y No I If yes, Y Type of test Pump Bailer I	by whom?	(Well Driller) NAME WEEKS DRILLING AND PUMP COMPANY
Depth to water at start of test_138_ft.	At end of test280ft	(Person, firm, or corporation) (Typed or printed)
Discharge 100+gal/min after 2 hours	Water temperature cool	Address P.O. Box 176-6100 Sebastopol Road
Cher nalysis made? Yes No IX If yes,		City Sebastopol, California Zip 95473
*Was-Ciectric log made? Yes No ho If yes, a	ttach copy to this report	License No. C57-177681 Date of this report May 24, 1990
DWR 188 (REV. 7-76) IF ADDITIONAL SP.	ACE IS NEEDED. USE N	EXT CONSECUTIVELY NUMBERED FORM

11N/06W-19M

ORIGINAL

FEB 13 1998

STATE OF CALIFORNIA

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File with DWR

THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

No. 211420

	RILLERS REPORT State Well No
Local Permit No. or Date WE 1277 5 1/2 OJE	NOC VILLAGE Other Well No
	(12) WELL LOG: Total depth 104ft. Depth of completed well ft. from ft. to ft. Formation (Describe by color, character, size or material)
(2) LOCATION OF WELL (See instructions):	O - 2 Embedded gravels in brown,clay
Owner's Well Number	2 - 104 Gravel and boulders
Well address if different from above	
Distance from cities, roads, railroads, fences, etc. 19	- ()
18696 Putah Lane	- 10
Middletown	- 1
A.P. # 014-362-03	- \\
Puray (3) TYPE OF WORK:	R
New Well X Deepening	
Reconstruction	- \\
Reconditioning	
Horizontal Well	(5/10 - 1/4)
Destruction (Describe destruction materials and procedures in Item 12)	10-
(4) PROPOSED USE?	- 6
Domestic Domestic	
Irrigation	1-11-12-1
Industrial	1 07 Th 1/0
Test Well	
Stock	3(1) - 3(100
Municipal	
WELL LOCATION SKETCH Other	A - C. 1A
(5) EQUIPMENT: (6) GRAVEL PACK:	(- V
Rotary Reverse No Size	
Cable Air Diameter of bore 9 7 8 12"	9/// z
Other Bucket Packed from 50 to 104 fr	4/1/1 · -
(7) CASING INSTALLED: (8) PERFORATIONS: microperf	<u> </u>
Steel Plastic X Concrete Type of perforation or size of screen	9
From To Dia. Cage or From To Slot	-
ft. ft. in. Wall ft. ft. size	
0 94 6 CL200 54 94 032	
(9) WELL SEAL:	
Was surface sanitary seal provided? Yes No I If yes, to depth ft.	
Were strata sealed against pollution? Yes ☐ No 🛣 Intervalft.	=
Method of sealing cement on sandpack	Work started 1-10 1996 Completed 1-16 19 96
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if knownft. Standing level after well completionft.	This well was drilled under my jurisdiction and this flegget in my so the hards porms knowledge and belief.
(11) WELL TESTS:	SIGNED Ward Thompson By: Thurman Adams
Was well test made? Yes X No I If yes, by whom? WEEKS	NAME WEEKS DRILLING AND PUMP COMPANY
Type of test Pump 15 Bailer K Air lift 79 Depth to water at start of test 15 ft. At end of test 79 ft	NAME
bepth to water at start of testt. At end of testt. At end of testt. Water temperature 64	Address P.O. Box 176-6100 Sebastopol Road
cal analysis made? Yes No X If yes, by whom?	City Sebastopol, California Zip 95473
Was electric log made? Yes \(\sigma \) No \(\beta \) If yes, by whom:	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

ORIGINAL File with DWR

ce of Intent No.

STATE OF CALIFORNIA

WATER WELL DRILLERS REPORT

THE RESOURCES AGENCY **DEPARTMENT OF WATER RESOURCES**

No. 213736

State				
Other	Well	No.H	NO6W	18

Local Permit No. or Date				Or	her Well No. HWO	6W18
(1)		(12) W	ELL LOG	2: Table 1 26	ft. Depth of compl	262
Addre	1.5	from ft.			color, character, siz	
City_	*-		=	THE CONTRACTOR	color, character, 312	e or material)
			_	- M		
(2) LOCATION OF WELL (See instructions)		0	- 27	Very hard	red and brow	n rock
	Number	27	- 38		black rock w	
Well address if different from above Township / Rancho Quenog (1) Sec	ction 28			traces of		
Distance from cities, roads, railroads, fences, etc.		38	- 79		black rock	
Yankee Valley Road, Hidden Val	lley	79	- 92		colored cong	lomerate
Middletown			- ^	rock		,
A.P. # 144-111-06		92	- 148	Hard black	rock with r	ed and
\otimes ./ / ./ ϵ //./ (3)	TYPE OF WORK:	- 71	-/2	green rock		
	Well 🔟 Deepening 🗋	148 <	~\\$ 89	Extremely	hard blue-gr	een rock
	onstruction 🔲	189	- 24/20		nd red volca	
Reco	onditioning	\$240	- 261		and red roc	
Horiz	zontal Well	137	_	(6/1)		
/ Destr	ruction [(Describe	111	<u> </u>	1111	0	
destri proce	uction materials and edures in Item 12	7	- 🙃		2 4 2	
(4)	PROPOSED USE:		- 160	a	10 A	
Dome	estic 💮	1	-11 W			
Security Gate Irriga Indus	ation 🔲		7 17	1.05	>	
Indus	strial	(O)-	\	110		
Text	Well 💛 🗆	11/10				. 43 100000
Stock	:// 25	(11)	- 0	100	10.51 .51.51.	
Harrman Ra, Muni	icipal	2	- ~ (%)	\(\text{\tin}\text{\tex{\tex		- T
WELL LOCATION SKETCH Deber	Y	\}	(2)	^		
(5) EQUIPMENT: (6) GRAVEL PACE	K:	37	_ &)			4:
Rotary Reverse Reverse No	Size	(6)	\$			
Cable			r	-		
Other Bucket Patched from 2	0' 10 261' n	11112	-			79
(7) CASING INSTALLED: (8) PERFORATION	saw cut	100				200000 VC 20000 N
Steel Plastic E Concese Type of performation of	on space of actions (9	_			2000
From To Dia. Cagasar From	ro (čsloto)		-			
ft. ft. (\mathread m. Wall ft	ft. X Y6226		- SE	P 0 4 1986	*	į.
0 262 42 CI200 201 2	516 NV8x3 I		Ÿ			*
	100	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		1354-504		32.
	11/1/1					
(9) WELL SEAL:	11/2		-	5		
Was surface sanitary seal provided? Yes ♣ No ☐ If yes	s, to depth 20 ft.				H	<u> </u>
Were strata sealed against pollution? Yes 🗌 No 🕱 I			-		3.5.5	,
Method of sealing Cement on gravel	раск	Work starte	<u>a_11/7~~</u>	19 85	Completed 11/	/8 19 85
(10) WATER LEVELS:	.			STATEMENT:	·	00098
Depth of first water, if known Standing level after well completion	131 ft.	This well w	pas drilled und and belief.	ler my idrisdiction o	and tiple deport to trial	to the pest of my
(11) WELL TESTS:		SIGNED		m - De	y Don Sinc	lair
Was well test made? Yes ▼ No □ If yes, by whom		JAVINEW		(Well Dr	iller)	
Type of test Pump 131 Bailer	Air lift 25	NAME	C. The Constitution of the		PUMP COMPAI	
		Address	P.O. Bo	x 176 - 610	n) (Typed or printed) 00 Sebastopo	Road
L	ter temperature cool		Sebasto			95472
Chemical analysis made? Yes No If yes, by whom Was electric log made? Yes No If yes, attach co	THE RESERVE AND ADDRESS AND ADDRESS.	City License No.	057-177		of this report Novel	
THE RESIDENCE OF THE PROPERTY	TO A STATE OF THE PARTY OF THE				1	
DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS	, REEDED, USE RE	LAI CUNS	COULTY EL	. RUMBERED	r U K M	90A - X 9

ORIGINAL

File with DWR

Permit No. or Date_____

STATE OF CALIFORNIA THE RESOURCES AGENCY TMENT OF WATER RESOUR

No. 228005

Other Well No. 11 06 18

State Well No._

Do not fill in

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

	(12) WELL LOG: Total depthft. Depth of completed wellft. from ft. to ft. Formation (Describe by color, character, size or material)
(9) LOCATION OF WELL (9)	_
(2) LOCATION OF WELL (See instructions): County Owner's Well Number	- ^
Well address if different from above	·0 - 10 red clay and boulders
TownshipHidden VAlley Lake Section	-
Distance from cities, roads, railroads, fences, etc.	10 - 70 blue volcanic rock
10 # w//	70 00 70
AP= 144-063-01 LOT R-4-55	70 - 80 red Wencanic rock
(3) TYPE OF WORK:	80 A 115 Volcanic ash
New Well ☑ Deepening □	
Reconstruction 🕒	-//
	(115 _ 270 blue vølcanic rock
	1111
Destruction (Describe destruction materials and	200 305 black volcanic w/ serpintine
procedures in Item 12	stringers
(4) PROPOSED USE:	
Domestic	305 335 fractured chert
Irrigation	305 335 fractured chert
Industrial	V (2) 72.
Teest Well	111 9- 0.
Stock	- / (1)
Municipal D	
WELL LOCATION SKETCH Other	→ <u>-</u> @,∀
(5) EQUIPMENT: (6) GRAVEL PACK:	n _ 🔾
Rotary No Reverse Reverse No Size 3	
30 325	
(7) CASING INSTALLED (8) PERFORATIONS:	<u> </u>
Steel Plastic Concrete Type of perforation or size of screen	_
From To Dia Cago or From To Slot	
ft. ft. vall ft. ft. size	-
0 335 4	_
psi	-
Olla D	-
(9) WELL SEAL:	-
Was surface sanitary seal provided? Yes \(\Sigma \) No \(\Gamma \) If yes, to depth \(\frac{20}{20} \) ft.	_
Were strata sealed against pollution? Yes [] No 🖫 Intervalft.	-
Method of sealing cement	Work started 11-6 19 80 Completed 11-8 180
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if knownft.	This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Standing level after wen completion.	
(11) WELL TESTS: Was well test made? Yes No If yes, by whom? driller	SIGNEDXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Was well test made? Yes X No ☐ If yes, by whom? CIPLITEY Type of test Pump ☐ Bailer ☐ Air lift ☐	NAME FISCH HERMAN DRILLING CO.
Depth to water at start of test 220 ft. At end of test 310 ft	(Person, firm, or corporation) (Typed or printed)
Discharge 100 gal/min after 2 hours Water temperature	Address 5001 Gravenseein Hwy.N.
uical analysis made? Yes Nac If yes, by whom?	City Sebastopol, Calif. Zip 95472
Veas electric log made? Yes NoN If yes, attach copy to this report	License No. 304138 Date of this report 11-14-80

ORIGINAL

STATE OF CALIFORNIA

Do not fill in

THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

No. 245343

Commerce	WATER WEI	L DRILLERS REPORT
(12) WELL LOG: Total depth. in. Depth of completed well. in. from fe to ft. Formation (Describe by color, changer, size or material) in the color of		State Well No
Adding the company of	L. Fermit No. or Date	Other Well No
Adding the company of	(1)	(10) WELL LOC
City. County Califor OF WELL (See instructions): County		(12) WELL LOG: Total depthft. Depth of completed wellft.
(2) LOCATION OF WELL (See instructions): County Lake Consert Well Sumbles County C		from it. to it. Formation (Describe by color, character, size or material)
WELL LOCATION SETCH (3) TYPE OF WORK: New Well (\$\text{Special Description above. North Shore} 0 - 45 hard bue vol. rock Value 142-122-10 50 - 78 blue vol.		
WELL LOCATION SECTCH (a) CANPEXT: (b) CANPEXT: (b) CANPEXT: (c) CANDE CANDER CONTROL CONTR		
Township Hidden Alley Location A.P. # 142-122-10 So - 78	, and the state of	0 - 45 hard hous vol rock
Distance from cities, mads, milmads, fenore, etc. A.P. # 142-122-10 Compete	m Hidden Not 1 law 1 Aka- (a)	5 45 Mara 5140 VOI. 100k
A.P. # 142-122-10 50 - 78 blue vol. Solution State Sta		45 - 50 rea vol.
(3) TYPE OF WORK: New Well & Deepening		43 - 30 11011
Stock Patter Complete Com	R,11 # 142 122-10	50 - 70 blue vol.
New Well & Despening Reconstruction		- //
New Well & Despening Reconstruction	(3) TYPE OF W	ORK. 70 2 100 red bol.
Reconstruction Recons		
Reconditioning Horizontal Well Destruction underials and proceedings in term 10 conditions in term 10 conditio	1	100 X 20 Klas tol
Horizontal Well Destruction Describe procedure in Item 210 Volcanic ash 210 Vol		
Destruction		
destruction materials and proceedings in item 12 per procedures in item 12 per procedures in item 12 per procedure in item 12 per post of the per procedure in item 13 per post of the per procedure in item 14 per post of the per procedure in item 14 per post of the per procedure in item 15 per post of the per procedure in item 15 per post of the per procedure in item 15 per post of the per procedure in item 15 per post per post per procedure in item 15 per post per procedure in item 15 per post per post per procedure in item 15 per post per post per procedure in item 15 per post per post per procedure in item 15 per post		1831
Cable Bucket Royane From To Dia. Caignor Type of perifection or Rice of screen Cable Plastic X Compared Type of perifection or Rice of screen Cable Plastic X Compared Type of perifection	destruction materials a	NA INTERPRETATION OF THE PARTY
Domestic Irrigation		
Irrigation Industrial		
Industrial		V 1
WELL LOCATION SKETCH WELL LOCATION SKETCH (6) GRAVEL PACK: Cable		
WELL LOCATION SKETCH Other (6) GRAVEL PACK: Cable Air	Tesh Well	
WELL LOCATION SKETCH Other Steading Pastic X Reverse Re		
WELL LOCATION SKETCH Other (5) EQUIPMENT: (6) GRAVEL PACK: Rotary IX Reverse 160 GRAVEL PACK: Cable Air		
Solution Company Com		
Rotary Reverse Reverse No Size No Size Cable Air So Reverse No Size Cable Bucket Reverse No Size Cable Shirt State Size No Size Cast State Size Size No Size Cast Size Size Size Size Size Size Size Size		
Cable Air		
Other Bucket Packed from 20 to 290 from 20 Bucket Packed from 20 from 20 Bucket Packed from 20 from 20 from 20 Bucket Packed from 20 from	(77)	
(8) PERFORATIONS: Steel Plastic X Converge Type of perfutning or size of screen - From To Dia. Gage of ft. ft. ft. ft. ft. ft. ft. ft. ft. ft	20 1 200	D #5
Steel Plastic X Convet Type of perfutation or size of screen -		
From ft. Dia. Gage-of ft. In. Wall ft. ft. Sizzy - 0 298 5% c160 210 299 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 standing level after well completion 150 ft. (11) WELL TESTS: Was well test made? Yes X No If yes, by whom? driller Standing level after well completion Air lift Name of test and belief: Was auface sanitary seal provided? Yes X No If yes, by whom? driller Air lift Name of test and belief: NAME FISCH HERMAN by kathy baker (Well Driller) NAME FISCH HERMAN DRILLLING CO. 60941 NAME FISCH HERMAN DRILLING CO. 60941 NAME FISCH HERMAN DRILLING CO. 60941 Cical analysis made? Yes X No If yes, by whom? Sebastopol, Ca. Zip 95472		2 D
ft. ft. In. Wall ft. ft. Size		<u></u>
O 290 5		ize
PSI		-
Completed 3-4 19 82		
Was surface sanitary seal provided? Yes X No I If yes, to depth 20 ft. Were strata sealed against pollution? Yes No I 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 I If yes, by whom? driller Depth water at start of test 150 ft. At end of test 260 ft Disc. 25 gal/min after 2 hours Water temperature (ical analysis made? Yes I No I If yes, by whom? Was under the provided? Yes I No I If yes, by whom? 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 Address 5001 Gravenstein Hwy. N. Sebastopol, Ca. Zip 95472		
Was surface sanitary seal provided? Yes X No I If yes, to depth 20 ft. Were strata sealed against pollution? Yes No I 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 I If yes, by whom? driller Depth water at start of test 150 ft. At end of test 260 ft Disc. 25 gal/min after 2 hours Water temperature (ical analysis made? Yes I No I If yes, by whom? Was under the provided? Yes I No I If yes, by whom? 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 Address 5001 Gravenstein Hwy. N. Sebastopol, Ca. Zip 95472	(9) WELL SEAL:	-
Were strata sealed against pollution? Yes \(\) No \(\) Interval \(\) ft. Method of sealing \(\) cement \(\) Work started \(\) 3-3 \(\) 19 \(\) 82 \(\) Completed \(\) 3-4 \(\) 19 \(\) 82 \(\) (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 \(\) No \(\) If yes, by whom? \(\) Air lift \(\) Bailer \(\) At end of test \(\) 260 \(\) ft. Depth \(\) water at start of test \(\) 150 \(\) ft. At end of test \(\) 260 \(\) ft. (real analysis made? Yes \(\) No \(\) If yes, by whom? \(\) Water temperature \(\) Sebastopol, Ca. \(\) Zip 95472		D_ft
(10) WATER LEVELS: Depth of first water, if known		
(10) WATER LEVELS: Depth of first water, if known	Method of sealing cement	Work started 3-3 19 82 Completed 3-4 19 82
Standing level after well completion 150 (11) WELL TESTS: Was well test made? YesX: No If yes, by whom? driller Type of test Pump Bailer X Der water at start of test 150 ft. At end of test 260 ft Dia 25 gal/min after 2 hours Water temperature (ical analysis made? Yes No If yes, by whom? (ical analy	(10) WATER LEVELS:	
Standing level after well completion 130 ft. (11) WELL TESTS: Was well test made? Yes No If yes, by whom? driller Type of test Pump Bailer Air lift Der water at start of test 150 ft. At end of test 260 ft Dia 25 gal/min after 2 hours Water temperature (ical analysis made? Yes No If yes, by whom? Sebastopol, Ca. Zip 95472		ft. This well was drilled under my jurisdiction and this report is true to the best of my
Was well test made? Yes No If yes, by whom? driller Type of test Pump Bailer Air lift Der water at start of test 150 ft. Dia 25 gal/min after 2 hours Water temperature (ical analysis made? Yes No If yes, by whom? (ical analysis made? Yes No If yes No		ft. Knowledge and belief.
Type of test Pump Bailer Air lift NAME FISCH HERMAN DRILLING CO. OO941 Der water at start of test 150 ft. At end of test 260 ft Dia 25 gal/min after 2 hours Water temperature (ical analysis made? Yes No I if yes, by whom? City Sebastopol, Ca. Zip 95472	1	
water at start of test 150 ft. At end of test 200 ft Die 25 gal/min after 2 hours Water temperature (ical analysis made? Yes No If yes by whom? (ical analysis made? Yes No If yes by whom?	Type of test Pump Bailer Air lift	NAME FISCH HERMAN DRILLING CO. 6094
(ical analysis made? Yes No If yes, by whom? City Sebastopol, Ca. Zip 95472		OO ft (Person, firm, or corporation) (Typed or printed)
	Water temperature_	
Was electric log made? Yes \(\Dagger \) No \(\hat{\partial} \) If yes, attach copy to this report. \(\begin{array}{c} \Lightharpoonup \) Lightharpoonup \(\text{No.} \) \(\frac{399220}{2} \) \(\text{Date of this report.} \) \(\frac{3-5-82}{2} \)	*	200226

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

Do not fill in

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

No. 264476

of Intent No.	State Well No.
Local Permit No. or Date	Other Well No.
(1	(12) WELL LOG: Total depth 10.3 ft. Completed depth 100 ft.
Ad	from ft. to ft. Formation (Describe by color, character, size or material)
Ci	
(2) LOCATION OF WELL (See instructions):	0-4 Brown Soil
County Owner's Well Number	_
Well address if different from above	4-19 Brown Clay
Township IIN Range 6W Section 7 19	<u> </u>
Distance from cities, roads, railroads, fences, etc. 50 NovTh of	19-51 Brown Way + Gravel Mix
GVANGE Rd IM. EAST OF HWY 29	- \\\
mi HoLeTown	51 -58 Muddy Brown Gravel
	- 10
(3) TYPE OF WORK:	58 -80 Brown Clay & Cravel MIX
New Well 🗶 Deepening 🗆	- \\\
Reconstruction	80 -95 CYAYEY SEMI COMENTE d
Reconditioning	
Horizontal Well	- Grave
Destruction (Describe	
destruction materials and pro-	93 400 Brown Clay + Gruvel MA
cedures in Item 12)	
(4) PROPOSED USE.	V 0- 15 0 0 0
Domestic	~ (N) ~ (N) &
Irrigation	A D VOZO
Industrial	Ø-1≥ 4/S
Test Well	~(/\Q), ©
Municipal	//// × V((V)
Other	0) 0 - (0)
WELL LOCATION SKETCH (Desertibe)	MAXIM ROCOMMended AMPING
(5) EQUIPMENT: (6) GRAVEL NACK:	Δ- Θ
Rotary Reverse No No Size	5 Riffe 300 GPM
Cable Air Niameter of bore	
Other Bucket Racked from 20 0	MAXINUM Recommended DYAW Down
(7) CACING INCTALLED () (c) PEDEGRAPIANCE /	
(7) CASING INSTALLED: (8) PERFORATIONS:	50 FeeT
Steel Plastic Concrete Type of performing nor street of the Concrete Type of performing nor street of the Concrete Type of performing nor street of the Concrete Type of the Conc	50 FeeT
Steel Plastic Oncore Type of performing or size of School	50 FeeT
Steel Plastic Ontrote Type of retornion or size of school From To Dia. Gage or ft. Dia. Wall tt size	50 FeeT
Steel Plastic Oncore Type of perform or size of school From To Dia Gage or Room To Stot	
Steel Plastic Ontrote Type of retornion or size of school From To Dia. Gage or ft. Dia. Wall tt size	
Steel Plastic Ontrote Type of retornion or size of school From To Dia. Gage or ft. Dia. Wall tt size	- -
Steel Plastic Ontrote Type of retornion or size of school From To Dia. Gage or ft. Dia. Wall tt size	
From the fit is Gage or the terminal fit size Compared to the fit is the f	- -
From To Dia Gage or fit. Typed rection on or size of size with the fit. Size (9) WELL SEAL: Was surface sanitary seal provided? Yes No If yes, to depth ft. No Interval ft.	
From To Dia Gage or ft. To Wall ft. Size (9) WELL SEAL: Was surface sanitary seal provided? Yes No If yes, to depth 20 ft.	
From To Dia Gage or fit. Typed rection on or size of size with the fit. Size (9) WELL SEAL: Was surface sanitary seal provided? Yes No If yes, to depth ft. No Interval ft.	- JUN 1 1989 - JUN 1 1989 - Work started 2/3 1989 Completed 2/14 1989 WELL DEHLER'S STATEMENT:
From To Dia Gage or ft. Typed feet on from To Story feet of the Story ft. To Wall ft. Size (9) WELL SEAL: Was surface sanitary seal provided? Yes No If yes, to depth ft. Were strata sealed against pollution? Yes No Interval ft. Method of sealing COMON ft. No Interval ft. Method of first water, if known ft.	- JUN 1 1989 - JUN 1 1989 - Work started 2/3 1989 Completed 2/14 1989 WELL DRILLER'S STATEMENT: 833
From To Dia Gage or ft. To Wall ft. Size (9) WELL SEAL: Was surface sanitary seal provided? Yes No If yes, to depth ft. Were strata sealed against pollution? Yes No Interval ft. Method of sealing COMENTAL SEALS:	
From Tb Dia Gage or ft. Typed feel on nor size of size of ft. Gage or ft. To Wall ft. Size (9) WELL SEAL: Was surface sanitary seal provided? Yes No If yes, to depth ft. Were strata sealed against pollution? Yes No Interval ft. Method of sealing COMENT (10) WATER LEVELS: Depth of first water, if known ft. Standing level after well completion ft. (11) WELL TESTS:	Work started
From Tb Dia Gage or ft. Typed feet on from or size of size will be fit. Size Gage or ft. ft. ft. iii. Wall ft. Size	Work started 1989 Completed 1989 WELL DRHLER'S STATEMENT: 83 This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Signet Well Drilley 1.00 Discuss of the state of the s
Steel Plastic Quicret Type of rection from or size of size	Work started 73 1989 Completed 714 1989 WELL DRHLER'S STATEMENT: 833 This well was drilled under my jurisdiction and this report is true to the best of mycknowledge and belief. Signel NAME DAVE 61E Sell Bill Well Drilling
Steel Plastic Oncret Type of pet form or size of size	Work started 1989 Completed 1989 WELL DRHLER'S STATEMENT: 83 This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Signet Well Drilley 1.00 Discuss of the state of the s
Steel Plastic Oncret Type of pet form or size of size	Work started 7/3 1989 Completed 7/1 1989 WELL DRILLER'S STATEMENT: 83 This well was drilled under my jurisdiction and this report is true to the best of mychnowledge and belief. Signed 1 (Well Drilleg) On // In 9 NAME DAVE C/EST (Well Drilleg) On // In 9
From Tb Dia Gage or ft. Type of pet form or size of size of ft. Type of pet form or size of size of ft. Type of pet form or size of size of ft. Type of pet form or size of size of ft. Type of pet ft. Type of test Pump Type of test Type of	Work started 7/3 1987 Completed 1989 Well Drill ER'S STATEMENT: 83 This well was drilled under my jurisdiction and this report is true to the best of mycknowledge and belief. Signet 1 (1989) On // In 9 Address 200 Persoy firm or corporation) (Typed or printed)

11N/06W-28M

ORIGINAL File with DWR

STATE OF CALIFORNIA THE RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES

Do not fill in

WATER WELL DRILLERS REPORT

No. 302060

Notice of Intent No.	State Well No.
Local Permit No. or Date WE-307	Other Well No.
, , , , , , , , , , , , , , , , , , , ,	(12) WELL LOG: Total depth ft. Completed depth ft.
	from ft. to ft. Formation (Describe by color, character, size or material)
	0 - 90 Boulders St.
(a) I OCATION OF WITH I (a	- Replen Volcanius
(2) LOCATION OF WELL (See instructions): CountyOwner's Well Number	- Brojeen voicania
encommunication (All contractions) and independent of the contraction (All contractions) and independe	an 220 Hack Blue Holcanics
Well address if different from above Townshin	90 -270 Hala Olae 00.00 mos
	270 -290 Green sandy Rock
Distance from cities, reads, railroads, fences, atc. 214 Bla Yan Kee Valley RR. Mydletown	270 -370 OTEER 34 MAY 120CM
10th 1111 1111 1111	
(3) TYPE OF WORK: New Well Deepening Reconstruction Reconditioning	- 1
(3) TYPE OF WORK:	- \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
New Well & Deepening	- \\ \/
Reconstruction	-/>
Reconditioning	
Horizontal Well	A - \
Destruction (Describe	1- 15
destruction materials and procedures in Item 12)	123
(4) PROPOSED USE	
Demosts User	V- (C, A, b) V
Honey Hill Rd Domestic	- 100
Irrigation Industrial	4 1 1000
Industrial Test Well	(0)-\sqrt{-\sq\t{-\sqrt{-\sq\ta}}}}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\sqrt{-\sinthinfty}}}}}}}\efiret\efiret\efiret{\efiret{\efit}}}}}}}\efiret\efiret\efiret{\efity}}}}}
Other	
WELL LOCATION SKETCH (Describe)	V - W
(5) EQUIPMENT: (A) GRAVEL MCK:	(/s
Rotary Reverse T You No D Size	
Cable Air Nameter of bore	
Other Bucket Racked from A Company	
(7) CASING INSTALLED: (8) PERPORATIONS:	<u></u>
Steel Plastic Doncrete Type of perforation or size of series	
From To Dia Gage or Rom To Slot	
0 290 48 FY80 250 20 18	-
(O) MIELY CEAY	
(9) WELL SEAL: Was surface sanitary seal provided? Yes No □ If yes, to depth ○ □ ft.	
Was surface sanitary seal provided? Yes No ☐ If yes, to depthft. Were strata sealed against pollution? Yes ☐ No ☐ Intervalft.	-
Method of sealing Grout Cement	111 11 11 11 11 11 11 11 11 11 11 11 11
(10) WATER LEVELS:	Work started 1970 Completed 1970 WELL DRILLER'S STATEMENT: 1970
Depth of first water, if known	7502
Standing level after well completion	This well was drilled under my jurisdiction and this report is true to the
	best of my knowledge and belief.
WELL TESTS: ell test made? Yes X No If yes, by whom?	Signed (Well Driller)
'ell test made? Yes A No ☐ If yes, by whom?	NAME Larry Herman Prilling
Depth to water at start of testftft.	Person firm, or corporation (Typed or printed)
Discharge 3 0 gal/min after hours Water temperature	Address 134 HWY &
Chemical analysis made? Yes No No If yes, by whom?	City DWE LAKE CA 711 4343/
Was electric log made Yes No If yes, attach copy to this report	License No. 4650 11 Date of this report 17-13
DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE	NEXT CONSECUTIVELY NUMBERED FORM 86 96355

	ORIGINAL File with D	WR	JU		Ω	i	19	97 WELL	COM	OF CALI	ON	REPOR'	т П	//N/C	64	1 ,000 1		TION NO.
	Page of		JL	!		U	N		Refer to It				l f	- 1 - 1	SIAIE	WELL N	(U./51A	TION NO.
	Owner's Wel Date Work F		7-/1	. (96	2		Ended		4	43	157		LATITUDE	_ [[ONGITUDE
_	Local Perr	1000		P	<u>.</u> I	H	Ľ,	Dept.						1 1 1	1 1	l a	1 1	
	Permit	-	JE-1	3	3 (>	ē	Permit	Date	7-10	ا نہ	96				APN/TE	S/OTHE	R
				GΕ	OL	OG:	I C	LOG —			T							
	ORIENTATION	(∠)						IZONTAL AN										
	DEPTH FRO	IM	DEPTH	TO	FIR	IST V	VAT	ER [80 (Ft.)	BELOW SUI	RFACE								
	SURFACE				n			SCRIPTION				72						
	Ft. to	Ft.	1/0/	- 1	Desc	noe	ina.	terial, grain size, co	nor, etc.			1 10	12 E	WELL LO	CATI	ON	<u></u>	+
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	180	85	Frac	te	LYI	el/	1	gd & Blive	Vokan	165	Lat	titude	MIN. SE	NORTH C.	Longi	tude_	DEG.	I WEST
	185 2	73	Ugic	q,		2/	-	156			-		CATION	SKETCH			154	CTIVITY (Z) —
	2500	75	Ere	20	120			115		1960		296 (9	NORT					NEW WELL
	ا دیکو						4	7-		745	/	4			8		MODI	FICATION/REPAIR Deepen
	i i										1	THE S.		_	¥`			Other (Specify)
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	1	!	1 12	_1_		1					ļ	\&	•	,	7			DESTROY (Describe Procedures and Materials
			180			٨	9	pm				\		<i>a</i>	90	10		Under "GEOLOGIC LOG")
	1		715		7	0		120 mm		<u> </u>	VEST	\rightarrow	\	3)	7	EAST		ANNED USE(S)· (∠)
	1							1297			~	on Toll	Χ	_ ञ	٤ -	200	_	MONITORING R SUPPLY
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		j								C	ľ			3	1	Α		Public
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ATTACHMENTS (∠)	CERTIFICATION STATEM	TENT -	
Geologic Log	I, the undersigned, certify that this report is complete and accurate	to the best of my know	wledge and belief.
— Well Construction Diagram	NAME WEEKS DRILLING AND PUMP COMPA	NY	
Geophysical Log(s)	(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)		
Soil/Water Chemical Analyses	P.O.BOX 176 Sebastopol, Califo	rnia 95473	
Other	ADDRESS Murnan adam	STATE	
ATTACH ADDITIONAL INFORMATION. IF IT EXISTS.	Signed WARD THOMPSON BY: THURMAN ADAMS	7-11-97	177681
Park II	WELL DRILLER/AUTHORIZED REPRESENTATIVE	DATE CICNED	C.E.7 LICENCE MIMADED

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- 1,1					-	٠.					1	DEPTH TO FIRST W	ATER L	(Ft.) BE	ELOW S	URFACE	E				
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ATTACHMENTS (%)													TION ST	ATEMENT	L	· -	L				
	ATTACHMENTS (\leq) CERTIFICATION STATEMENT I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.																				
-	Geologic Well Con	Log struction D)iaoran	n			NAME	\mathcal{L}	arry	s H	4	man	0	r(i)	ng						
		ical Log(s)	-	•			, araw	(PERSO	ON, FIRM, OR O	ORPORATION)	m	YPED OR PRINTED)		1	//	^		301100			
-	Soil/Water Chemical Analyses 1304 Hwy 29 Lower Lake Ca 95957													12957							
-	Other					-	ADDRES		Ya.	1	[/	Lama	_	CITY	-10	-0	STATE	165071			
ATTACH A	DDITIONAL I	NFORMATI	ON, IF	IT EX	ISTS		Gigne	THE	DRILLER/AUTHO	RIZZO REPRE	SENT	TATIVE		/ DA	TE SIGNED)		-57 LICENSE NUMBER			

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Page of	#2	1.	1	39		WELL	Refer to D					1	S	ATE W	ELL NO	./STATIO	ON NO.			
Owner's Well No	#2	?					No.	^{2.} 71	3	818			Ш							
Date Work Began	1/13/	99				Ended			0	010		LAT	TUDE			LC	NGITUDE			
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DEPTH FROM	METHOD	_	1.10			ESCRIPTION	FLUID													
SURFACE Ft. to Ft.	1	Desc	rib	e m	ate	rial, grain si:	e, color, et	c.	WELL LOCATION											
0 5	Brow								Address 18585 Gwenoc Lane											
5 11	Brow								City Middletown, California 95461											
11 12	Brow	şa	nd	у	clay		County LAKE													
12 18	Brow	m	gr	av	el,	S		APN Book 014 Page 270 Parcel 60												
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Well Cor	nstruction Di	agra	m			NAME _				G AND PUME YPED OR PRINTED)	5	COMPANY								
Geophys	sical Log(s)					11			6 Sebastopol, California 95473											
	er Chemical	Ana	lyse	S		ADDRESS	.O. BOX	1/6 8	sek	pastopol,	C		1 95	14/3		STATE	ZIP			
Other						-	WARD TH	OMPSON	1 F	BY: THURMA	M			126 1	20		177681			
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File with DWR Page of MAY 2 1 2001 WELL COMPLETION REPORT Owner's Well No. #1 No. 7715265 Local Permit Agency LAKE COUNTY HEALTH DEPARTMENT STATE OF CALIFORNIA LOCAL PORT OF CALIFORNIA STATE OF CALIFORNIA STATE OF CALIFORNIA LOCAL PORT	TION NO.											
Date Work Began 4-4-01 Ended 4-104015265												
TARE COMMING HEAT MILL DEDARMINE												
LOCAL Permit Adency	ONGITUDE											
Permit No. WE2056 Permit Date 3-22-01												
GEOLOGIC LOG												
ORIENTATION () VERTICAL — HORIZONTAL — ANGLE — (SPECIFY)												
DEPTH FROM SURFACE DESCRIPTION AIR ROTARY FLUID N/A DESCRIPTION												
Ft. to Ft. Describe material, grain size, color, etc.												
0 34 Red Clay, boulders & cobble Address 20572 Honey Hill Road	Address 20572 Honey Hill Road,											
	City Hidden Valley											
APN Book 174 1 Page 07 Parcel 10												
221 340 Volcanic Conglomerate rock Township // N Range Ow Section 18												
Latitude NORTH Longitude DEG. MIN. SEC. Longitude DEG.	MIN. SEC.											
NODTU	CTIVITY (∠) — NEW WELL											
	FICATION/REPAIR											
	Deepen Other (Specify)											
	DESTROY (Describe											
	Procedures and Materials Under "GEOLOGIC LOG"											
	NNED USES (∠)											
<u>x</u>	Domestic Public Irrigation Industrial											
WEST WEST	MONITORING											
CATH	DDIC PROTECTION											
	HEAT EXCHANGE											
	DIRECT PUSH											
VA VA	APOR EXTRACTION											
Illustrate or Describe Distance of Well from Reads Buildings	SPARGING											
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.	OTHER (SPECIFY)											
	WATER LEVEL & YIELD OF COMPLETED WELL											
DEPTH TO FIRST WATER (Ft.) BELOW SURFACE												
DEPTH OF STATIC WATER LEVEL 175! (Ft.) & DATE MEASURED 4-1 ESTIMATED VIELD: 60 + (COLOR & TEXT DOES AIR	0-01											
ESTIMATED TIELD (GPM) & TEST TYPE	LIFTED											
TOTAL DEPTH OF BORING 340' (Feet) TOTAL DEPTH OF COMPLETED WELL 335' (Feet) TOTAL DEPTH OF COMPLETED WELL 335' (Feet) *May not be representative of a well's long-term yield.												
BONE- BORE-	MATERIAL PE											
PL to Ft. DIA. (Inches) DIA. (Inches) DIA. (Inches) MATERIAL / GRADE MATERIAL / GRADE DIAMETER OR WALL IF ANY (Inches) THICKNESS (Inches) Ft. to Ft. (C) (C) (C)	FILTER PACK											
	(TYPE/SIZE)											
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20 340 8HB 20 340 X PVC/F480 5" CL200	PEA GRAVI											
235 335 X 2032												
	-											
ATTACHMENTS (∠) CERTIFICATION STATEMENT	<u></u>											
I the understand modify that this secret is sound to any date and secret to the board of	ge and belief.											
I, the undersigned, certify that this report is complete and accurate to the best of my knowled	1,30.											
— Geologic Log — Well Construction Diagram WEEKS DRILLING & PUMP COMPANY (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)												
— Geologic Log — Well Construction Diagram — Geophysical Log(s) WEEKS DRILLING & PUMP COMPANY (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED) P.O. BOX 176, Sebastopol, Ca 95473												
— Geologic Log — Well Construction Diagram WEEKS DRILLING & PUMP COMPANY (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)	7IP 177681											

ORIGINA File with					WE	ELL	COM	OF CALIF	ON I		RT [DWR U	10	- DO	NOT FINANCIAL PROPERTY OF THE
	_ of							Instruction			1-		STATE WELL	NO./STAT	ION NO.
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TOTAL DE TOTAL DE FROM SU	PTH OF CPTH OF	BORE-HOLE DIA. (Inches)	BLANK SOREEN (F)	E(<u></u>	MATE GRA	(Feet)	CASING (S INTERNAL DIAMETER (Inches) (65/8) ersigned, c	GAUGE OR WALL THICKNES	DEPTH DEPTH WATER ESTIMA TEST LIX * May	e or Describe Rivers, etc. ar y. PLEASE I WATE TO FIRST V OF STATIC LEVEL ATED YIELD ENGTH not be reprint LOT SIZE IF ANY (Inches) ERTIFICA TIS Complet	SOUTH Distance of Vand attach a management of the second stack of	Well from Rocap. Use addition TE & COMI & YIELD (Ft.) & DAT (GPM) & TOTAL DRAW F a well's los EPTH SURFACE to Ft.	OF COM ELOW SURF. E MEASURED TEST TYPE. NOOWN. ng-term yiel AN (\(\sigma\)) (\(\sigma\)	PLETED ACE (Ft.) Id. NNULAR TY INITE FILL (\(\precedum)\)	HEAT EXCHANGE DIRECT PUSH INJECTION POR EXTRACTION SPARGING REMEDIATION OTHER (SPECIFY) WELL A7-01 SIELL MATERIAL (PE FILTER PACK (TYPE/SIZE)
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TOTAL DE TOTAL DE FROM SU	Ft. ATTACI Geologic Well Cor Geophys	BORING COMPLET BORE-HOLE DIA. (Inches) Complete Size Size Size Size Size Size Size Siz	TYPE NHAME SOURCE NAME OF THE	DUCTOR I	MATE GRA	(Feet)	CASING (S INTERNAL DIAMETER (Inches) (65/8) ersigned, c	GAUGE OR WALL THICKNES	DEPTH DEPTH WATER ESTIMA TEST LI * May	e or Describe Rivers, etc. ar y. PLEASE I WATE TO FIRST V OF STATIC LEVEL ATED YIELD ENGTH not be represented in the complete of the complet	SOUTH Distance of value and attach a make ACCURA R LEVEL VATER (Hrs.) The seentative of the seentativ	Well from Rocap. Use addition TE & COMI & YIELD (Ft.) & DAT (GPM) & TOTAL DRAW F a well's los EPTH SURFACE to Ft.	OF COM ELOW SURF. E MEASURED TEST TYPE. NOOWN. ng-term yiel AN (\(\sigma\)) (\(\sigma\)	PLETED ACE (Ft.) NNULAR TY (SN.) HITE FILL (\(\precedum{2}\))	HEAT EXCHANGE DIRECT PUSH INJECTION POR EXTRACTION SPARGING REMEDIATION OTHER (SPECIFY) WELL A7-01 SIELL MATERIAL (PE FILTER PACK (TYPE/SIZE)
TOTAL DE TOTAL DE FROM SU	EPTH OF EPTH OF TH JRFACE Ft. GO JOO JOO Geologic Well Cor Geophys Soil/Wate Other	BORING COMPLET BORE-HOLE DIA. (Inches) REPRESENTS Log Instruction Dialetical Log(s) BORING TYPE WENTER BITYPE SOBEEN (ELL NOO ONCION HILL HILL HIPE	MATE GRA	_(Feet)	CASING (S INTERNAL DIAMETER (Inches) (a5/8) ersigned, c	GAUGE OR WALL THICKNES 188	DEPTH DEPTH WATER ESTIMA TEST LI * May	e or Describe Rivers, etc. ar y. PLEASE I WATE TO FIRST V OF STATIC LEVEL ATED YIELD ENGTH not be represented in the complete of the complet	SOUTH Distance of value and attach a make ACCURA R LEVEL VATER (Hrs.) The seentative of the seentativ	Well from Rotago. Use addition & YIELD (Ft.) & DAT (GPM) & TOTAL DRAW f a well's los EPTH SURFACE TOTAL TRAVEL TOTAL TRAV	OF COM ELOW SURF. E MEASURED TEST TYPE. NOOWN. ng-term yiel AN (\(\sigma\)) (\(\sigma\)	PLETED ACE (Ft.) Id. NNULAR TY INITE FILL () (\(\sigma \) STATE	MATERIAL PE FILTER PACK (TYPE/SIZE) ge and belief.	

ORIGINAL File with DWR

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Page 1 of 1	Refer to Instruction Pamphlet
Owner's Well No. Well #1	^{No.} e033469

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

Local Permit Agency Lake Co Environ Health
Permit No. WE-2425 Perm

Permit Date 11/9/2005

DWR USE ONLY DO NOT BILL TO
1/N 106 W-07
STATE WELL NO./ STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

remit No	GEOLOGIC LOG		
		WELL OWNER -	
ORIENTATION (≰)	→ VERTICAL — HORIZONTAL — ANGLE — (SPECIFY) DRILLING AIR ROTARY — FLUID N/A		
DEPTH FROM			
SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain, size, color, etc.	CITY	STATE ZIP
	Stiff tan clay	Address 18967 Comstock Court	STATE ZIF
	Light brown sandy clay	Address 18967 Comstock Court	
	Light brown sandy clay with gravel	City Middletown CA	110 - 1
	Loose fractured rock	County Lake	
		APN Book 144 Page 121 Parcel 030	
	Gray rock	Township IIN Range Obusection O	<u>}</u>
	Volcanic rock	Latitude I DEG. MIN. SEC.	L
210 220	Red rock	DEG. MIN. SEC. LOCATION SKETCH	DEG. MIN. SEC. ACTIVITY (∠)
		NORTH -	✓ NEW WELL
		5000 500 5	
ļi			MODIFICATION/REPAIR —— Deepen
			Other (Specify)
			— DESTROY (Describe Procedures and Materials
			Under "GEOLOGIC LOG"
			PLANNED USES (∠)
		T	WATER SUPPLY Domestic Public
-		WEST EAST	Irrigation Industrial
	TO THE PROPERTY OF THE PARTY OF		MONITORING
ļ	6		TEST WELL
			CATHODIC PROTECTION
			HEAT EXCHANGE
			DIRECT PUSH
			INJECTION
			VAPOR EXTRACTION SPARGING
		south —	REMEDIATION
	The state of the s	Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc., and attach a map. Use additional paper if	OTHER (SPECIFY)
		Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.	
		WATER LEVEL & YIELD OF COMPL	ETED WELL
		DEPTH TO FIRST WATER- (Ft.) BELOW SURFACE	
		DEPTH OF STATIC WATER LEVEL 130 (Ft.) & DATE MEASURED	11/23/2005
		ESTIMATED VIELD • 30 (GPM) & TEST TYPE_/	AIR DEVELOP
TOTAL DEPTH OF	BORING 220 (Feet)	TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN 220.	
	COMPLETED WELL 220 (Feet)	May not be representative of a well's long-term yiel	
		may not be representative of a west's long-term yield	

DEPTH BORE			CASING (S)								DEF	PTH	ANNULAR MATERIAL						
FROM SUR	RFACE	BORE - HOLE DIA.		TYPE (<)				INTERNAL	041105	01 07 0175	FROM SI	JRFACE				PE			
Ft. to	Fl.	(Inches)	BLANK	SCREEN	CON-	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	FL. t	o Ft.	CE- MENT (<u>✓</u>)	BEN- TONIT (<u>✓</u>)	FILL (<u>√</u>)	FILTER PACK (TYPE/SIZE)			
0	20	11									0	19	1						
20	220	8" HB									19	21		V					
+2	220		\checkmark	Π	П		PVC	5	CL200		21	220			V	3/8 pea gravel			
140	220			~		П				.032									
1																			

	ATTACHMI	ENTS	(∠)			- 71				CERTI	FICATIO	N STAT	EMEN	т —				_
_	Geologic Log	9				Ш	I, the undersig	ned, certify th	at this report is c	omplete and a	ccurate to t	he best of r	ny knowle	dge and be	elief.			
_	Well Constru	ction Di	iagram			- 11			ng & Pump									
	Geophysical	Log(s)				- 11	,		R CORPORATIO	N) (TYPED C	R PRINTE							
	Soil/Water C	hemical	Analysi	s		Ш	P.O. Box	176	n 1		1-	Seb	astopo	<u> </u>	<u>C</u>		95473	
_	Other					- 11	ADDRESS	\mathcal{A}	Y OVIA	11 1	La	Day	CITY	10/00/05		TATE	ZIP	
ATTACH ADD	OITIONAL INFO	RMATIC	N, IF IT	EXIS	TS.		Signed	L DRILLER/A	UTHORIZED RE	PRESENTATI	VE Y	7		12/09/05 ATE SIGNE			7681 7 LICENSE NU	МВЕ
							WEL	L DRILLER/A	UTHORIZED RE	PRESEIVIATI	VE #		<i>U</i> /	TE SIGNE	U	U-0	I LICENSE NO	n

Page 1 of 1

STATE OF CALIFORNIA

JUN 0 1 2015 WELL COMPLETION REPORT

Refer	to	Instruction	Pamphle

0	Instruction	Pamphlet
	No. e02	267546

Owner's Well No. WELL #1 ___, Ended 4/28/2015 Date Work Began 4/17/2015

Local Permit Agency Lake County Environmental

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

ILL OWN -	DO NOT FILL IN													
	O./ STATION NO.													
	4 L 1 L 1 H													
LATITUDE	LATITUDE LONGITUDE													
APN/TRS	/OTHER													

CA

Sebastopol

05/22/15

FILTER PACK (TYPE/SIZE)

CONCRETE

3/8 Pea Gravel

95473

E ZIP 177681 C-57 LICENSE NUMBER

		GEOLOGIC LOG	WELL OWNER -	
ORIENTATI	, ,	VERTICAL HORIZONTAL ANGLE (SPECIFY) DRILLING METHOD AIR METHOD AIR	·	
DEPTH F SURFA		DESCRIPTION		
Ft. to	Ft.	Describe material, grain, size, color, etc.	CITY	STATE ZIP
0	43	Red ash and rock	Address 15519 Spruce Grove Road	
43	62	Extra hard gray rock	- City Middletown CA	
62	83	Red lava rock and voids	CountyLake	
83	131	Burgundy colored rock		7
131	141	Extra hard gray rock	APN Book 0.13 Page 0.60 Parcel 0.6 (Township 1114 Range Section	1017
141	176	Burgundy and purple rock		122 33 ₁ 684 W
176	304	Hard gray, black and green rock	DEG. MIN. SEC.	DEG. MIN. SEC.
304	343	Gray, black, green and red rock	LOCATION SKETCH	ACTIVITY (∠) —
343	408	Extra hard blue/gray rock	NONTH	→ NEW WELL
408	472	Gray, black and green rock with water		MODIFICATION/REPAIR Deepen
		producing fractures from 447' to 451'		Other (Specify)
472	540	Extra hard blue/gray rock	1	
		, , , , , , , , , , , , , , , , , , , ,	-	DESTROY (Describe Procedures and Materials
				Under "GEOLOGIC LOG
			Well and	PLANNED USES (∠) WATER SUPPLY
			1S: 80 → 1S	✓ Domestic — Public
				Irrigation Industrial
-			一一人图人	MONITORING
				TEST WELL
			- January	CATHODIC PROTECTION HEAT EXCHANGE
				DIRECT PUSH
			•	INJECTION
			1	VAPOR EXTRACTION
			SOUTH	SPARGING
			Illustrate or Describe Distance of Well from Roads, Buildings,	REMEDIATION
-			Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.	OTHER (SPECIFY)
	-		WATER LEVEL & YIELD OF COMPL	ETED WELL
			DEPTH TO FIRST WATER N/A (Ft.) BELOW SURFACE	1
		_	DEPTH OF STATIC WATER LEVEL 310 (FL) & DATE MEASURED	
			WATER LEVEL 310 (Ft.) & DATE MEASURED	4/20/2015
TOTAL DEP	TH OF I	BORING 540 (Feet)	ESTIMATED YIELD • 6 (GPM) & TEST TYPE	
		500	TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN BTM	
OTAL DEP	In OF	COMPLETED WELL 532 (Feet)	May not be representative of a well's long-term yield	1
		CASING (S)		

DEPTH BORE			CASING (S)									PTH	4		MATERIAL													
FROM SURFACE HOLE		HOLE .			Ę (:	<u> </u>					FROM					T)	/PE											
Ft. to	Ft.	DIA. (Inches)												BLANK	SCREEN	CON	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	Ft.	to	Ft.	CE- MENT (<u>√</u>)	BEN- TONITE (✓)	FILL (✓)	FILTER PAG (TYPE/SIZE
0	20	11									0		1	1			CONCRET											
20	540	8		Γ	T						1	1	25		1													
+2	372		✓				PVC	5	SDR21		25	1	532			✓	3/8 Pea Gr											
372	532			~			PVC	5	SDR21	.032							0,01000											
			_	_	_							<u> </u>																
												1			l I													

_	AT	TA	CI	IM	EN	IS	(×)	

- 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

Signed . WELL DRILLER IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 REV. 11-97

State of Complete MAR 2 3 2016 State of Complete	tion Report	Latit	State Well N	Only – Do Not Fill In Umber/Site Number Longitude U/TRS/Other
Geologic Log Orientation Overtical O Horizontal O Angle Specify				
Drilling Method Direct Rotary Drilling Fluid Bentonite mu	d_			
Depth from Surface Description Feet to Feet Describe material, grain size, color, etc				
0 75 Red ash, cobbles and boulders		We	ell Locatio	on
70 100 Gray ash and crushed rock	Address 15591	- Internal	Manager Landson	
100 220 Gray volcanic rock	City Middletow			ounty_Lake
220 240 Gray volcanic rock with large fractures	Latitude 38	50 100		tude 122 33 687 w
24 280 Gray volcanic rock	Deq.			
280 370 Red volcanic rock with red and burgundy cinders	APN Book 013	the second secon		Decimal Long Parcel 070
370 380 Tan ash and gray rock 380 420 Green ash and gray rock	Township 11N		10	Section 6 V
380 420 Green ash and gray rock 420 550 Burgundy and red volcanic rock and cinders		ation Sketch		Activity
550 592 Fractured gray volcanic rock		wn by hand after for North		New Well
592 600 Shale clay Total Depth of Boring 600 Feet	Illustrate or describe distantivers, etc. and attach a man Please be accurate and company to the static water Level 27 Estimated Yield **	South So well from roads, built by the south of the southout of the south of the south of the south of the south of the so	empleted V	O Modification/Repair O Deepen O Other O Destroy Describe procedures and materials under 'GEOLOGIC LOG' Planned Uses ● Water Supply □ Domestic □ Public □ Irrigation □ Industrial O Cathodic Protection O Dewatering O Heat Exchange O Injection O Monitoring O Remediation O Sparging O Test Well O Vapor Extraction O Other Well (Feet below surface) Measured 02/01/2016 Type Air Lift
	Test Length 8.0			I Drawdown 580 (Feet)
Total Depth of Completed Well 594 Feet	*May not be repr	esentative of a	well's long to	erm yield.
Depth from Borehole Wall Outside	Screen Slot Siz	e Depth fron		lar Material
Surface Diameter Type Material Thickness Diameter Feet to Feet (Inches) (Inches) (Inches)	r Type if Any	Surface Feet to Fe	FI et	II Description
0 60 13		0 54	Cement	
60 600 10 Blank PVC Sch. 40 SDR21 6		54 58 58 594	Bentonite Filter Pa	
194 594 Screen PVC Sch. 40 SDR21 6	Milled Slots 0.032	50 594	i illei Fai	on orea Glavel
	1			
Attachments		tion Stateme		

☐ Well Construction Diagram ☐ Geophysical Log(s)		Person, Firm or Corp (176		Sebastopo		CA 95473	
☐ Soil/Water Chemical Analyses ☐ Other	Signed		marco	ini ci	3/11/16	State 177681	Zip
Attach additional information, if it exists.		C-57 Licensed Wate	Well Contractor		Date Signed	C-57 License Nu	ımber
WD 100 DEV 1/2006					-		

t 188 (REV, 12-68)

STATE OF CALIFORNIA ... THE RESOURCES AGENCY

WENT OF WATER RESOURCES .

ektuaga gumanerekti kirkika et e e e wee e e	manday sanday sanday a Palace
	Do not fill in
ES ,	Frankli

No.	27	EQ3	a 🧲	do
140.	JI	593	J	mek.
tate Well	No			

r's Copy .	WALK WELL DE	RILLERS REPORT No. 375939 Stoneham
of Ir No. WE 561	WE	Other Well No.
WNER: Name Stonehouse M	utual Water Company	(12) WELL LOG: Total depth 205 ft. Completed depth 180 ft.
% Winzler & Kelly, 495	Tesconi Circle	from it to it Formation (Describe by color, character, size or material)
Santa Rosa, CA	· 21P 95401	.0 - 10 Brown sandy clay & sandy gravel
The state of the s	•	- with cobbles
OCATION OF WELL (See instru	actions): 14-270-66	10 -115 Sandy gravel with conglowerate
Lake: Own. direct if different from above 18963	cr's Well Number	- and boulders
Idress if different from above	GLARIE NOCA	115 -120 Sand & gravel with conglowerate
ip Middletown Range	Section	- and boulders small amoints of
no from cities, roads, railroads, fences, etc.		- silty clays & Sandy clay
Commence of the Commence of th		120 -165 Sandy grave with conglowerate
	***************************************	- and harders
		165 -170 conglowerate sand & quaival with
•	(3) TYPE OF WORK	. ((: - ()
	New Well & Deepening	ago -ton call-auto bear a clay with
	Reconstruction	
	Reconditioning	
	Horizontal Well	
8 2 8	Destruction (Describe destruction materials and pro-	198 -205 Tan Santy Clay
	cedures in Item 12)	
	(4) PROPOSED USE	
	Domestic E	10 A 10 A 10 A 10 A 10 A 10 A 10 A 10 A
	Irrigation	
	Industrial	
	Test Well	
A.	Municipal	11112 0000
	Other	
	(Describe) Rublic	
WELL LOCATION SKETCH	(12)	
QUIPMENT: (6) C:	RAVEL RICK	, (6)
idary & Reverse - Total	J 110 E., July 2017	
	etect of borg 128 287	REDEIVED
nher Bucket Racke	d rom 50 6 180 (F	100 00
	ERFORATIONS:	₩) = = AFR # 8 1992
ASING INSTALLED: (8) PI	of person of are of State of	JAMES A
	a ballanda a manifest	- JAMES C. HANSON
m To Dia Gage or E	To Shot	
. id in Wall	77 - 12 - 12 - 12	
180 12/3/4 025	80 1 192 .070	
	N I I	
WELL SEAL:	1 If we to death 50 ft	
	,	
Cond Court	L L L L L L L L L L L L L L L L L L L	10.22 10.91
77.7.	VIII. PALIK	Work started 10-9 1911 Completed 111-22 19-22 WELL DRILLER'S STATEMENT:
WATER LEVELS:	6	Add Decide address to the Contract of the Cont
h of first water, if known fing level after well completion		This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
) WELL TESTS: .		Signed Ward Thompson,
well test made? Yes 20 No 11	ra by whom? Weeks	(Well Driver)
and the Pump (5) Ba	iler Alrini C	(Person, (irm, or corporation) (Typed or printed)
harga /00 gal/min after _6 hours	Water temperature 670	Addres POB-176
	yes, by whom?	City Sebastopol; Ca zip 95473
destrictements You FT No D 11	yes, attach copy to this report	License No
I I I I I I I I I I I I I I I I I I I	onal space is needed, usi	E NEXT CONSECUTIVELY NUMBERED FORM & HUS

37	1972
arar	rge Road
Wel	10#4

TOO DECACALL

RECEIVED MAR 1 0 2003

			-4715 C
TRIPLICATE	EL	EV	956.89

TRIPLICATE	FL	BA
Owner's Copy		

WELL COMPLETION REPORT Refer to Instruction Pamphlet

Page 1 of 1 No.769936 Owner's Well No. Well:#4 _____, Ended 2/26/2003 Date Work Began 1/23/2003

Local Permit Agency Lake Co Environ Health.

	COL	10				0-1			4	
	- D	WA	USE	ONLY	_	DO	NOT	FI	1.	N
	1	1	1	1	1	1	1	1	1.	\perp
			STA	TE WE	LL NO	1 STAT	1 NOI	10.		
	1.1	1		1		1	1	1	1	
-	' '	ATIT	UDE	-		LC	TIEM	JDE		
Г	1	1	1	1	1	1	1	1	1	
_		_	_		1000	OTHER			-	

RIENTATIO	N (₹)	GEOLOGIC LOG — ✓ Vartical — HORIZONTAL — ANGLE — (SPECIFY) DRILLING MUD ROTARY — FLUID BENTONILE	Name Hidden Valley Com. Service District Mailing Address 19400 Hartman Road	
DEPTH FR SURFAC	OM	DESCRIPTION	Middletown	CA STATE ZIP
FI. ID		Describe material, grain, size, color, etc.	CITY WRLLLOCATION	SIAIE ZII
0	12	Tan clay	Address 18963 Grange Road	
12	59	Sand and gravel, cobble and boulders	City Middletown CA	
59	72	Clay	CountyLake	
72	84	Sand and gravel	APN Book 014 Page 270 Parcel 67	
84	87	Clay	Township Range Section	
871		Sand and gravel	Yatitude . 1	1 1 1
94	-	Clay	DEG. MIN. SEC. LOCATION SKETCH	EG. MIN SEC.
95		Sand and gravel and clay streaks	NORTH -	✓ NEW WELL
115	-	Clay	The state of the s	MODIFICATIONIREPAIR
135		Sand and gravel		— Despeit — Other (Specify)
138		Clay with embedded gravel		- Other (Special)
147	167	Sand and gravel and streaks of clay		DESTROY (Describe
167	180	Clay with streaks of sand and gravel		DESTROY (Describe Procedures and Materia Under "GEOLOGIC LO
180	189	Blue clay with embedded gravel and streaks	ľ	PLANNED USES (-4)
100	100	of loose gravel		WATER SUPPLY Domestic Public
189	100	i Clay with embedded rock	WEST	Industri
199		Hard serpentine	≥	MONITORING -
204		Stiff clay		TEST WELL
204	201	Currency		ATHOOIC PROTECTION.
-	_		3	HEAT EXCHANGE
-+				DIRECT PUSH
-+				VAPOR EXTRACTION
-	-			SPARGING_
			SOUTH SOUTH Illustrate or Describe Distance of Well from Reads, Buildings.	REMEDIATION
			Fences, Rivers, etc. and attach a mop. Use additional paper in necessary. PLEASE BE ACCURATE, & COMPLETE.	OTHER (SPECIFY)
	-		WATER LEVEL & YIELD OF COMPL	
	_		DEPTH TO FIRST WATER (FI.) BELOW SURFACE	
			DEPTIL OF STATIC. WATER LEVEL 22 (FL) & DATE MEASURED	2/26/2003
			ESTIMATED YIELD . 100 (GPM) & TEST TYPE	BAILED
		noonio 231 was	TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN44	(Fl.)
LOLY DE	THO	F BORING 231 (Feet) F COMPLETED WELL 206 (Feet)	May not be representative of a well's long-term yle	14

DEPTH FROM SURFACE FL to FL		HORE.				- ,	C	ASING (S)			FROM SU	TH		ANNU	-	MATERIAL
		BORE - HOLE DIA. (Inches)		SCREEN AL SCREEN			MATERIAL/ GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT S(ZE IF ANY (Inches)	Fi. to		CE. MENT	BEN- TONITE	FILL (∠)	FILTER PACH (TYPE/SIZE)
14 14			a	Š	-	드		-			n	50	1			sand grout
0:	231	7 7/8									co	206			1	8 x 16 sand
50	218	22							b Lancard		50		-	-		O K IV
+31	206		1				STEEL	,14			1 2 19					
-0	50		· · ·		V	4	S. STEEL	24								
-50	110		-	1	-	-	S. STEEL			.050						
148	188		-	-	-	-	S. STEEL	1		.050						

 ATTACHMENTS	(Z)	
Geologic Log		
Well Construction		
 Goophysical Log(s		
SoltWater Chemic	al Analys	els.

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

	CERTIFICATION STATEMENT
the understance, certify that this report is co	emplete and accurate to the best of my knowledge and belief.
MANE Weeks Drilling & Pump	

(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED) WELL DRILLERAUTHORIZED REPRESENTATIVE

Sebastopol STATE

DWK 158 KEY, 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

WATER WELL DRILLERS REPORT

File Original, Duplicate and Triplicate with the ON MICAONILLY (Sections 7074, 7077, 7078, Water Code)

REGIONAL WATER POLLUTION
CONTROL BOARD No. 5

STATE OF CALIFORNIA

No 32402

State Well No. LINI GW 39A/

	(11) WELL LOG:
	Total depth //O fr. Depth of completed will //O fe.
	Formation: Describe by color, character, size of material, and structure,
	10" 15" GRAVER (DRY)
(a) LOCATION OF WELL.	
(2) LOCATION OF WELL: County LANS Owner's number, if any—	32 35 BROWN CLAY
R. F. D. or Street No. R6W, TIIN, SCE. 29	35 50 GRAVEZ "17" fow
	50 " 54" BROWN CLAY
JUNICION HIGHWAY 53 AND	
GRANGE ROAD IN COUNTE VALLE	
AND ABOUT 40 ET. 304TH	18 86 GRAVEC (1/2 705")
	86" 96 " Blown ciny
(3) TYPE OF WORK (check):	96 106 GRAVE
	ndon - 106 " 116 " Broken 2500"
If abandonment, describe material and procedure in Item 11.	
(4) PROPOSED USE (check): (5) EQUIPM	IDNI:
Domestic Industrial Municipal Rotary	- · ·
Irrigation Test Well Other Dug Well	CONTRA
	Section point I A I
(6) CASING INSTALLED: If gravel pack	ed
SINGLE DOUBLE Grown	10
From O tt. to 110 tt. 14 Diam, 10 will of Boss tc.	fr. "
Va 0 0 0 0	m m
u u u u u	n n
	* 0
	11 11 11
Type and size of shoe or well ring 2/8% / Size of gravals	
Describe Joint BUT IVERD	- " Alles
(7) PERFORATIONS:	" " "
Type of perforator und ACILLS	" " " " " " " " " " " " " " " " " " "
Size of perforation: 21/2 in., length, by 3/8	
7 22 4:	ta
	FOR OFFICIAL USE ONLY
	" " " "
10 1-10	- " " "
(8) CONSTRUCTION:	D 11
Was a surface sanitory seal provided? Yes No To what depth	ft. " "
Were any steam realed against pollution? Yes No If yes, note depth of steam	0 9
From (c. to (c.	n n
	п п
Method of Sealing	Work issued Ast 10 195% Completed Acto 18 5
(9) WATER LEVELS:	WELL DRILLER'S STATEMENT: This well was drilled under my jurisdiction and this report is true to the best of
Depth at which water was first found /5	my knowledge and beilef.
adies level before perforating /7	NAME HUTTON -SUMMAN
action level after perforating /2	11. (Perion, Grey, ve corporation) (Typed or printed)
——————————————————————————————————————	Address Upper LACE
(10) WELL TESTS:	
Was a pump test made? Yes No It yes, by whom? HATTOY Screet A	W Carlitton
Yields 1000 gol,/min. with 17 ft. draw down after &	bri. [Signato] Will Driller 3/ 5
Temperature of water Wat a chemical analysis made? [] Yet 📜 N	
Was electric log made of well? Yes Wo	BOSES 3-84 SOM QUILY ® SPO DWR FORM NO. 246 (NEV. 3-94)

CATE Topy

THE RESOURCES AGENCY DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

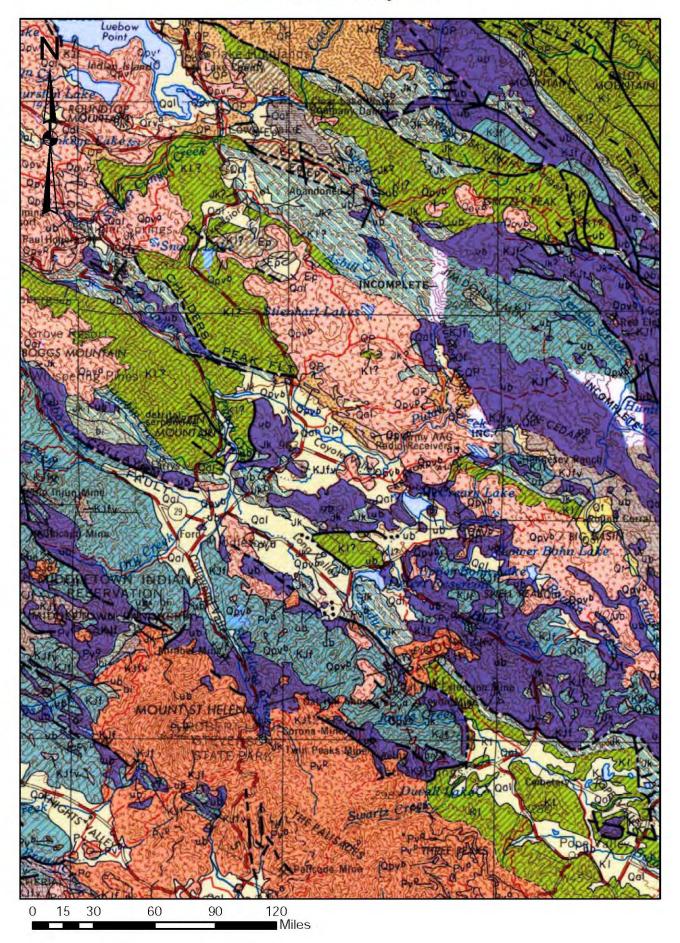
Do not fill in

No. 177233

State Well No.

F19 1191 10 10 10 10 10 10 10 10 10 10 10 10 10		Other Well No.
VNER: Name Stonehouse Mutual Water C	ia.	(12) WELL LOG: Total depth 292 fe: Dopth of completed world 20 is:
/o William Hamann, P. O. Sox 471		from it. to it. Formation (Describe by color, character, the or material)
	5461	
512		
EATTON OF WELL (See instructions):	1	
Chapter And Namper	•	
ess if different files above Granga Road		and gravel
Attid tetown Range Section		51 - 58 Conglomerate gravels, cobbles &
non cities, roeds, relimeds, from etc.		- trages of brown clay
		58 - 74 Gravels and cobbles
		74 117 Constamerate boulders, cobbles.
		and gravels
(3) TYPE OF	WORK:	113 77117 Brownicelay
New Well D)cobeding 🔲	117 150 Brown sandy clay with cemented
Reconstruction	σ	
Reconditioning	a i	
REDEIVED Horizontal Well		
MAR - 7 1991 Destruction (1)	Urscribe	gravel
MAR - 7 1991 Destruction of a destruction mater	dels and on 121	178 - 181 Brown clay & ownented boulders
AND A STATE OF THE	denomina e-poster roce	184 - 192 Brown clay s oscenost courses
IAMES C. HANSON (4) PROPOSE		
Industion		THE CO! DIONII CLAY, WITHER DW COUNT OF MINABEL
Industrial		
Text Well	* .	
* · · · · · · · · · · · · · · · · · · ·		1824104
Stock	(5)	
Municipal'	2 0.	
WELL LOCATION SKETCH Other		248 - 260 Brown clay
IIPMENT: (6) GRAVEU PACMOSTORS		260 263 Blue clay
D' Neverre Yes X No Slee X		263 265 Strocks of small blue gravel
O. Alr Dismoter of boro 12 - 38"		265 282 Blue clay with streaks of comenter
□ Buchet □ Packed Irvm 53 tts.	120 6	gravol
ING INSTACLED: (8) PERPORATIONS:		282 293 Comented conglomerate
Plastic Concrete C Type Registration 19 15 of 11	erilo	- /_ Johnstood County Daniel State
To Dia Cage or From To	Slot	
fti in Wall ft ft	, size	-
720 1237 250 70 115	.050	-
	2.7,107	to to
ELL SEAL:		
see sentary wal provided? Yes @ No 3 If yes, to depth_	53_ft.	
was realed, ausigns (soliutions? Yes No Interval		
of Halling Company or the Company		Wark started 5/1/ 1985 Completed 5/15 1985
'ATEN LEVELS:		WELL DRILLER'S STATEMENT:
Sink water, if known		This wall was drilled under my jurisdiction and this reform is ing to the out
level after well completion 221	fŁ	knowledge and belief.
TELL TESTS:	+00+00	Signed Gerald G. Thompson, By: Ward Thompson
test made? Yes No D II yes, by whom To be best Pump Buller D Air life	CAPPEG.	
a role of tot 23 ft At end of test	70 "	(Ferson, Brm, or corporation) (Typed or printed)
2 2 21/min alter bours Water temperat	220	Address P. Q. Box 176
50 March 1971	. مدال المارينيون الا مدا	Chy Sebastopol, CA zip 95472
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Geologic Map of Coyote Valley and Surrounding Area Modified from Koenig, 1963



EXPLANATORY DATA

SANTA ROSA SHEET GEOLOGIC MAP OF CALIFORNIA

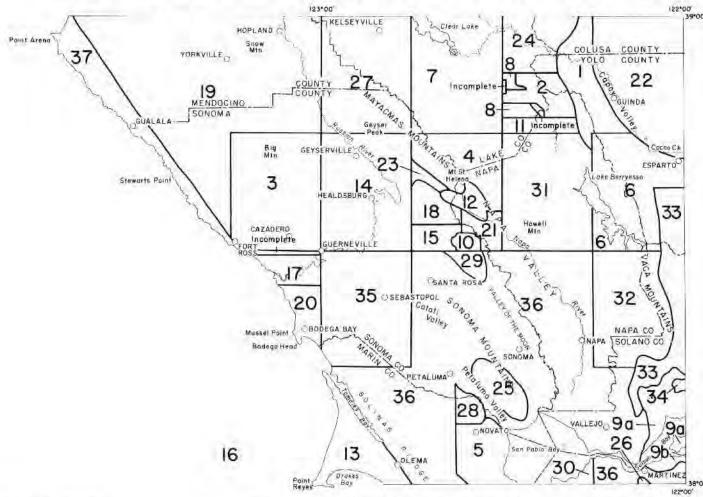
OLAF P. JENKINS EDITION

Compiled by James B. Koenig 1963

(Third Printing, 1976)

INDEX TO GEOLOGIC MAPPING

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STRATIGRAPHIC NOMENCLATURE - SANTA ROSA SHEET STATE STATE MAP UNIT STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES AGE MAP State Map Units listed here are not necessarily in stratigraphic (The formally named formations grouped within an individual State Map Unit sequence; the sequence used has been standardized SYMBOL are listed in stratigraphic sequence from youngest to oldest.) for all sheets of the Geologic Map of California Dune sand and associated beach deposits. RECENT DUNE SAND Qs RECENT ALLUVIUM Stream and valley alluvium. Artificial fill. Mud flats and salt marsh deposits bordering San Pablo Bay. Qal RECENT RIVER AND MAJOR STREAM CHANNEL River silts and sands (deposits along channels and natural levees of major streams). Qsc DEPOSITS IN THE GREAT VALLEY RECENT ALLUVIAL FAN DEPOSITS IN THE Alluvial-fan deposits (Pleistocene and Recent). Qf GREAT VALLEY RECENT BASIN DEPOSITS IN THE GREAT Sediments deposited during flood stages of major streams in areas between natural levees and alluvial fans. Sacramento-San Joaquin River delta Qb mud, loam, muck and peat. VALLEY RECENT VOLCANIC ROCKS: Andesite and basalt.1 UNDIFFERENTIATED Qrv RHYOLITIC Olivine dacite.1 Qrvr Qrvb BASALTIC Basalt.1 Qrvp PYROCLASTIC Basaltic lapilli and other ejecta, forming cinder cone south of Clear Lake.1 River and stream terrace sands, silts and gravels. In Big Valley, near Kelseyville, these deposits form a thin veneer over diatomaceous silts and QUATERNARY NONMARINE TERRACE DEPOSITS gravels of the Cache Formation. Includes older alluvium on west side of Sonoma Valley. Qt Millerton Formation-fossiliferous sands, clays and gravels (on Tomales Bay and near Carquinez). Marine and nonmarine deposits on wave-cut PLEISTOCENE MARINE DEPOSITS AND MARINE TERRACE DEPOSITS terraces along coast. Qm Red Bluff Formation-poorly-sorted reddish-brown sands and gravels, and minor clay beds (may include post-Red Bluff stream terrace gravels). PLEISTOCENE NONMARINE SEDIMENTARY Montezuma Formation—gravels, sands and clays. Huichica Formation—clay and silt, and gravelly and sandy clay, with reworked pumice and DEPOSITS tuff near base. Unnamed silts, clays, sands, gravels, and minor peat deposits (in part called Older Alluvium in alluviated valleys). Qc PLEISTOCENE VOLCANIC ROCKS: Rhyolite flows and tuffs of Cobb Mountain. Rhyodacite. Silicic dacite. Obsidian (in part Recent). 1 Qpvr RHYOLITIC Andesite. ANDESITIC Qpva Basalt and olivine basalt, largely quartz-bearing (basal flows intercalated with the Cache Formation; may be in part Pliocene). QDVD BASALTIC PYROCLASTIC Rhyolitic tuff of the Cache Formation, stratigraphically below quartz-bearing basalts (Qpvb). QDVP Cache Formation-silts, gravels, and clays, with beds of tuffaceous sand, marl, limestone, and diatomite. Glen Ellen Formation-poorly sorted PLIOCENE-PLEISTOCENE NONMARINE silts, gravelly clays, and sands and gravels, with basal reworked tuff beds. (Includes Older Alluvium of Travis, 1952, and upper part of the SEDIMENTARY DEPOSITS Sonoma Group of Gealey, 1950. Lower section of the Glen Ellen Formation is interbedded with the Merced Formation and with the Sonoma QP 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 cinder cone south of Clear Lake. QUATERNARY AND/OR PLIOCENE CINDER * CONES UNDIVIDED PLIOCENE NONMARINE Alluvial and lacustrine sand, silt, gravel, diatomite, and gravelly clay, largely tuffaceous. (Considered to be part of the Sonoma Group: see Pv. PC SEDIMENTARY ROCKS UPPER PLIOCENE NONMARINE Tehama Formation-fluviatile and lucustrine (?) silt, clay, silty sand with sand and gravel lenses, and basal beds of reworked tuff. (May locally Puc include correlatives of the Red Bluff Formation.) SEDIMENTARY ROCKS UPPER PLIOCENE MARINE SEDIMENTARY 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 ROCKS early Pleistocene). Ohlson Ranch Formation-marine sandstone, siltstone, and conglomerate, and fluviatile or lacustrine conglomerate (middle to Pu late (?) Pliocene age). MIDDLE AND/OR LOWER PLICCENE Wolfskill Formation-sandstone, conglomerate and andesitic tuff (in vicinity of Port Chicago). Petaluma Formation-sandstone, conglomerate NONMARINE SEDIMENTARY ROCKS 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.) Pmlc Pliocene MIDDLE AND/OR LOWER PLICCENE MARINE Siltstone, diatomaceous siltstone, sandstone, and claystone (on Pt. Reyes; early Pliocene age). Pml SEDIMENTARY ROCKS PLIOCENE VOLCANIC ROCKS: UNDIFFERENTIATED PV 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.) RHYOLITIC Rhyolite of the Sonoma Group," including the St. Helena Rhyolite-rhyolitic flows and tuffs, perlite, pumice and obsidian, with interhedded Pyr agglomerate, sands, clays, and gravels. Andesite flows, tuffs, breccias and agglomerates of the Sonoma Group.2 PVa ANDESITIC PVb BASALTIC Basalt flows and breccias of the Sonoma Group.3 Tuffs, tuff breccias, agglomerates, water-laid sands, gravels, diatomaceous clays and silts, minor pumice and perlite, and interbedded flows of the PVP PYROCLASTIC Sonoma Group, 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). UPPER MIOCENE MARINE SEDIMENTARY San Pablo Group—marine sandstones, tuffs and shales consisting of: Neroly Sandstone—fine- to course-grained sandstone, with thin shale beds; ROCKS 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. Mu Monterey Group-six alternating shale and sandstone units: Rodeo Shale-siliceous and chalky shale; Hambre Sandstone-brown-gray sand-MIDDLE MIOCENE MARINE SEDIMENTARY stone and minor sandy shale; Tice Shale—chalky bituminous shale; Oursan Sandstone—sandstone and tuffaceous sandstone; Claremont Shale— ROCKS shale with minor grit lenses; Sobrante Sandstone—fine- to coarse-grained sandstone. "Monterey Shale"—siliceous shales, glauconitic sandstone, Mm and bedded chert (on Pt. Reyes).3 Point Arena Beds-foraminiferal clay shales, bituminous sandstone, cherty shale (may be in part of middle Miocene age). Gallaway Beds-sandy LOWER MIOCENE MARINE SEDIMENTARY shales, mudstones and sandstones (on Pt. Arena; may be in part Oligocene). Sandstone, mudstone, shale, and minor volcanic rock of early ROCKS Miocene age, near Fort Ross.5 MI San Ramon Formation-silty shale, and interbedded sandstone and conglomerate. (Considered by many paleontologists to be earliest Miocene, OLIGOCENE MARINE SEDIMENTARY ROCKS Oligocene rather than Oligocene.) 0

STRATIGRAPHIC NOMENCLATURE - Continued

A	٩G	E	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.)
		Focene	Е	ECCENE 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" quartitic 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. ⁶
		Paleocene	Ep	PALEOCENE MARINE SEDIMENTARY ROCKS	Martinez Formation—micaccous sandstone, gray foraminiferal shale, glauconitic sandstone (includes "Lower Meganos (?)" shale; 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. Sandstone, conglomerate, and mudstone of Paleocene and possibly Late Cretaceous age, north of Fort Ross.
ار			Тс	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.
CENOZOIC	}	Undivided	Tib Tir Tio	TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS: BASALTIC RHYOLITIC ANDESITIC	Hornblendite and "Solano" diabase of Weaver, 1949, on Sulphur Springs Mountain (pre-middle Eocene; probably Mesozoic). Rhyolitic plugs, northeast of Santa Rosa. Sulphur Springs Mountain Andesite—altered reddish-buff, shallow-intrusive andesite (post-Knoxyille and pre-middle Eocene).
		'n	Tv ^b	TERTIARY VOLCANIC ROCKS: BASALTIC PYROCLASTIC	Putnam Peak Basalt—dense, black, vesicular basalt (age estimated to be Oligocene (?) to Pliocene (?)—Thomasson, Olmsted and LeRoux, 1960). Skooner Gulch Basalt—flow breecia and amygdaloidal basalt (also called Iversen Basalt by Weaver, 1944; Eocene to Miocene in age). Unnamed black spilite at Black Point. Vent breecia, west of Petaluma (post-Franciscan and pre-Merced, Johnson, 1943).
CRETACEOUS			К	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.)
	CKETACEOUS		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, quartizitic sandstone, and thin-bedded shales, in vicinity of Novato. Includes rocks of probable Early Cretaceous age in hills west of Oakville.
			KI	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 K1(?) may include rocks of Late Cretaceous or Jurassic age.)
	1111		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 MESOZOIC	1		KJfv	FRANCISCAN VOLCANIC AND METAVOLCANIC ROCKS	Greenstone, basalt, and diabase of the Franciscan Formation.
WE	1		gr†	TONALITE (QUARTZ DIORITE) AND DIORITE	"Bodega Diorite"—quartz diorite, granodiorite and diorite (Pt. Reyes, Tomales Point, and Bodega Head).
1	i		bi	MESOZOIC BASIC INTRUSIVE ROCKS	Gabbro and diorite (closely associated with serpentine, and with diabase intrusive bodies of the Franciscan Formation).
JURASSIC	1		ub	MESOZOIC ULTRABASIC INTRUSIVE ROCKS	Serpentine, peridotite, dunite, and pyroxenite, and minor amounts of silica-carbonate rock derived from alteration of serpentine.
	Jakasar 		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.)
UNDIVIDED	{		m Is	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.

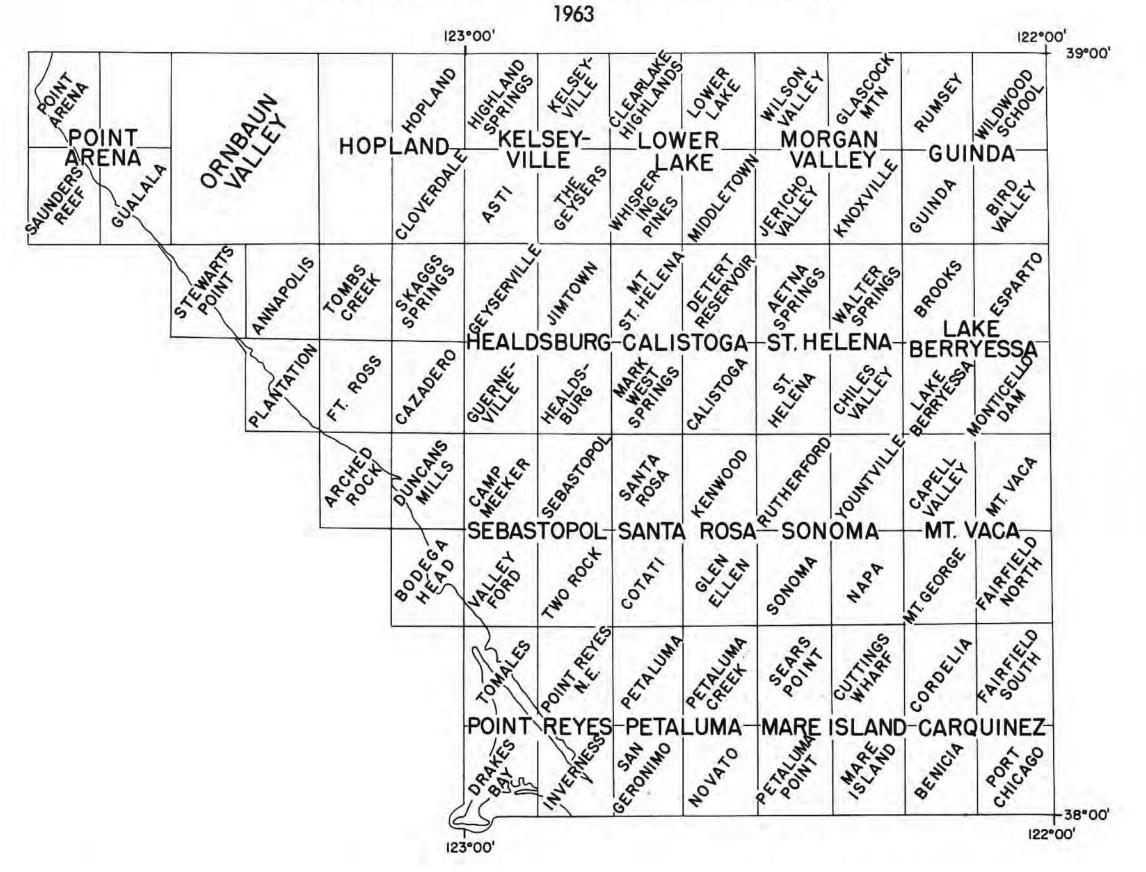


View southeast along the San Andreas Fault Zone, which separates rocks of the Franciscan Formation (mainland, left) from the quartz diorite pluton exposed on Bodega Head (right center) and Tomales Point (top of photo, center). The San Andreas Fault Zone, here approximately two miles wide, extends for 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

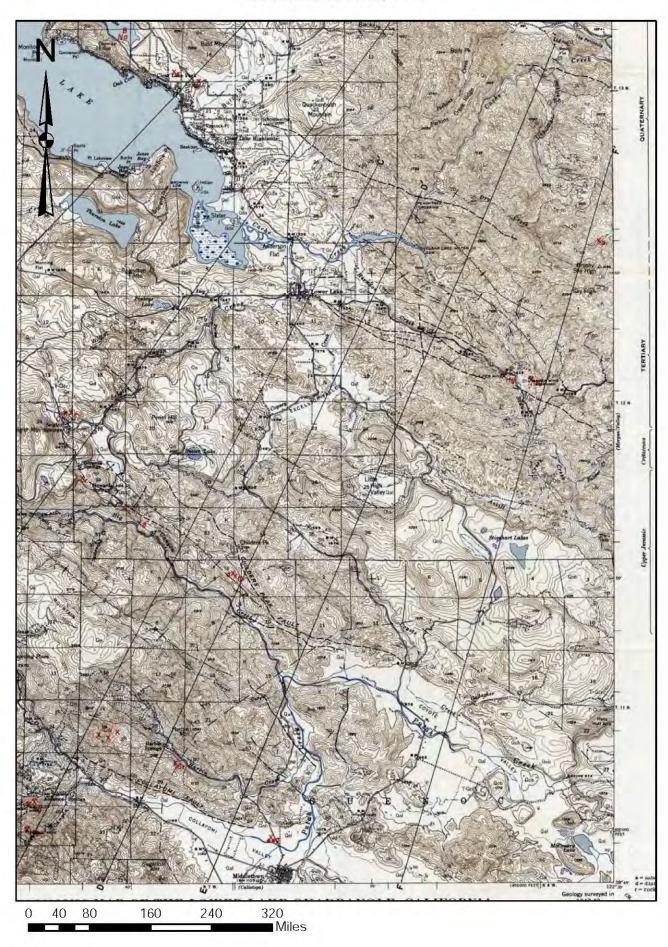




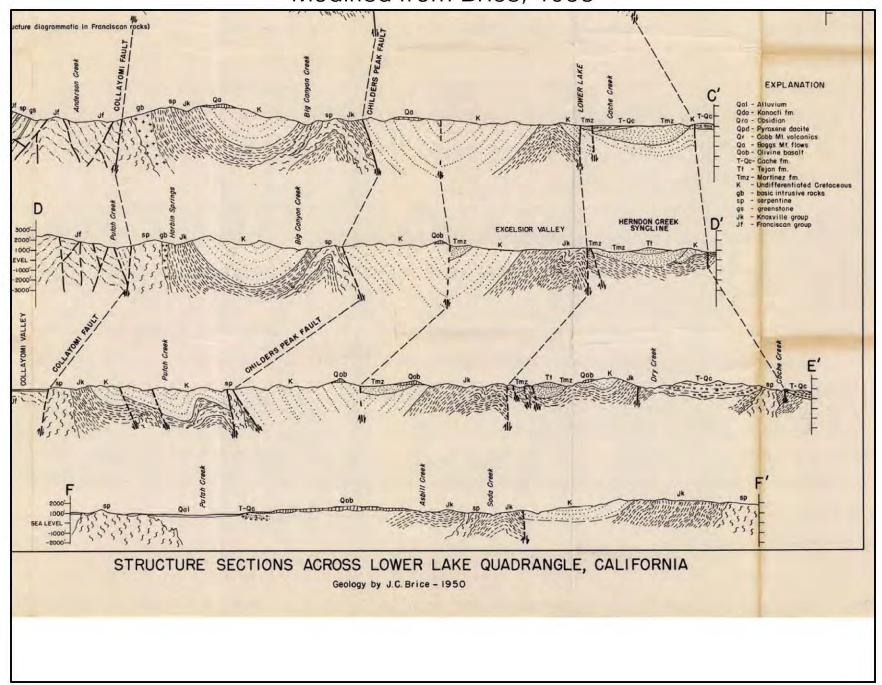
View northwest across Clear Lake (Santa Rosa and Ukiah map sheets). The lake, it is believed, was formed by a lava flow damming pre-existing stream valleys. Mt. Konocti (upper left), composed of Pleistocene dacite and andesite, rises nearly 3000 feet above the lake. Beyond Mt. Konocti is alluvium-filled 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

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



Cross Section F-F' Modified from Brice, 1953



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