HYDROGEOLOGIC ASSESSMENT REPORT

6095 Bodega Ave
Petaluma, CA 94952
APN 022-200-002

PREPARED FOR:

Mr. Michael Wright
Petaluma, California 94952

July 18, 2018
(Revised September 25, 2018)

PREPARED BY:

HURVITZ ENVIRONMENTAL SERVICES INC.
105 Morris Street, Suite 188
Sebastopol, California 95472

Lee S. Hurvitz, PG #7573 CHG #1015
Certified Hydrogeologist

PROJECT NO. 5021.01

HURVITZ ENVIRONMENTAL
GEOLOGIC & ENVIRONMENTAL CONSULTING

July 18, 2018

Mr. Wright
6095 Bodega Avenue
Petaluma, California 94952

RE: Hydrogeologic Assessment Report
6095 Bodega Ave, Petaluma, CA 94952
APN: 022-200-002
Hurvitz Environmental Project No. 5021.01

Dear Mr. Wright:

Hurvitz Environmental Services, Inc. (HES) is pleased to submit this Hydrogeologic Assessment Report (HAR) for the above referenced property. HES prepared this HAR in accordance with the Sonoma County Permit and Resource Management Department (Permit Sonoma) Policy and Procedure Number 8-1-14 and General Plan Policy WR-2e. The purpose of this HAR was to evaluate the aquifer conditions at the site, which is located within a Zone 2 groundwater availability area, and to determine if the proposed groundwater usage will cause overdraft conditions, well interference or impact nearby stream-flow.

The quantity of groundwater to be used for the project and within the Cumulative Impact Area compared to the quantity of available groundwater indicates that pumping for the Project is unlikely to result in significant declines in groundwater resources over time. Based on the findings of this report, pumping and groundwater extraction at the Project well will not significantly impact neighboring wells or near-site stream flow conditions. In addition, based on the relative distance to the coastal areas, the depth of the site well and the proposed water usage rates, salt water intrusion is not considered to be a concern to this Assessment.

We appreciate the opportunity to provide you with these services. Please do not hesitate to contact us at your convenience, should have any questions or comments regarding this report or our recommendations.

Sincerely,
HURVITZ ENVIRONMENTAL SERVICES, INC

Lee S. Hurvitz, PG# 7573 CHG #1015
Certified Hydrogeologist

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1.0 INTRODUCTION AND SCOPE OF SERVICES

Mr. Michael Wright (the applicant) is applying to Sonoma County for approval to develop a 12,500 sqft mixed light cannabis cultivation within a 15,000 sqft greenhouse at the property located at 6095 Bodega Avenue, Petaluma, California (the site). The site is located within Sonoma County Groundwater Availability Class 2 – Major Natural Recharge Area[1]. According to Sonoma County General Plan Policy WR-2e, development of property intending to use groundwater within Groundwater Availability Zone 2 does not typically require completion of a Hydrogeologic Assessment unless specifically requested by Permit Sonoma. Permit Sonoma requested a Hydrogeologic Assessment for this proposed development.

On behalf of the applicant, Hurvitz Environmental Services (HES) conducted a Hydrogeologic Assessment for the site in accordance with the Permit Sonoma Procedures for Groundwater Analysis and Hydrogeologic Reports (Policy No. 8-1-14).

Policy WR-2e states that procedures for proving adequate groundwater should consider groundwater overdraft, land subsidence, saltwater intrusion, and potential impacts to neighboring wells and nearby creeks.

Therefore, this groundwater report includes the following elements:

- Delineation of a Cumulative Impact Area.
- Estimates of existing and future potential water uses within the Cumulative Impact Area.
- Characterization of local hydrogeologic conditions within the site watershed and sub-basin.
- Compilation of Well Completion Reports (drillers' logs) from the area.
- Review of a recent Well Yield Test performed at an on-site well.
- Estimates of annual groundwater storage and recharge relative to existing and proposed groundwater uses.
- Assess potential for the project to create salt water intrusion.
- Assess potential for well interference between the project well and neighboring wells and between the project well and nearby streams.

[1] Groundwater Availability Map, Sonoma County Permit and Resource Management Division, April 1, 2004

2.0 SITE DESCRIPTION

The site is located at 6095 Bodega Avenue, in an unincorporated, rural agricultural area of Sonoma County, approximately 6 miles west northwest of downtown Petaluma, California. (**PLATE 1 – SITE LOCATION MAP**). The Sonoma County Assessor's Office identified the site as Assessor's Parcel No. (APN) 022-200-002 (**PLATE 2 – ASSESSORS PARCEL MAP**). The 7.09-acre parcel is zoned as Land Extensive Agriculture (LEA-60). The site is also located in groundwater availability Zone 2 – Major Natural Recharge, and the site is located in the jurisdiction of the North Coast Regional Water Quality Control Board. The site is located outside of the Petaluma Valley Groundwater Basin, a State defined Priority Groundwater Basin. The site is located within the Sonoma County Petaluma Dairy Belt Area, where residential development is mostly associated with agricultural land use.[2]

The property features a residence, garage and several small outbuildings. Most of the land is grassland with some trees and shrubs. A small drainage swale and two operating domestic water wells are located onsite. Site photographs are presented in **APPENDIX A**.

2.1 USGS 7.5 MINUTE QUADRANGLE MAP

HES reviewed the most recent United States Geological Survey (USGS) 7.5-minute Quadrangle Map, 2018 (**PLATE 3 – TOPOGRAPHIC MAP**)[3]. The site is a roughly square, 7.09-acre parcel, elongated 650 feet in the northwest to southeast direction and approximately 550 feet in the southwest to northeast direction. The site topography gently dips from the southeast corner where the elevation is approximately 210 feet above mean sea level (MSL) to northwest corner where the elevation is approximately 150 feet above MSL. A small unnamed ephemeral creek which is created from pond overflow on an adjacent parcel to the south, flows northwesterly across the property. A second unknown ephemeral creek is located proximate to the site along Bodega Avenue which eventually coalesces with Stemple Creek approximately 3 miles west of the site. Several properties near the site appear to utilize retention ponds for livestock and irrigation.

2.2 HISTORICAL AERIAL PHOTOGRAPHY

HES reviewed aerial photographs from years 1993-2017 depicting the site and vicinity to obtain information about historical developments and other surficial features. 1993 satellite imagery depicts agricultural barns and pastures at the site and the surrounding areas. 2018 imagery presents the same level of development as 1993 imagery, indicating that the vicinity has not seen any significant increase in development since 1993. Overall much of the area has remained pasture and

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[2] The Petaluma Dairy Belt Area Plan priorities are to 1) Preserve and enhance the agricultural resources and protect the agricultural industry in this area, 2) Preserve the area's scenic beauty, 3) Accommodate a variety of rural life styles, and 4) Encourage the development of an adequate transportation network which will accommodate proposed development and projected travel needs, and which will facilitate movement of agricultural products to the market place.

[3] USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data | USGS The National Map: 3D Elevation Program. Data refreshed January 2018. | USGS TNM – National Hydrography Dataset. Data refreshed January 2018.

dairy land with interspersed residential structures.

2.3 NEIGHBORING PROPERTIES

The surrounding land uses are predominantly pasture land, dairy farms and rural residential developments. Tomales Bay and the Pacific Ocean are approximately 13 miles west and the mouth of the Petaluma River at San Pablo Bay is approximately 17 miles southeast of the site. The developed properties are serviced by private septic systems and groundwater wells. There is one retention pond located on a neighboring property 900 feet southeast of the site. Access to neighboring properties is provided from Bodega Avenue and Middle Two Rock Road.

2.4 SITE DEVELOPMENT AND WATER USE

On August 15, 2017, Permit Sonoma received a request for a use permit (UPC17-0018) from the project applicant with a proposal for 10,000 square feet of small mixed light cultivation as well as an onsite processing facility. We understand that the applicant will also be developing an additional 2,500 sq/ft within the 15,000 sq/ft greenhouse for early plant vegetation. On January 10, 2018, Permit Sonoma Responded to the use permit application and requested a hydrogeologic assessment among other things. On March 23, 2018, Permit Sonoma issued a well permit (WEL18-0110) for the installation of a new Class 1 water well on the property. The well was installed on June 12, 2018 and a subsequent 72-hour pump test was performed by Les Petersen Drilling between June 26 – June 30, 2018. The well construction details and the results of the well test are discussed in Sections 4.1 and 4.1.2, respectively. The site already has an existing domestic water well however the property owner intends to dedicate the new domestic well (Project well) to the proposed cannabis project.

We understand that the applicant has planned to cultivate cannabis within a 15,000 sq/ft greenhouse located southwest of the residence. The approximate location of the proposed cultivation is shown on (**PLATE 4 – ENGINEERED SITE LAYOUT)**. The newly installed onsite domestic well (project well), located approximately 150 feet from the cultivation area and approximately 990 from unnamed, intermediate creek, will provide water for the proposed cultivation project. The Well Completion Report indicates that the well was installed to a total depth of 300 feet below ground (bg) with a sanitary seal of 100 feet.

The mixed light cultivation will consist of a total of approximately 3,000 plants within the 12,500 sq/ft cultivation area and includes all plants as they move through their life cycle from clones, to vegetative to flower stage. Water use has been estimated using the anticipated peak water use for the whole facility. The project plans do not involve any water diversions or imported water at this time. The estimated annual water use for the entire cultivation project is 514,487 gallons which is approximately 1.58 acre-feet of groundwater use per year.

The applicant determined an estimate of 0.33 gallons of water per plant per day based on usage from previous experience. However, to be conservative, we have included in our final water use calculation an overall 10% exceedance of these water use estimates bringing the total usage to 0.363 gallons per day.

Water will be utilized in a Pad evaporative cooling system for the greenhouses on the hottest days of the year. The Pad evaporative cooling system is only used to cool when the temperatures are above optimal growing levels. This would be greater than 85 degrees, during the peak times of the day. When outside temps are below 85 degrees, ambient outside air will be utilized for cooling, which means the Pad wall will not be being utilized. Pad evaporative cooling systems are self-regulating and only use as much water as is necessary. This is a highly efficient demand-based system. If only a slight amount of cooling is needed, only one exhaust fan will be used (pulling less air through the Pad, and hence less evaporation). As the demand increases so would the number of fans needed.

Petaluma's climate is very temperate, due to the proximity to the ocean, keeping the temperature very stable. Attached is the Weather Data, from weatherspark.com, for Petaluma in **APPENDIX B**. The first data chart shows the average temperatures highs and lows throughout the year. The majority of the time the average temp is well below the 85-degrees set point for cooling. When it is needed it would only be for the hottest times of the day during the hottest months of the year.

An alternative cooling measure utilized by indoor growers, but not greenhouse growers, is a full HVAC system. In **APPENDIX C** the Applicant has provided a document on power consumption (Energy Efficiency in Cannabis Growing), it is estimated that climate-controlled greenhouses use up to 70% less power than indoor cultivations. By using a modest amount of water on the hottest days to cool the greenhouses one can apparently avoid wasting a significant amount of power.

The water use for the project is presented below:

> Mixed Light Greenhouse Water Use per Day = 0.363 gallons water x 3,000 plants x 365 days/year = 397,485 gallons/year
>
> Evaporative cooling = 250 gallons/hour x 4 hours/day for 3 months out of the year = 90,000 gallons/year

487,485 gallons = 1.50 acre-feet/year = Total Annual Water Use for Cannabis Cultivation

Using the Napa County Water Availability Guidance Document[4] estimate of 15 gallons of water utilized per day per cultivation worker on site, we calculated the following additional water usage for the cultivation project:

- Annual Onsite Worker Water Use = 5 (average number of daily employees) x 15 gallons/day (daily employee water usage) x 365 days/year) = 27,375 gallons /year = 0.08 acre-feet/year = Total Annual Onsite Worker Water Use

Thus, the total Annual Site Water Use for this proposed Cannabis Cultivation Project including worker use is 514,860 gallons per year or 1.58 acre-feet/year. The projects estimated water use is summarized on **TABLE 1**.

The Applicant also plans to implement water conservation methods in the future as part of the proposed mixed light greenhouse cultivation project including the installation of a rainwater

[4] Water Availability Analysis (WAA) Guidance Document, Napa County, Adopted May 12, 2015.

catchment system attached to the greenhouse building. The rainwater catchment system will capture rain from approximately 15,000 sq/ft of proposed roof structure and will be stored in onsite poly tanks totaling approximately 20,000-gallons. Based on the surface area available for rain capture and the annual rainfall in the area, we estimate the following amount of water could potentially be captured and utilized on-site.

Rainwater capture area = 15,000 sq/ft (roof) / 43,560 SF/acre = 0.34-acre

Annual Rainfall Capture Potential = 0.34-acre (rainwater capture area) x 2.3 feet (annual on-site precipitation[5]) = <u>0.8 acre-feet/year</u>

The greenhouse/indoor cultivation will operate through most of the winter and spring so the actual groundwater usage during those months could be significantly offset by the captured rainwater. Details on potential rainwater offset are also presented on **TABLE 1**.

[5]Sonoma County Mean Seasonal Precipitation in Flood Control Design Criteria manual: Plate No. B-3, Sonoma County Water Agency, Revised January 2005

TABLE 1 – ESTIMATED PROJECT WATER USAGE

Source	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	----------Gallons----------												
Mixed Light Greenhouse	33,124	33,124	33,123	33,124	33,124	33,123	33,124	33,124	33,124	33,123	33,124	33,124	397,485
Evaporative Cooler	0	0	0	0	0	0	30,000	30,000	30,000	0	0	0	90,000
Onsite Workers	2,281	2,281	2,282	2,281	2,281	2,282	2,281	2,281	2,281	2,282	2,281	2,281	27,375
TOTAL USAGE	**35,405**	**35,405**	**35,405**	**35,405**	**35,405**	**35,405**	**65,405**	**65,405**	**65,405**	**35,405**	**35,405**	**35,405**	**514,860**
Rainwater Capture Potential**	48,278	52,105	37,053	15,782	8,529	1,569	0	784	1,960	13,919	32,446	48,278	260,703
TOTAL Groundwater Usage after potential rainwater offset	**0**	**0**	**0**	**19,623**	**26,876**	**33,836**	**65,405**	**64,621**	**63,445**	**21,486**	**2,959**	**0**	**298,251**

** Rainwater capture total based on average monthly rainfall in Petaluma (USclimatedata.com).

The rainfall capture potential previously calculated in this Section of the Report may offset the site groundwater water usage by up to 0.80 acre-feet per year, approximately a 40% reduction. Considering this reduction, the net demand on groundwater at the site can be recalculated as:

1.58 acre-feet/year (Project groundwater usage) – 0.80 acre-feet/year (rain capture potential)
= <u>0.78 acre-feet/year = Annual Project Groundwater Usage after Rainwater Offset</u>.

3.0 CUMULATIVE IMPACT AREA

HES reviewed available water well records obtained from Permit Sonoma and California Department of Water Resources (DWR) and assessed information obtained from peer-reviewed scientific publications as referenced in this report to determine an appropriate Cumulative Impact Area for the site. HES delineated the Cumulative Impact Area based on known geologic, hydrologic and groundwater characteristics in the area. The total area of the Cumulative Impact Area is approximately 604-acres. Some properties within the Cumulative Impact Area extend outside of the Cumulative Impact Area.

HES identified 30 properties in the Cumulative Impact Area including the site. The Cumulative Impact Area includes the entire site and all or portions of the other 29 properties (**PLATE 5- SITE PLAN - CUMULATIVE IMPACT AREA**). The property sizes included in the Cumulative Impact Area range from 2.44-acres to 394.88-acres with an average size of approximately 8.0 acres. A total of 27 of the 30 Cumulative Impact Area properties are developed with residences or single, family homes. The county identifies one of the 27 residential properties as a Dairy with Residence (APN 022-090-002, 5730 Bodega Avenue), also known as The Witt Home Ranch. The remaining parcels are identified by the county assessors use code as Rural Residential, Pasture with Residence, or Pasture.

3.1 GROUNDWATER USAGE IN CUMULATIVE IMPACT AREA

Based on available information including a Google Earth February 2018 aerial photograph[6], HES estimated the land use acreage within the 604-acre Cumulative Impact Area as follows:

50 acres	Drainage and Wooded Land
120 acres	Residential use including houses and landscaping (~ 4 acres per residential)
150 acres	Current Pasture Livestock Land
284 acres	Future Potential Livestock Land

The wooded land within the Cumulative Impact Area is situated primarily along the drainage feature bordering Bodega Avenue, providing limited but valued privacy between properties and the road so further reduction of existing wooded land may not be feasible or pursued.

3.1.1 Domestic Water Use

According to the USGS, the average person within the Santa Rosa Plain Watershed uses 0.19 acre-feet/year for domestic purposes[7]. In addition, the United States Census Bureau reported in 2010 that the average household in Sonoma County has 2.55 residents[8]. Therefore, for the purpose of this assessment we used a conservative number of three (3) residents per primary residence within the Cumulative Impact Area and assumed that each person uses 0.19 acre-feet of groundwater per year. We also assumed that ½ of the properties are developed with 2nd units and that 2 residents, on average, occupy the 2nd Units. Therefore, with 27 developed properties identified, we estimate that 109 residents currently live within the defined Cumulative Impact Area. With this data we

[6] Details derived from Google Earth aerial photograph, dated May 2018.
[7] Santa Rosa Plain Groundwater Management Plan, Sonoma County Water Agency, 2014
[8] http://www.bayareacensus.ca.gov/counties/SonomaCounty.html

calculated the following domestic water usage.

27 Properties x 3 Residents/Primary Dwelling x 0.19 acre-feet/year = 15.39 acre-feet/ year

14 2nd Units x 2 Residents/2nd Unit x 0.19 acre-feet/year = 5.32 acre-feet/year

So, 15.39 acre-feet/year (Primary Dwelling) + 5.32 acre-feet/year (2nd Unit) = 20.71 acre-feet/year

Current Annual Domestic Water Use in Cumulative Impact Area = 20.71 acre-feet/year

This method for calculating domestic water demand indicates the estimated domestic water use within the Cumulative Impact Area is 20.71 acre-feet/year. HES notes that water conservation measures by the general public has increased which has effectively reduced domestic annual water consumption in this area over the last 10 years that included 4 drought years.

Future domestic water demand within the Cumulative Impact Area assumes that 3 additional properties will be developed with residential homes including landscaping and all 30 properties will be developed with 2nd units. Using the methods described above Future Domestic Water Demand is calculated below.

3 properties x 3 Residents/Primary Dwelling x 0.19 acre-feet/year = 1.71 acre-feet/year

16 properties x 2 Residents/2nd Unit x 0.19 acre-feet/year = 6.08 acre-feet/year

So, 1.71 acre-feet/year (3 currently undeveloped properties) + 6.08 acre-feet/year (16 potential 2nd Units) + 20.71 acre-feet/year (Existing Residential Demand) =

Future Annual Domestic Water Use in Cumulative Impact Area = 26.79 acre-feet

3.1.2 Pasture Land and Dairy Land

The Witt Home Ranch (APN 022-090-002) covers approximately 150-acres of the cumulative impact area and is located just north of the site. Average domestic water use for properties within the Cumulative Impact Area was estimated to be less than 1 acre-foot per year however, the water use for ranch/dairy farming is likely much more significant.

HES searched available sources for information regarding water use at farms raising livestock, most notably grazing dairy cows. As a general rule we found that water demand per cow was estimated to be 40 to 50 gallons of water per cow per day. However, A study conducted by the University of Michigan Extension monitored water usage at a commercial dairy farm in Ohio using 13 water meters at key locations for two years. The average milk production on this farm was 80 pounds per cow per day. There were 854-1005 total cows on the farm during the study period. Over the two study years, the average drinking water per cow (both milking and dry cows) was 23.6 gallons and the average waste water (water used for cleaning) was 6.3 gallons/day for an average total water use

of 29.9 gallons per cow per day which is significantly lower than the 40 to 50 gallons per cow per day commonly cited in the literature.[9]

As noted in Section 3.1of this Report, HES estimated that there are currently approximately 150 acres of current pasture/dairy land within the Cumulative Impact Area and there is an additional 284 acres of pasture/dairy land that theoretically could be developed in the future. HES conservatively assumed that all pasture/dairy land areas found within the Cumulative Impact Area are irrigated by pond water and that 2 cows per acre is the sustainable amount allowed. Therefore, HES estimated the current water demand for pasture/dairy land within the Cumulative Impact Area as follows:

150 (Acres of Current Pasture-Dairy Land) x 2 (Sustainable Number of Cows/Acre) x 30 (gallons of water/cow/day) x 365 (days/year) = 3,285,000 gallons/year

(3,285,000 gallons/year) / (325,851 gallons/acre-feet) =

Current Pasture/Dairy Water Use in Cumulative Impact Area = 10.08 acre-feet/year

Future pasture/dairy land water demand within the Cumulative Impact Area assumes that the additional 284-Acres will be developed with Dairy or other livestock. Using the methods described above Future Annual Pasture-Dairy Land Water Demand is calculated as follows.

284 (Acres of Potential Pasture Dairy Land) x 2 (Sustainable Number of Cow/Acre) x 30 (gallons of water/cow/day) x 365 (days/year) = 6,219,600 gallons/year

(6,219,600 gallons/per year) / (325,851 gallons/acre-foot) =

Potential Additional Pasture Land in Cumulative Impact Area =19.09 acre-feet/year

So, 10.08 (Current Pasture Land) + 19.09 (Potential Additional Pasture Land) =

Future Potential Pasture/Dairy Land Water Use in Cumulative Impact Area = 29.17 acre-feet/year

3.1.3 Total Water Demand in Cumulative Impact Area

Based on the conservative assumptions discussed above, HES estimated Current Annual Groundwater Demand (in acre-feet/year) for the Cumulative Impact Area (excluding the Project):

20.71 acre-feet/year (Current Domestic in CIA, including site) + 10.08 acre-feet/year (Pasture Livestock) =
Current Groundwater Demand in Cumulative Impact Area = 30.79 acre-feet/year

[9] http://msue.anr.msu.edu/news/water_use_on_dairy_farms

Based on the conservative assumptions discussed above, HES estimated Future Potential Annual Groundwater Demand for the Cumulative Impact Area as follows:

> 26.79 acre-feet/year (Potential Domestic) + 29.17 acre-feet/year (Potential Pasture Livestock) =
> **Future Potential Groundwater Demand in Cumulative Impact Area = 55.96 acre-feet/year**

The Project's water demand of 1.58 acre-feet/year increases the Cumulative Impact Area current total water demand (30.79 acre-feet/year) by 5% and the future total water demand (55.96 acre-feet/year) by 2.8%. A breakdown of water usage within the Cumulative Impact Area is presented below on **TABLE 2**.

TABLE 2– ESTIMATED WATER USAGE IN CUMULATIVE IMPACT AREA

UNITS	Water Use Type	Projected Water Use per Day Average	Projected Water Use per Day Peak	Projected Water use per Month Average	Projected Water Use per Month Peak	Projected Water Use Annual
27developed residential properties,14 with 2nd units (109 residents site included)	Existing Domestic Water	18,489 gallons 0.06 acre-feet	18,489 gallons 0.06 acre-feet	562,364 gallons 1.73 acre-feet	562,364 gallons 1.73 acre-feet	6,748,374 gallons 20.71 acre-feet
3 undeveloped residential properties and 16 potential 2nd Units (41 residents)	Future Potential Domestic Water	5,428 gallons 0.02 acre-feet	5,428 gallons 0.02 acre-feet	165,098 gallons 0.51 acre-feet	165,098 gallons 0.51 acre-feet	1,981,174 gallons 6.08 acre-feet
150-acres of existing Pasture Land	Existing Ranch Water	9,000 gallons 0.028 acre-feet	9,000 gallons 0.028 acre-feet	273,750 gallons 0.84 acre-feet	273,750 gallons 0.84 acre-feet	3,285,000 gallons 10.08 acre-feet
284-acres of potential Pasture Land	Future Potential Ranch Water	17,040 gallons 0.052 acre-feet	17,040 gallons 0.052 acre-feet	518,300 gallons 1.59 acre-feet	518,300 gallons 1.59 acre-feet	6,219,600 gallons 19.09 acre-feet
Site Project	Irrigation, Evaporative Cooling and Workers	1,411 gallons 0.004 acre-feet	2,180 gallons 0.007 acre-feet	42,905 gallons 0.13 acre-feet	65,405 gallons 0.20 acre-feet	514,860 gallons 1.58 acre-feet
Total Water Usage Estimate	**Existing and Proposed Water Demand**	**51,368 gallons 0.16 acre-feet**	**52,101 gallons 0.16 acre-feet**	**1,562,417 gallons 4.79 acre-feet**	**1,584,917 gallons 4.86 acre-feet**	**18,749,008 gallons 57.54 acre-feet**

4.0 HYDROGEOLOGICAL CONDITIONS

The site is located outside and west of the Petaluma Valley and within the northwest trending structural province of the Coast Ranges of northern California. The regional structure consists primarily of northwest-trending folds and a few major faults, the most prominent of which is the San Andreas fault, a right-lateral fault, about 12 miles west of the site. The Petaluma Valley occupies a northwest-trending structural depression in the southern part of the Coast Ranges of northern California. This depression divides the Mendocino Range on the west from the Mayacamas and Sonoma Mountains on the east. West of the southern end of Petaluma Valley are the Marin Mountains, in which Burdell Mountain, immediately adjacent to the Valley, rises to an altitude of 1,560 feet.

According to the Geologic Map of the Petaluma 7.5 Quadrangle, the site is underlain by the Miocene aged Wilson Grove Formation (Formerly Merced Formation), a light gray to light yellow-brown marine sandstone. The sandstone is fine grained, well sorted, and massive to poorly bedded and locally contains thin lenses of pebble conglomerate. Exposed near ground surface to the south and east and underlaying the Wilson Grove formation is the Franciscan Assemblage (Jurassic-Cretaceous), a tectonic mixture consisting predominantly of a matrix of sheared graywacke and shale and to a lesser extent serpentinite enclosing blocks of less sheared graywacke and graywacke interbedded with shale. The unit is characterized by hard, resistant tectonic blocks of chert, greenstone, and exotic high-grade metamorphic rocks.[10] Native sediment and rock underlying the site is thought to consist of light brown clayey to silty fine-grained sand (Wilson Grove Formation), light brown sandstone, and dark serpentinite (Franciscan Complex). The Wilson Grove Formation, which is a marine unit of late Miocene to Pliocene age, is the principal aquifer in western Sonoma County.

According to Special Report 120 "Geology for Planning in Sonoma County[11] the site is listed as being part of the Plio-Pleistocene aged Merced Formation consisting of fine-grained sandstone and local minor coarse-grained grit and tuff breccia **(PLATE 6A - GEOLOGIC MAP DETAIL)**. Other geologic formations identified within close proximity of the site include the Franciscan Assemblage and quaternary aged alluvial deposits (**PLATE 6B – REGIONAL GEOLOGIC MAP)**.

4.1 PROJECT WATERSHED

According to www.ecoatlas.com[12] the project site is located within the San Pablo Bay Hydrologic Region Cataloging Unit (HUC-8), The Petaluma River-Frontal San Pablo Bay Estuary Watershed Region (HUC-10), and the 180500050303 sub-watershed (HUC-12) also identified as the Estero de San Antonio/ Stemple Creek Watershed. The Stemple Creek Watershed is entirely underlain by the Franciscan Formation, a hard, metamorphic rock with frequent and deep fractures. This rock forms the Coast Range of California. In the watershed, Franciscan rocks are exposed at the surface along a north south axis that runs from Deer Valley

[10] GEOLOGIC MAP OF THE PETALUMA 7.5' QUADRANGLE SONOMA AND MARIN COUNTIES, CALIFORNIA: A DIGITAL DATABASE VERSION 1.0, California Department of Conservation California Geological Survey, 2002.
[11] Special Report 120, "Geology for Planning in Sonoma County, California Department of Mines and Geology, 1980.
[12] www.ecoatlas.org, EcoAtlas has been developed through funding from the US Environmental Protection Agency and the California State Water Resources Control Board.

(near Walker Road), through Two Rock (where the resistant material gives the community its name), to the south of Spring Hill Road. The ends of this axis form the highest points of the watershed, 715 feet elevation on the north, and 853 feet on the south. Water flows into the Franciscan Formation and travels along its many fractures. Groundwater discharge occurs when a slope or stream channel cuts across the fractures; thus, the "springs" of Spring Hill (south of the site). Because water flows through the Franciscan formation relatively slowly, it is a good source of summer baseflow in the steam, as well as perennial springs that water small tributaries.

A closer look at the geology of the upper watershed further confirms this similarity. The Franciscan formation is exposed at the points noted above. The remainder of the watershed is overlain by the Wilson Grove formation, which extends north and east from the Stemple Creek basin and includes the areas around Valley Ford, Freestone, Sebastopol and Graton. The formation is a moderately consolidated sandstone conglomerate that weathers into soft rounded terrain, with wide valley bottoms filled with Quaternary (Recent) alluvium. The bedrock weathers into well-drained sandy loam soil which supports the orchards and vineyards of Sebastopol, and the early potato farms of the coastal valleys.

The Wilson Grove formation stores a large amount of groundwater, especially where the sandstone is massive (thick/deep) and not excessively interbedded with shale lenses. However, the formation is a poor source of stream baseflow during the summer. Groundwater in the Wilson Grove rocks is not confined to fractures as it is in the Franciscan Formation. Therefore, water flows more evenly downslope. Unless it meets a geologic intrusion that forces flow to the surface, the water tends to stay below ground. However, the near-surface flow that occurs in the Wilson Grove formation and the valley alluvium can support lush riparian vegetation. In such habitat, when geologic conditions do cause surface flow, the water is relatively cool and of high quality.

The drainage of the upper watershed, unlike the lower portion in Marin County, is arranged in a dendritic (branch-like) pattern. The north and south branches, as noted above, rise from the Franciscan Formation and provide perennial streamflow where they meet near the entrance of the Two Rock Coast Guard facility. The middle branch, which would normally be considered the main stem of the creek, is a small channel with intermittent flow in a broad valley. The drainage divide at the hydraulically most distant point in the basin is near Stony Point Road. This divide has a relatively low elevation, and is physically on such a gentle slope that it is difficult to locate on topographic maps or in the field. This head of the watershed is relatively new geologically. Before the Pleistocene (3 million years ago), the headwaters of Stemple Creek were in the Sonoma Mountains to the east. The watershed area was at least double its current size. (Higgins 1952) The larger basin area and greater flow would account for the broad alluvial valley in which the current Stemple Creek channel is clearly underfit. It would also explain why what appears to be the main stem is no longer the major source of baseflow to the stream[13].

[13] http://www.krisweb.com/biblio/stemple_mcrcd_prunuskeetal_1994_wep.pdf

4.2 GROUNDWATER RESOURCES

Groundwater resources have long played a significant role in the development, growth and sustainability of the Petaluma Valley and surrounding areas. These groundwater resources are relied upon to varying degrees by rural and urban residents, agricultural users, golf courses and other businesses and also support the rich ecosystems present in Petaluma Valley. Assuring sustainable groundwater supplies in the Petaluma Valley is critical to the environmental health and economic vitality of the Basin.[14]

A comprehensive study of the Petaluma Valley Basin was last completed in 1982 by the Department of Water Resources. In recognition of the importance of local groundwater resources, in 2014, the Sonoma County Water Agency and City of Petaluma partnered with the U.S. Geological Survey to conduct a three-year groundwater study of the Petaluma Valley, which is currently nearing completion. The study will culminate in a report by 2018 consisting of the following major sections:

- Hydrogeologic characterization
- Data collection and interpretation (primarily water quality)
- Numerical groundwater flow model.

Groundwater is the primary source of supply for domestic and agricultural use by rural property owners in the Basin and while urban water supply to the City of Petaluma is primarily imported Russian River surface water, groundwater is a vital supplemental and backup source of water for the City of Petaluma. Estimates of total groundwater use in Petaluma Valley, along with the water budget are being developed as part of the USGS study.

Five faults or fault systems are documented within Petaluma Valley which may have an influence on groundwater movement and water quality. Aquifers are generally discontinuous vertically and horizontally, creating partitions of variable water quality and aquifer properties.

[14] http://sonomacountygroundwater.org/pv-basin/

4.3 DOMESTIC WELL INFORMATION

HES performed a domestic well search through the Department of Water Resources and Permit Sonoma to identify Well Completion Reports within a ¾ mile radius of the site. Through this research, HES identified 16 domestic well logs for 11 properties within the Cumulative Impact Area, including the site (**TABLE 3**). Seven of the 16 well logs are listed as being located on the subject property. However, we understand that the site was previously subdivided into several parcels and domestic wells were drilled on each parcel but were given the same site address. However only two wells presently reside on the subject parcel now identified as 6095 Bodega Avenue, well #143891 drilled in 1977 and well #WCR2018-004761 drilled in 2018. Well#143891 will be used only as a monitoring well while well #WCR2018-004761 will be the only well used for the proposed project as well as for residential domestic purposes. The exact locations of the other 5 wells that previously belonged to parcel 022-200-002 are not known. Available well logs are included in **APPENDIX D**. Most of the wells identified were completed to total depths less than 200 feet and appear to obtain water from shallow marine sandstone deposits likely from the Wilson Grove Formation. Some deeper wells (>250 feet) identified in the area appear to penetrate shale layers likely from the underlying Franciscan Assemblage. The project well was completed to a total depth of 300 feet while the average well depth for the area is 183 feet. The well has a screen interval of 180 feet and the average well screen thickness in the Cumulative Impact Area is 100 feet. The Project well was also installed with a 100-foot sanitary seal per Permit Sonoma -West Petaluma High Nitrate Area Guidelines.

TABLE 3 WELL INVENTORY

APN or Address/ Well No.	Well Installed	Distance to Site Well (Feet)	Surface Elevation (Feet)	Total Well Depth (Feet)	Screen Interval (Feet)	Total Screen Thickness (Feet)	Well Yield (GPM)	Draw-down (Feet)	Specific Capacity
Site Well (6/2018) 022-200-002 Well # WRC2018-004761	2018	0	180	300	120-300	180	7	124	0.056
022-200-002 Well # 80477	1964	Exact distance unknown	Unknown	160	40-100, 120-160	100	9	143	0.063
022-200-002 Well # 80482	1964	Exact distance unknown	Unknown	114	34-114	80	5	90	0.056
022-200-002 Well # 80488	1964	Exact distance unknown	Unknown	295	"Open Hole"	NA	10	200	0.050
022-200-002 Well # 80489	1964	Exact distance unknown	Unknown	204	64-84, 104-144, 164-204	100	8	135	0.059
022-200-002 Well # 80491	1964	Exact distance unknown	Unknown	136	36-136	100	12	116	0.103
022-200-002 Well # 143891	1975	310	165	160	40-160	120	10	225	0.044
022-330-010 Well # 143874	1976	680	160	155	73-100	27	6	100	0.060
022-330-008/ Well # 066438	1979	1,170	200	185	65-85, 105-125, 145-185	80	7	135	0.052
022-330-004/ Well # 91008	1975	1,800	280	200	50-102	52	4	60	0.067
022-190-015/ Well # 143889	1977	1950	250	203	"None"	NA	4	90	0.044
4381 Middle Two Rock Rd. Well # 52699	1959	2,100	250	30	NA	NA	3	NA	NA
022-190-012/ Well # 812610	2000	2,715	160	250	130-250	120	20	250	0.080
022-330-001/ Well # 338650	1990	2,850	350	257	117-257	140	20	110	0.181
4045 Middle Two Rock Rd./ Well # 24918	1956	2,950	385	130	NA	NA	1	128	0.008
6410 Bodega Ave./ Well # 2910	1957	3,530	125	155	NA	NA	3.75	140	0.027
Average Well TD =183 feet					Average Screen Thickness =100 feet		Average Specific Capacity = 0.063 gpm/foot drawdown		

Review of the Well Completion Report for the on-site Project water well (Well Completion Report No. WCR2018-004761) indicates the site well was installed in June 2018 to a total depth of 300 feet and completed at 300 feet. According to the Well Completion Report, the well penetrated layers of brown and blue sandy clay with the saturated areas consisting of sedimentary rock likely composed of the Wilson Grove Formation. The well logs for other nearby wells (within the Cumulative Impact Area) recorded similar subsurface conditions. All sixteen of the well logs within the cumulative impact area exhibit lithologies consisting of various colored sandstone. In addition, wells #80482, #177254, #143889, #338650 and #2910 also exhibit layers of clay interfingered throughout the sandstone. Well #812610 was drilled into sandstone to a depth of 240, however the well drillers noted that the remaining 10 feet (from 240-250 feet) was drilled into yellow Franciscan shale. These well log descriptions suggest that the wells were drilled into the Wilson Grove Formation and that the Franciscan Formation can be found at depth underlying the Wilson Grove. The well yields for the sixteen wells identified varied from 1 to 20 gpm with an average yield of 8.1 gpm.

4.3.1 Site Well Yield Test

Petersen Drilling and Pump, Inc. (Petersen) conducted a 72-hour well yield test on the Project Well between June 26, 2018, and June 29, 2018. The test pump was set at a depth of 280 feet bg. Petersen listed the static water level at 56.034 feet, a total drawdown of 124 feet and a sustained yield of 7gpm. Based on this information we calculated a specific capacity for the well of 0.056. The well yield test data and calculations are attached in **APPENDIX E**.

HES also used the specific capacity calculation from the well yield test to calculate an aquifer transmissivity (T) and aquifer hydraulic conductivity (K). Using relationships between specific capacity and transmissivity (Discoll, 1986, Appendix 16D) aquifer transmissivity is approximately equal to specific capacity x 1,500 for unconfined aquifers and 2,000 for confined aquifers. Assuming generally unconfined conditions at the site we calculated the following aquifer Transmissivity:

T = 0.056 gpm/foot (Specific Capacity from well test) x 1,500 (unconfined aquifer) =

84 gpf/day = Aquifer Transmissivity

Based on the relationship between Transmissivity and hydraulic conductivity we can calculate the aquifers hydraulic conductivity (K) using the following relationships and equations.

K = T / D (Aquifer Thickness)

K = 84 gpd/foot (transmissivity) / 180 feet (onsite aquifer thickness) = <u>0.47 gpd/ft²</u>

The K value calculated above generally correlates to fractured sandstone or fine to coarse sand (Driscoll, Figure 5.1.4) and is likely representative of the Wilson Grove Formation.

5.0 WATER BALANCE INFORMATION

The USGS and DWR studies that included the Petaluma area provided water balance information that HES used to assess groundwater sustainability within the Cumulative Impact Area.

5.1 GROUNDWATER STORAGE

HES used well log information from eleven wells to estimate the aquifer thickness beneath the Cumulative Impact Area. The average screened interval for 11 wells was estimated at 100 feet. A 2013 USGS study in the nearby Santa Rosa Plain estimated the average specific yield of the Santa Rosa region at 5 percent (0.05)[15]. Therefore, using this data the Aquifer Storage can be estimated using the following equation

100 feet (Aquifer Thickness) x 0.05 (Specific Yield) x 604 acres (Cumulative Impact Area) =

Estimated Aquifer Storage = 3,020 acre-feet

5.2 PRECIPITATION

Precipitation, primarily as rainfall is the major source of inflow to the Petaluma Valley Watershed and our defined Cumulative Impact Area. Mean seasonal precipitation maps from Sonoma County Water Agency[16] and various local studies referenced in this report indicate the mean annual rainfall in the site vicinity is about 25 to 30 inches per year (averaged to approximately 2.3 feet per year) (**PLATE 7 - PRECIPITATION MAP**). Precipitation over the Cumulative Impact Area is:

2.3 feet/year (Regional Precipitation) x 604 acres (Cumulative Impact Area) =

Precipitation in Cumulative Impact Area = 1,389 acre-feet/year.

5.3 GROUNDWATER RECHARGE

Groundwater recharge is the replenishment of an aquifer with water from the land surface. It is usually expressed as an average rate of inches of water per year, similar to precipitation. Thus, the volume of recharge is the rate times the land area under consideration times the time period, and is usually expressed as acre-feet per year. In addition to precipitation, other sources of recharge to an aquifer are stream and lake or pond seepage, irrigation return flow (both from canals and fields), inter-aquifer flows, and urban recharge (from water mains, septic tanks, sewers, drainage ditches).

For our defined Cumulative Impact Area, the interspersed clay beds that accompany the sandstone of the Merced/Wilson Grove Formation characterizes the aquifer as confined to semi-

[15] Hydrologic and Geochemical Characterization of the Santa Rosa Plain Watershed, Sonoma County, California, U.S. Geological Survey, Scientific Investigations Report 2013–5118.
[16] Sonoma County Mean Seasonal Precipitation in Flood Control Design Criteria manual: Plate No. B-3, Sonoma County Water Agency, Revised January 2005.

confined. Drainage features that intersect and border the Cumulative Impact Area have likely eroded through the limited overlying confining layers and are contributing to the recharge of the regional aquifer through stream bottoms. However, it is also likely that a portion of the rain water falling directly on the site infiltrates the ground surface and migrates downward through the soil matrix and rock pores until it recharges the aquifer. Soil types and land cover within the watershed affect the extent and magnitude of storm water runoff (retention and infiltration).

To estimate the groundwater recharge within the Cumulative Impact Area HES first assumed that the recharge to the aquifer is primarily through rainfall and that all rainfall accumulated within the 604-acre Cumulative Impact Area drains to the creeks proximate to the site. However, this estimate does not account for surface run-off, stream underflow, and evapo-transpiration. Therefore, to estimate the percentage of rainfall that contributes to recharge of the aquifer, HES reviewed available groundwater studies including the Santa Rosa Plain Watershed Groundwater Management Plan, and the USGS Scientific Investigation Report 2006-51157, as well as other regional groundwater studies in Sonoma County. Estimates for recharge found in these documents are considered to be reliable for our site evaluation. Average recharge to the ground-water system for the entire Santa Rosa Plain, including mountainous zones, is derived from an estimated average of 531,000 acre-ft of precipitation falling within the entire watershed. After accounting for runoff (188,400 acre-feet/year) and evapotranspiration (262,000 acre-feet/year), the amount of water recharging the Santa Rosa Plain Watershed equates to 80,600 acre-ft/year or approximately 15.2% of the annual rainfall. However significant variations to this value can occur based on topography, soil infiltration rates, geology etc., and according to these USGS and Sonoma County Water Agency Reports, the long-term average precipitation that recharges groundwater in these regions can be as low as 1.67%.

While these USGS studies are not specific to the site or the defined Cumulative Impact Area, the average long-term recharge to the aquifer within our defined Cumulative Impact Area likely falls within the ranges seen in the nearby watersheds. HES conservatively estimates that 10% of rainfall likely contributes to groundwater recharge within the defined Cumulative Impact Area. Based on this recharge value we can re-calculate the groundwater recharge within the Cumulative Impact Area using the following data and equation.

> 1,389 acre-feet/year (annual precipitation in CIA) x 0.10 (estimated long term recharge average)
>
> = <u>Annual Aquifer Recharge = 138.9 acre-feet/year</u>

6.0 WATER QUALITY

Elevated levels of nitrate have been identified in groundwater within the western portions of the Petaluma Valley due to past land use practices. A 2013 USGS groundwater study indicates chloride, total dissolved solids, nitrate, arsenic, boron, iron, and manganese are water-quality constituents of potential concern in the region. In addition, a report from the California Department of Water Resources in 1982 found that saltwater intrusion from the tidally influenced portion of the Petaluma River affected shallow aquifers prior to 1962, but that there had been no further incursions after that time. They attributed the lack of further saltwater intrusion to substitution of groundwater with surface water.

On June 28, and July 6, 2018, water samples were collected from the onsite well and tested for volatile organic compounds (VOC's) Total Coliform and E. Coli bacteria, nitrates, arsenic, zinc, iron, manganese, boron, sodium, calcium, magnesium, silica, aluminum, chloride, Sulfate as SO4, and Total dissolved solids (TDS). Results of the water sampling are presented below in **TABLE 3** and **APPENDIX F – LABORATORY REPORTS**.

TABLE 3 – Water Quality Data

Location (APN)	**VOC's**	**pH**	**EC** µS/cm	**Silica**	**Nitrate as N (Mg/L)**	**Total Coliform (MPN/ 100 ML)**	**E-Coli Bacteria (MPN/ 100 ML)**	**Arsenic (ug/L)**	**Zinc (mg/L)**
022-200-002	NA	9.09	530	35	ND	**<1***	**<1***	ND	ND
California Maximum Contaminant Level (MCL)	Varies	NA	NA	NA	10	<1	<1	10	5**

NA Not Applicable

ND Non Detect

* Initial Samples Collected on June 28 indicated that Total Coliform concentrations were >2400 and E-Coli concentrations were 1. The well was resampled on July 6, 2018 and the sample results were both <1.

** California Secondary Drinking Water Standard

TABLE 3 – Water Quality Data (Continued)

Location (APN)	**Boron**	**Sodium**	**Sulfate as SO4**	**TDS**	**Magnesium**	**Calcium**	**Chloride**	**Aluminum**	**Manganese**	**Iron**
	mg/L							**ug/L**		
022-200-002	0.078	110	2.6	340	0.59	3.4	20	770	ND	580
California Maximum Contaminant Level (MCL)	1**	NA	NA	500*	NA	NA	500*	1000	50	300*

*California Secondary Maximum Contaminant Levels

** California Notification Level

NA – Not Applicable

Hardness = 11

The results of the water quality testing performed on the project well indicate that bacteria contamination was present in the first sample collected on June 28, 2018. A subsequent groundwater sample was collected and tested for Total Coliform and E Coli bacteria on July 6, 2018 and analytical results indicated the bacteria was no longer present. It is not uncommon for initial water tests in newly drilled wells to contain bacterial contamination introduced during the drilling and well completion processes. No other contaminants were identified in the well water above the California Primary or Secondary Maximum Contaminant Levels for Drinking Water.

7.0 POTENTIAL IMPACTS TO STREAMS AND NEIGHBORING WELLS

HES estimated the radius of influence of the planned site well to evaluate potential well pumping impacts to wells on other properties and impact to the nearby unnamed creek. Using general relationships discussed in Driscoll (1986), HES estimated the lateral pumping influence using information from the 2018 well yield test performed by Petersen. HES used an approximate relationship between specific capacity calculated from the well yield test and aquifer transmissivity, based on "typical" pump test values.

Since the site aquifer is considered to be unconfined to semi-confined, transmissivity was estimated for an unconfined aquifer, using the relationship of Specific Capacity (yield/drawdown) x 1,500 (unconfined). To develop the slope of the drawdown curve from the pumping well, HES calculated the value of Δs (drawdown over one log graph cycle) for a distance-drawdown relationship, where $T = 528Q/\Delta s$ (Driscoll,1986, Equation 9.11).

The analysis is shown on the attached semi-log plot, **APPENDIX G**. As estimated for an unconfined aquifer, pumping the project well at 7 gpm for 72 hours might result in a zone of pumping influence extending 300 feet from the well. The closest neighboring well (#143891) which is approximately 310 feet from the site well is located just at the limits of the potential area of pumping influence. Well #143891 is on the project site and will be used as a monitoring well and will not be used for any project or domestic water uses. The nearest surface water is the unnamed intermediate stream along Bodega Highway located approximately 990 feet northwest of the project well and is also outside the wells potential area of pumping influence.

The maximum daily Project water demand is 2,180 gallons (irrigation, evaporative cooler and site workers), which would require about 5 hours and 20 minutes of pumping with a well yield of 7 gpm. Therefore, the actual extent of pumping influence from the Project well will likely be less than estimated in our calculations.

8.0 CONCLUSIONS

Aquifers within the Wilson Grove Formation beneath the site are generally considered unconfined to semiconfined and recharge to the aquifer likely occurs primarily from rainfall and creek beds proximate to the property. The wells identified within the Cumulative Impact Area have an average thickness of 100 feet and if extended over the entire 604-acre area produces an estimated total aquifer storage value of 3,020 acre-feet. Based on annual precipitation and estimated aquifer recharge rates, the annual recharge to the aquifer is estimated to be 138.9-acre-feet. The current annual water demand within the Cumulative Impact Area (including the site) is conservatively estimated to be 30.20 acre-feet, and the future potential water demand is estimated at 55.96 acre-feet. The estimated annual water demand for the proposed Project is 1.58 acre-feet (without consideration of the Applicant's rainwater catchment offset plans). The total annual water demand proposed for the site is sustainable based on current and future development within the Cumulative Impact Area. In summary:

3,020.00 acre-feet	Aquifer Storage
138.90 acre-feet	Annual Recharge to Aquifer
30.20 acre-feet	Cumulative Impact Area Current Annual Water Demand
55.96 acre-feet	Cumulative Impact Area Future Potential Annual Water Demand
1.58 acre-feet	Site Project Annual Water Demand
0.80 acre-feet	Site Estimated Rainfall Catchment System Offset

Based on the conservative assumptions and estimates presented in this report, the quantity of groundwater to be used for the project and within the Cumulative Impact Area compared to the quantity of available groundwater indicates that pumping for the Project is unlikely to result in significant declines groundwater resources over time. Based on the findings of this report, pumping and groundwater extraction at the Project well will not significantly impact neighboring wells or stream flow conditions in nearby creeks. In addition, based on the relative distance to the coastal areas, the depth of the site well and the proposed water usage rates, salt water intrusion is not considered to be a concern to this Assessment.

9.0 LIMITATIONS

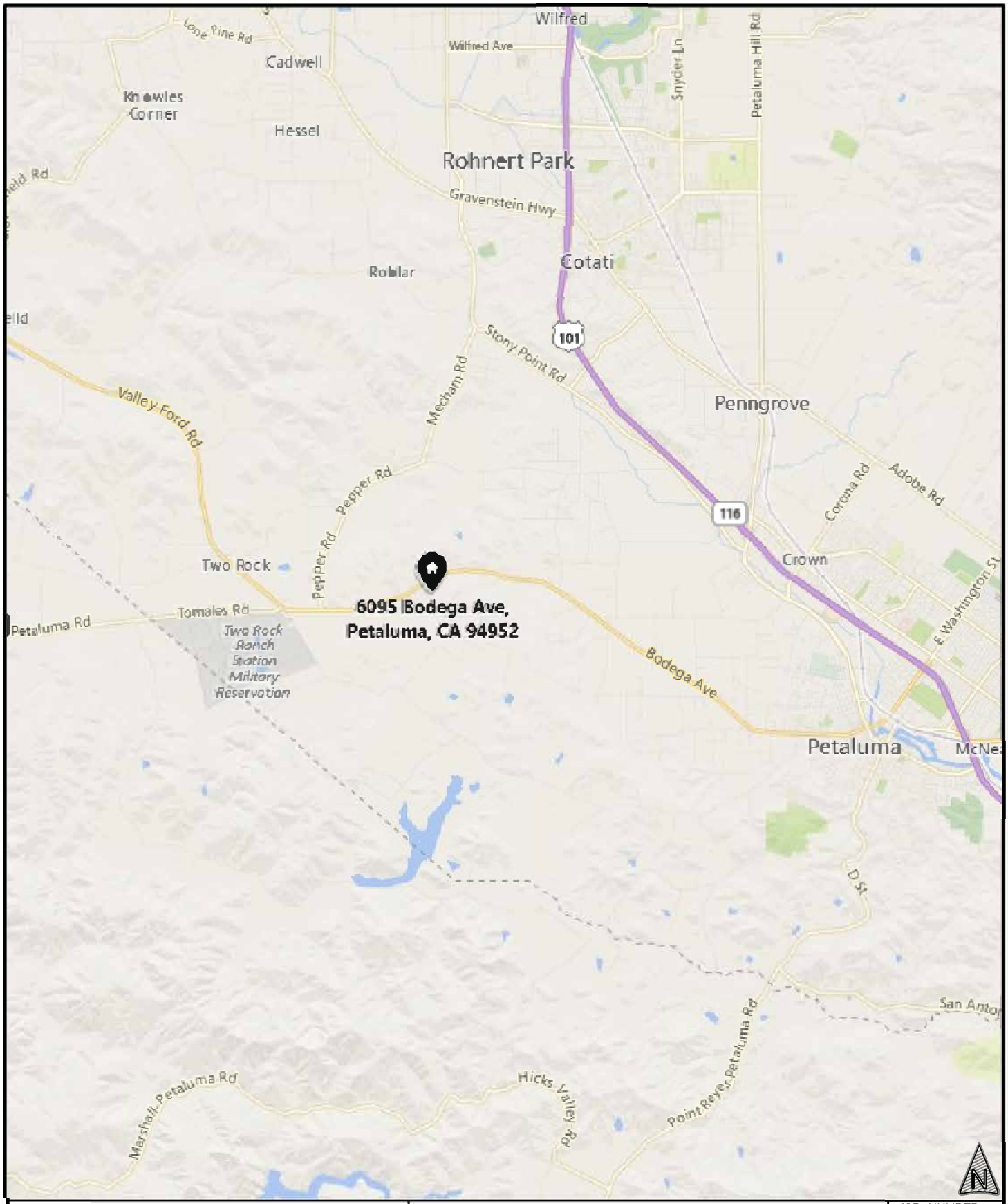
HES is not responsible for the independent conclusions, opinions or recommendations made by others based on the records review, site inspection, field exploration, laboratory test data and interpretations presented in this report.

Groundwater systems of Sonoma County are typically complex, and available data rarely allows for more than general assessment of groundwater conditions and delineation of aquifers. Hydrogeologic interpretations are based on the drillers' reports made available to us through the California Department of Water Resources, available geologic maps and hydrogeologic studies and professional judgment. This analysis is based on limited available data and relies significantly on interpretation of data from disparate sources of disparate quality.

It should be noted that hydro-geological assessments are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. Additionally, the passage of time may result in a change in the environmental characteristics at this site and surrounding properties. This report does not warrant against future operations or conditions, nor does this warrant operations or conditions present of a type or at a location not investigated.

This study is not intended to assess if any soil contamination, waste emplacement, or groundwater contamination exists by subsurface sampling through the completion of soil borings and the installation of monitoring wells. The scope of work, determined by the client, did not include these activities.

This Report is for the exclusive use of Michael Wright, his affiliates, designates and assignees and no other party shall have any right to rely on any service provided by Hurvitz Environmental Services without prior written consent.



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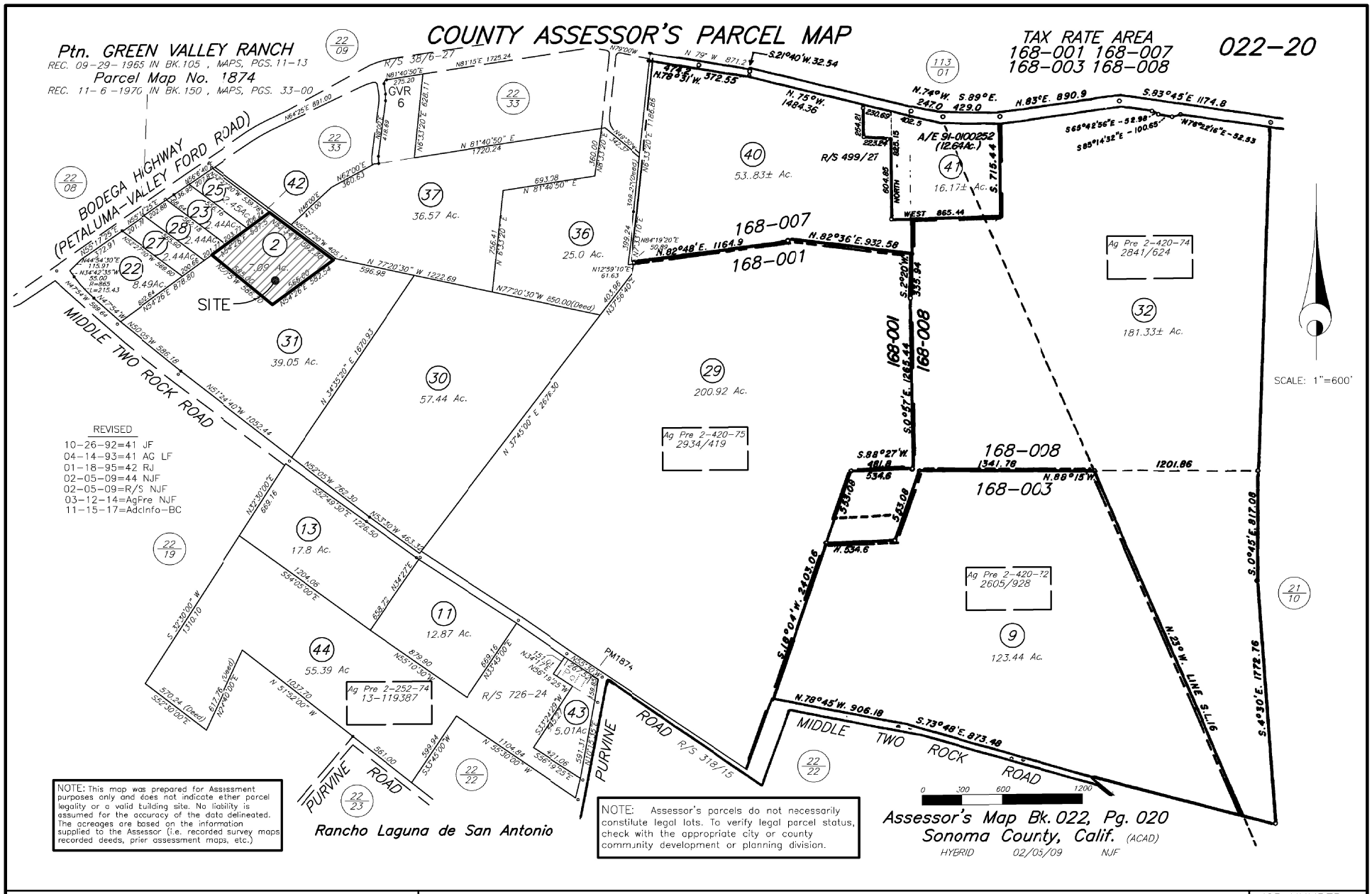
SITE LOCATION MAP

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 1



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ASSESSORS PARCEL MAP

022-200-002
6095 BODEGA AVE
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JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 2

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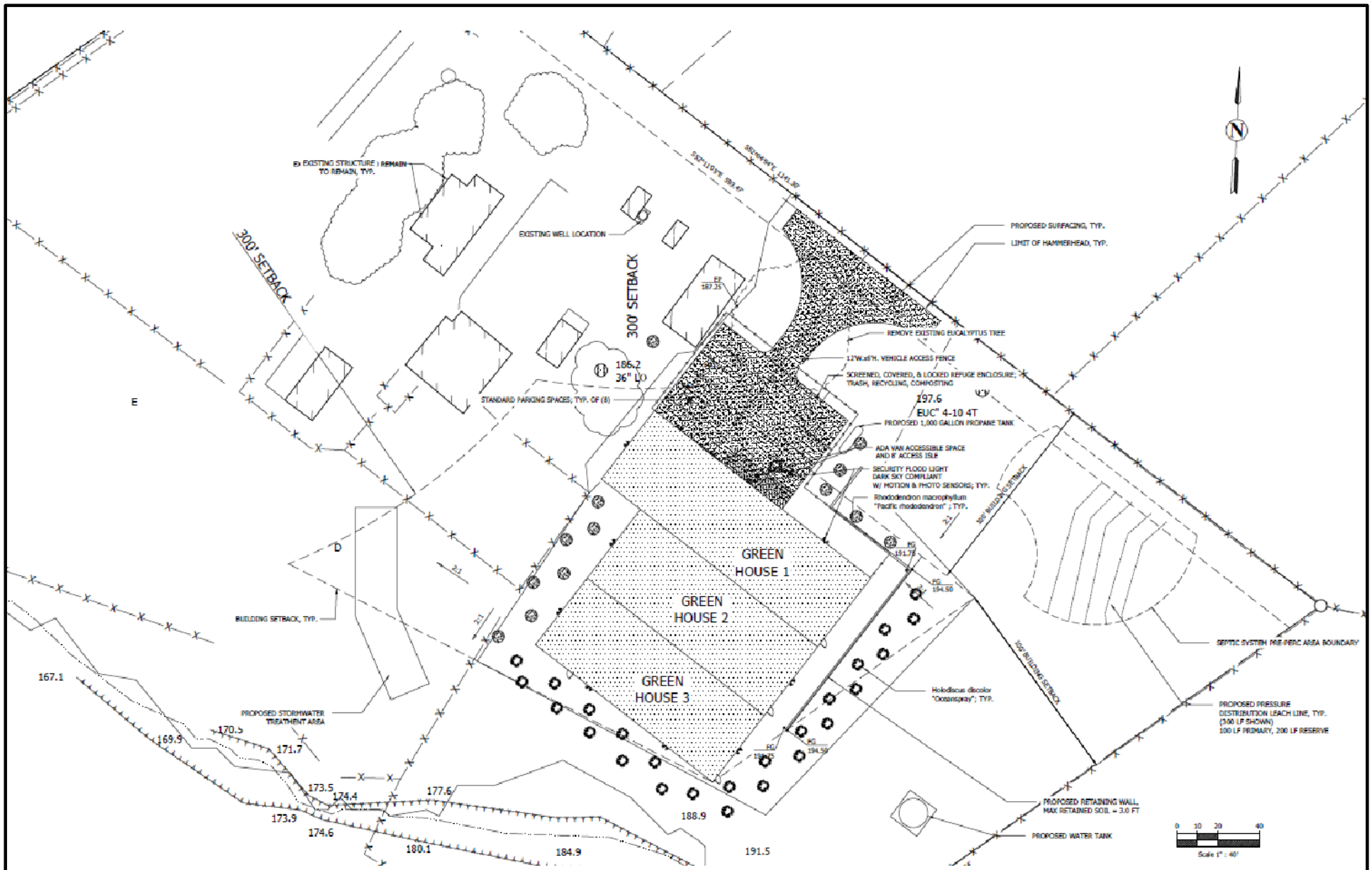
TOPOGRAPHIC MAP

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 3



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ENGINEERED SITE LAYOUT

022-200-002
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PLATE: 4

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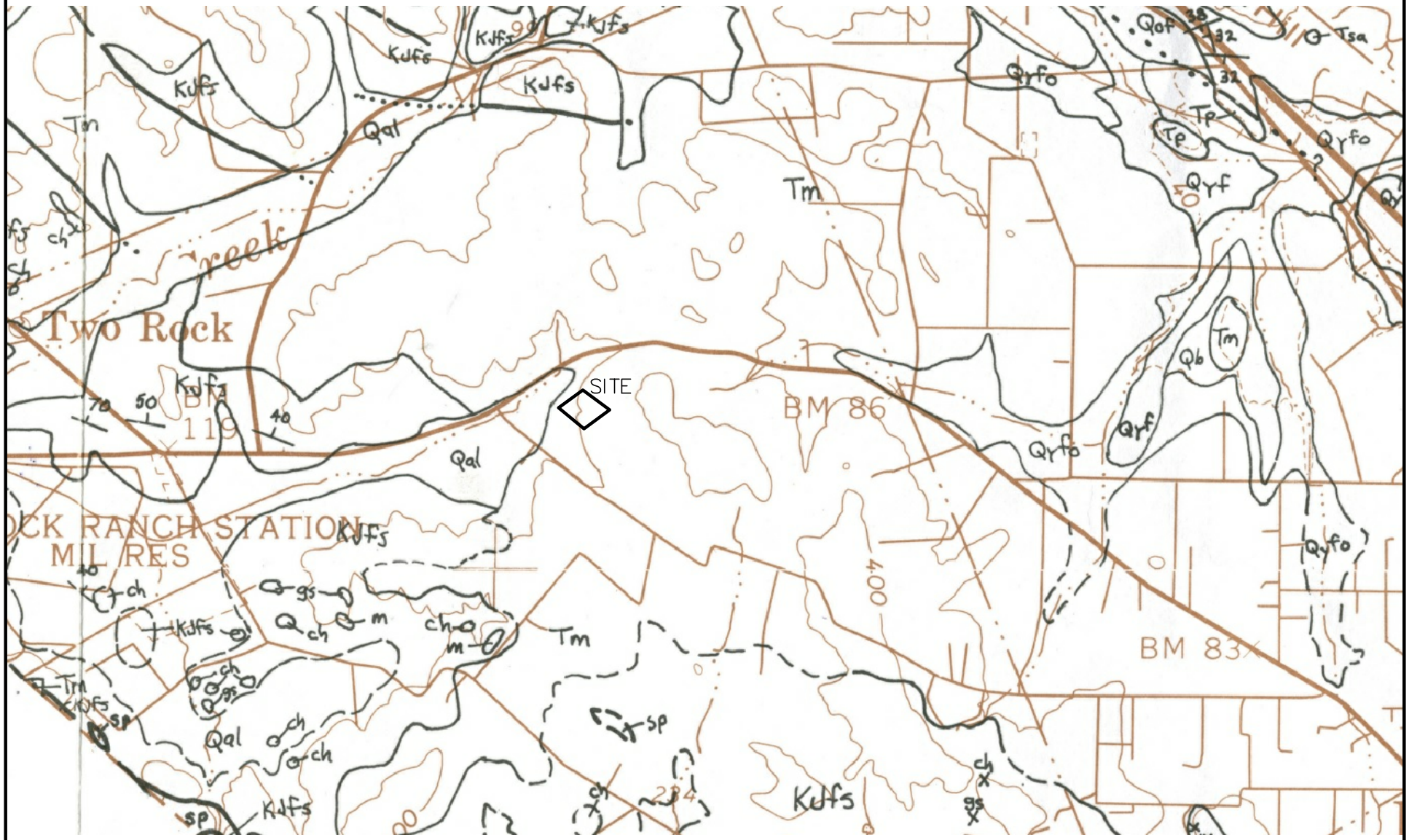
SITE PLAN – CUMULATIVE IMPACT AREA

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 5



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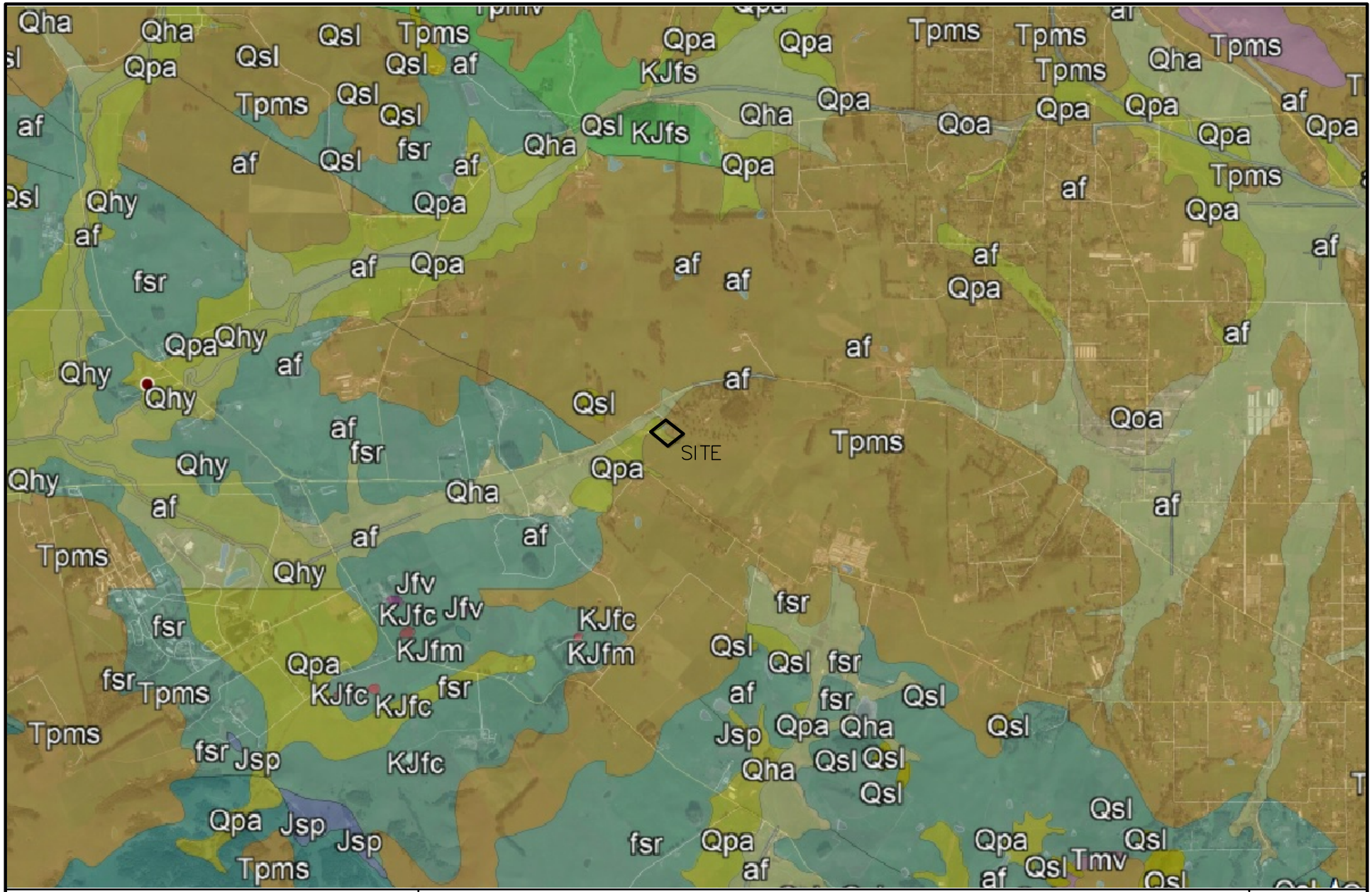
GEOLOGIC MAP

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 6A



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REGIONAL GEOLOGIC MAP

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 6B

Surficial Sediments	
af	Artificial Fill
Qhym	Mud deposits (late Holocene)
Qhy	Alluvium (late Holocene)
Qha	Alluvium (Holocene)
Qs	Beach and dune sand (Quaternary)
Qsl	Hillslope Deposits (Quaternary)
Qpa	Alluvium (Pleistocene)
Qt	Marine terrace deposits (Pleistocene)
Qoa	Alluvium (early Pleistocene)

Overlying Rocks	
QTs	Sediments (early Pleistocene and (or) Pliocene)
QTv	Volcanic rocks (early Pleistocene and (or) Pliocene)
Tps	Sedimentary rocks (Pliocene)
Tpv	Volcanic rocks (Pliocene)
Tpms	Sedimentary rocks (Pliocene and early Miocene)
Tpmv	Volcanic rocks (Pliocene and early Miocene)
Tms	Sedimentary rocks (Miocene)
Tmv	Volcanic rocks (Miocene)
Tmos	Sedimentary rocks (Miocene and (or) Oligocene)
Tmov	Volcanic rocks (Miocene and/or Oligocene)
Tmoes	Sedimentary rocks (Miocene, Oligocene, and (or) Eocene)
Tos	Sedimentary rocks (Oligocene)
Tov	Volcanic rocks (Oligocene)
Toes	Sedimentary rocks (Oligocene and (or) Eocene)
Tes	Sedimentary rocks (Eocene)
Tepas	Sedimentary rocks (Eocene and (or) Paleocene)
Tpas	Sedimentary rocks (Paleocene)
TKs	Sedimentary rocks (Paleocene and (or) Late Cretaceous)

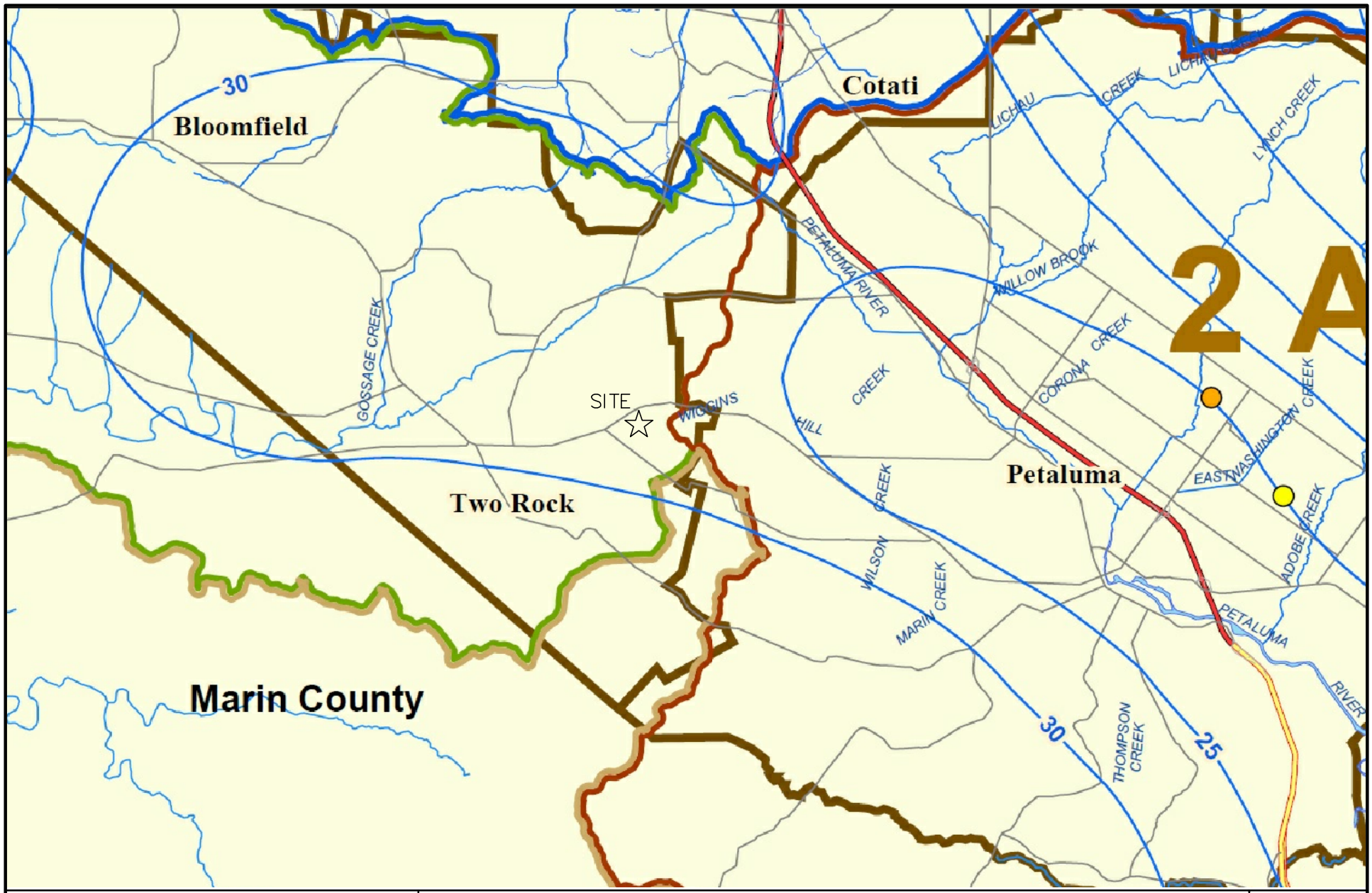
Basement Complex Rocks	
TKfs	Franciscan Complex sedimentary rocks (Eocene, Paleocene, and (or) Late Cretaceous)
fsr	Franciscan Complex mélange (Eocen, Paleocent, and (or) Late Cretaceous)
TKfv	Franciscan Complex volcanic rocks (Paleocene and (or) Late Cretaceous)
Ks	Great Valley complex sedimentary rocks (Cretaceous)
Kfs	Franciscan Complex sedimentary rocks (Cretaceous)
Kfv	Franciscan Complex volcanic rocks (Cretaceous)
Kfm	Franciscan Complex metamorphic rocks (Cretaceous)
Kgr	Salinian complex plutonic (granite) rocks (Cretaceous)
KJs	Great Valley complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
KJv	Franciscan or Great Valley complex volcanic rocks (Early Cretaceous and (or) Late Jurassic)
KJfs	Franciscan Complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
KJfc	Franciscan Complex chert (Early Cretaceous and (or) Late Jurassic)
KJfv	Franciscan Complex volcanic rocks (Early Cretaceous and (or) Late Jurassic)
KJfm	Franciscan Complex metamorphic rocks (Early Cretaceous and (or) Late Jurassic)
KJfvc	Franciscan Complex volcanic rocks and chert (Early Cretaceous and (or) Late Jurassic)
KJfvs	Franciscan Complex volcanic and sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
Jv	Great Valley complex volcanic rocks (Jurassic)
Ji	Great Valley complex plutonic rocks (Jurassic)
Jsp	Great Valley complex serpentinite (Jurassic)
Jfv	Franciscan Complex volcanic rocks (Jurassic)
Jhg	Salinian complex plutonic rocks (Jurassic)
MzPzm	Salinian complex metamorphic rocks (Mesozoic and (or) Paleozoic)
	Depositional or intrusive contact
	Fault
	Fault active in the Holocene (within the last 11,500 years)
A	Letter showing the approximate location where a rock or fossil on this poster was found

HURVITZ ENVIRONMENTAL
105 MORRIS ST, STE 188
SEBASTOPOL, CA 95472
PH: 707.824.1690
FX: 707.824.2675
HURVITZ.ENVIRONMENTAL@GMAIL.COM
CA PG# 7573

REGIONAL GEOLOGIC MAP KEY

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 6C



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PRECIPITATION MAP

022-200-002
6095 BODEGA AVE
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 5021.01
DATE: 6/18/18
PLATE: 7

APPENDIX A

PHOTOGRAPHIC LOG

SITE PHOTOGRAPHS
July 19, 2018

Photo 1: View of Project well installed in June 2018 and proposed for cannabis irrigation.

Photo 2: Alternate view of Project well. Installed to 300 feet with 100’ annular seal.

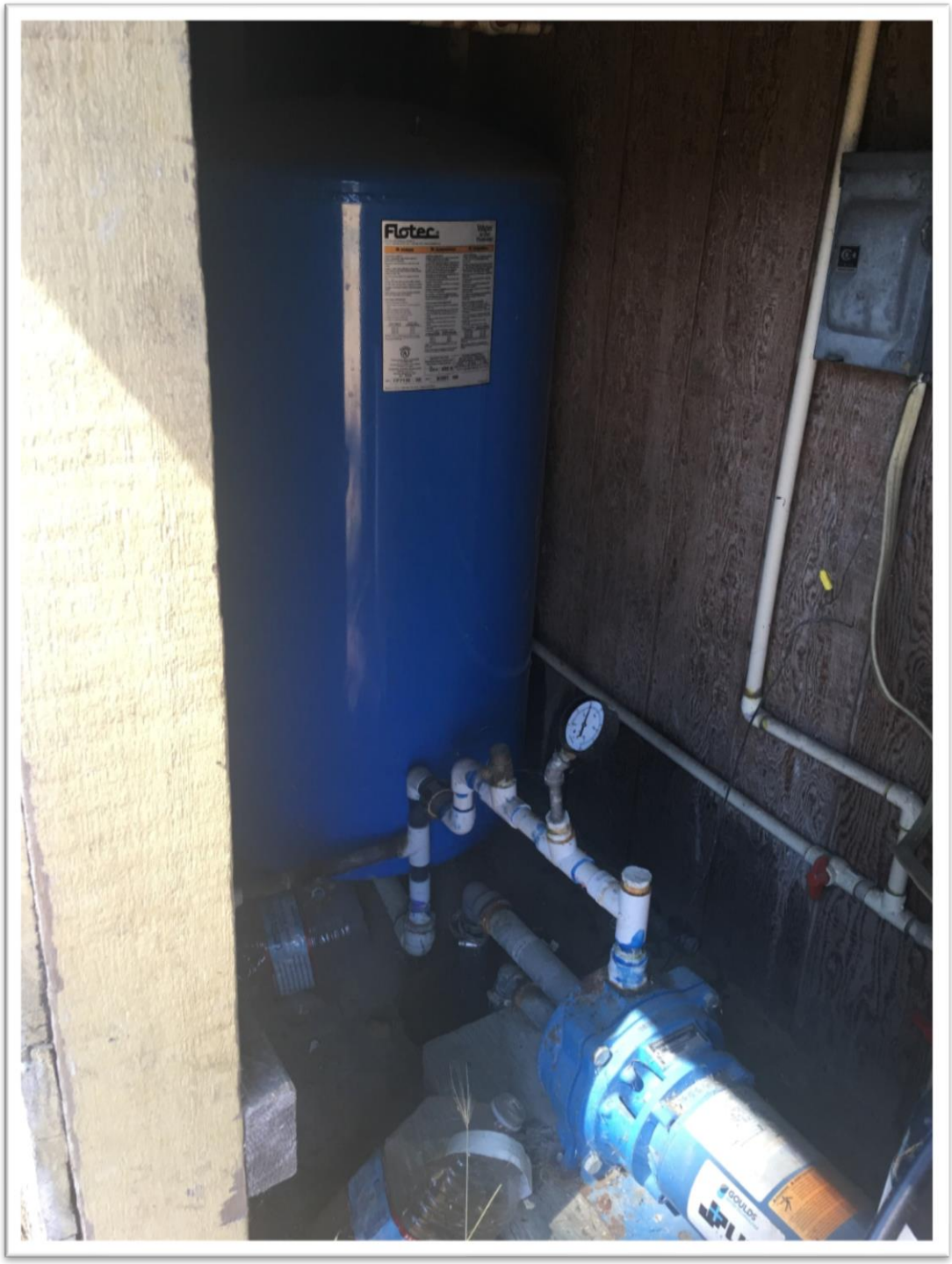


Photo 3: View of domestic well that supplies water to the residence onsite.

SITE PHOTOGRAPHS
July 19, 2018

Photo 4: View southerly of drainage swale to that intersects the site.

Photo 5: Alternate view of drainage swale that originates on the adjacent property to the south.

APPENDIX B

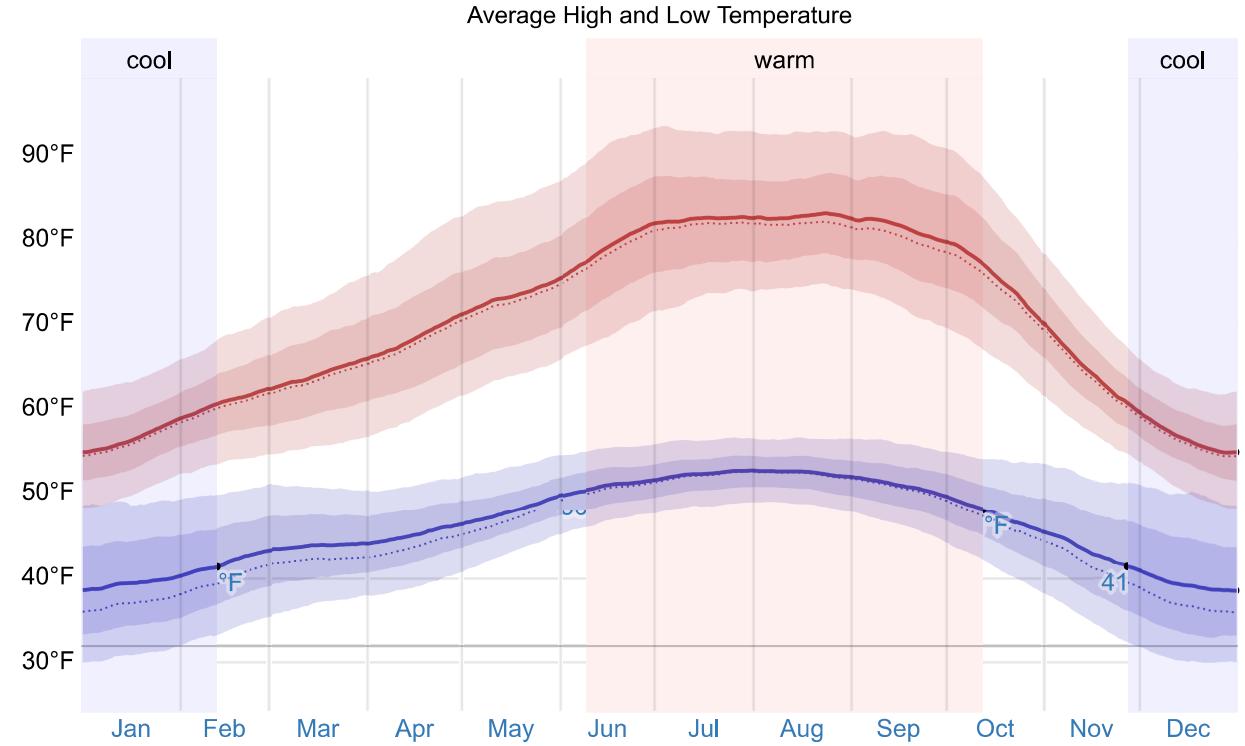
WEATHER DATA FROM WEATHERSPARK.COM

Average Weather in Petaluma California, United States

In Petaluma, the summers are long, warm, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 39°F to 83°F and is rarely below 30°F or above 93°F.

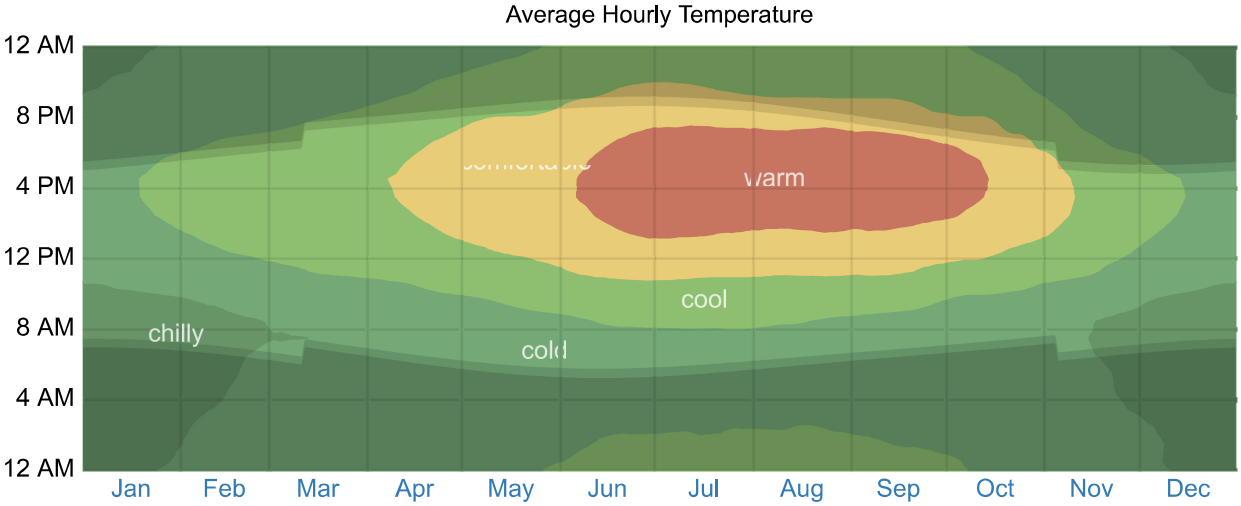
The warm season lasts for 4.1 months, from June 9 to October 12, with an average daily high temperature above 77°F. The hottest day of the year is August 23, with an average high of 83°F and low of 52°F.

The cool season lasts for 2.5 months, from November 27 to February 12, with an average daily high temperature below 61°F. The coldest day of the year is December 31, with an average low of 39°F and high of 55°F.



The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

The figure below shows you a compact characterization of the entire year of hourly average temperatures. The horizontal axis is the day of the year, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day.



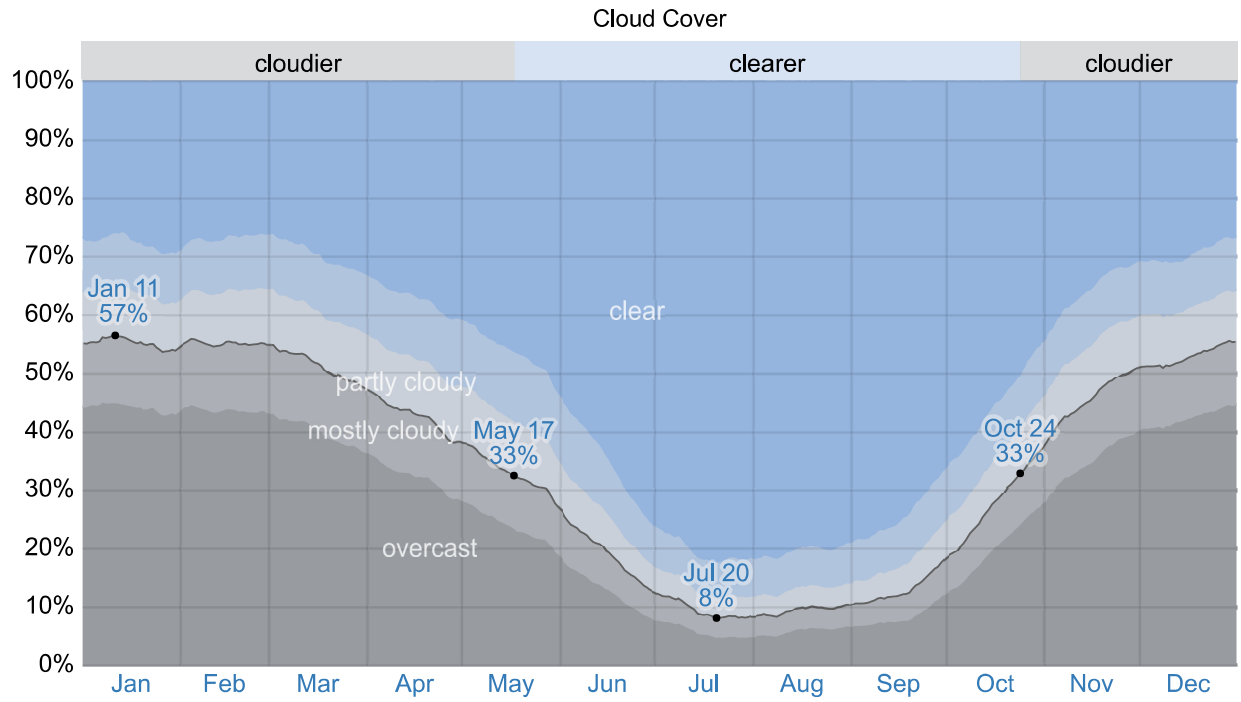
The average hourly temperature, color coded into bands: frigid < 15°F < freezing < 32°F < chilly < 45°F < cold < 55°F < cool < 65°F < comfortable < 75°F < warm < 85°F < hot < 95°F < sweltering. The shaded overlays indicate night and civil twilight.

Clouds

In Petaluma, the average percentage of the sky covered by clouds experiences significant seasonal variation over the course of the year.

The clearer part of the year in Petaluma begins around May 17 and lasts for 5.2 months, ending around October 24. On July 20, the clearest day of the year, the sky is clear, mostly clear, or partly cloudy 92% of the time, and overcast or mostly cloudy 8% of the time.

The cloudier part of the year begins around October 24 and lasts for 6.8 months, ending around May 17. On January 11, the cloudiest day of the year, the sky is overcast or mostly cloudy 57% of the time, and clear, mostly clear, or partly cloudy 43% of the time.



The percentage of time spent in each cloud cover band, categorized by the percentage of the sky covered by clouds: clear < 20% < mostly clear < 40% < partly cloudy < 60% < mostly cloudy < 80% < overcast.

Precipitation

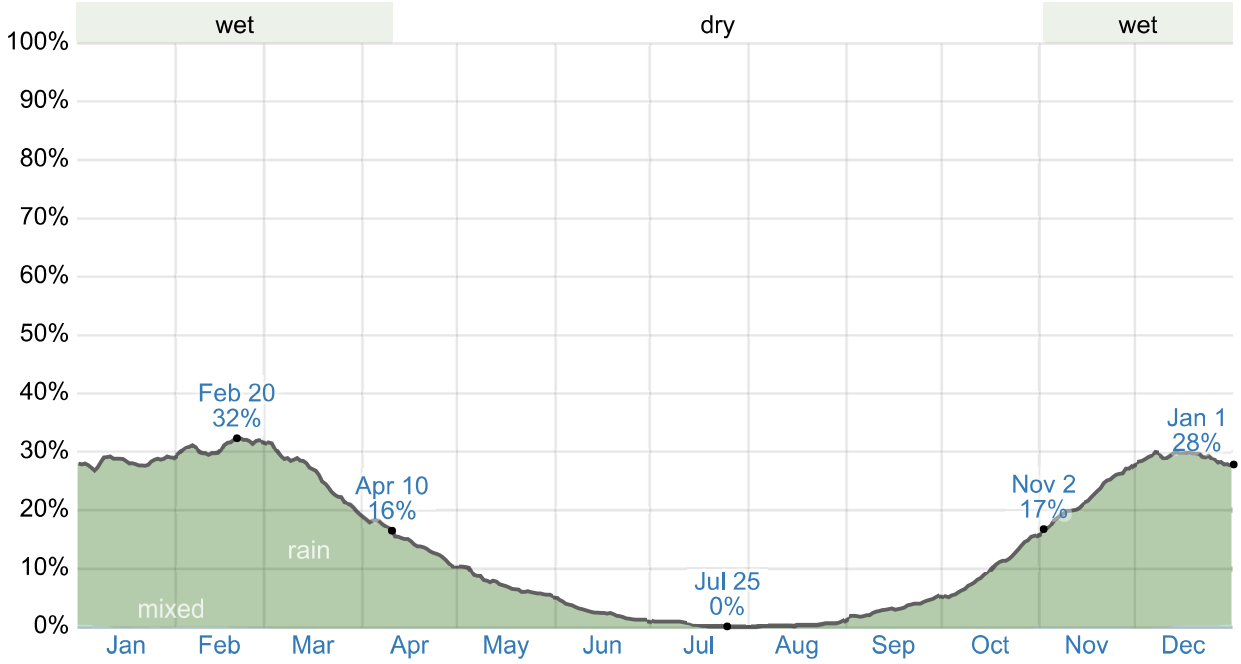
A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Petaluma varies significantly throughout the year.

The wetter season lasts 5.3 months, from November 2 to April 10, with a greater than 16% chance of a given day being a wet day. The chance of a wet day peaks at 32% on February 20.

The drier season lasts 6.7 months, from April 10 to November 2. The smallest chance of a wet day is 0% on July 25.

Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 32% on February 20.

Daily Chance of Precipitation



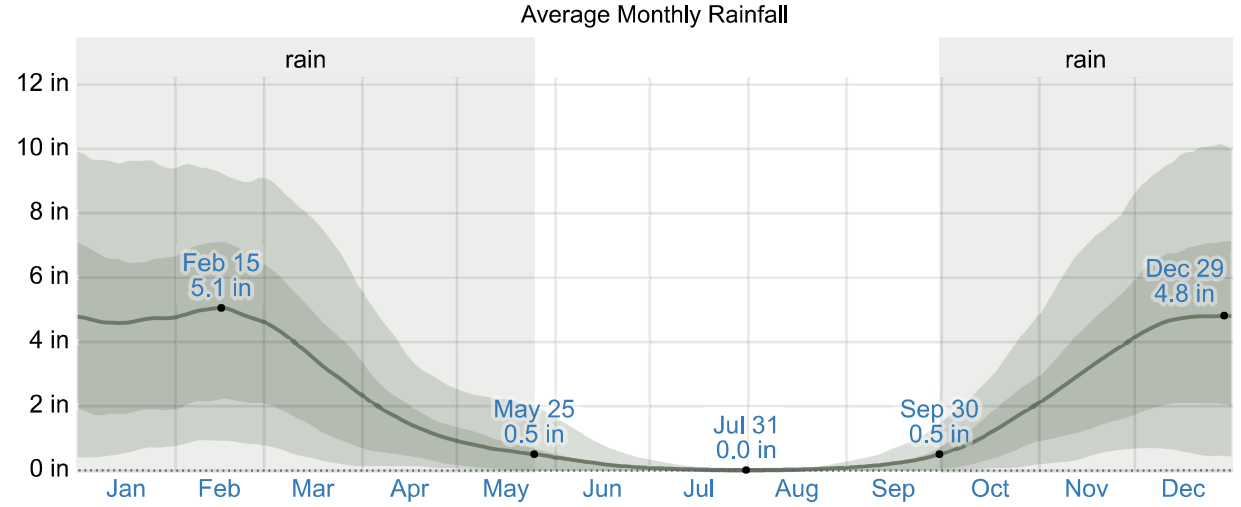
The percentage of days in which various types of precipitation are observed, excluding trace quantities: rain alone, snow alone, and mixed (both rain and snow fell in the same day).

Rainfall

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Petaluma experiences extreme seasonal variation in monthly rainfall.

The rainy period of the year lasts for 7.8 months, from September 30 to May 25, with a sliding 31-day rainfall of at least 0.5 inches. The most rain falls during the 31 days centered around February 15, with an average total accumulation of 5.1 inches.

The rainless period of the year lasts for 4.2 months, from May 25 to September 30. The least rain falls around July 31, with an average total accumulation of 0.0 inches.

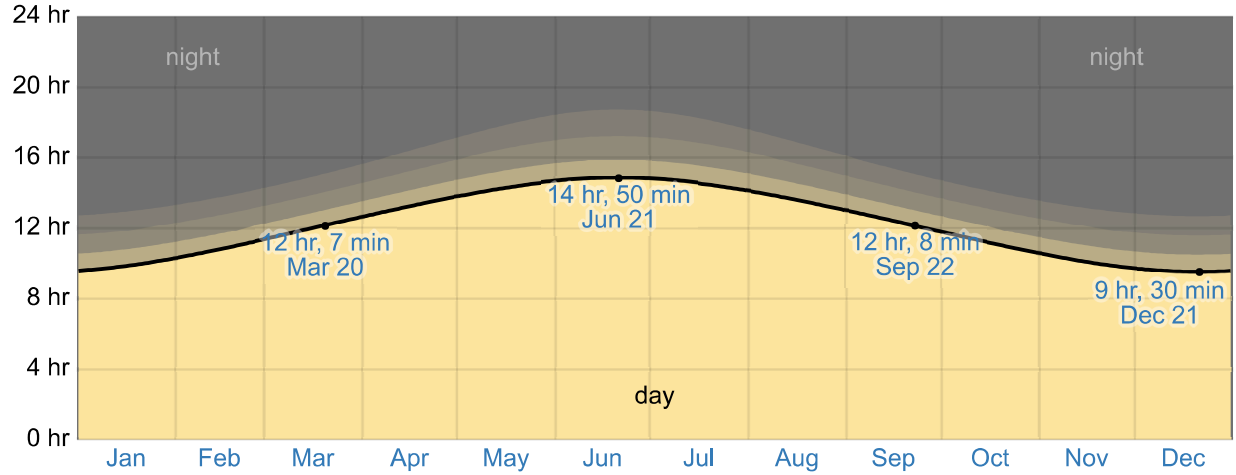


The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall.

Sun

The length of the day in Petaluma varies significantly over the course of the year. In 2017, the shortest day is December 21, with 9 hours, 30 minutes of daylight; the longest day is June 21, with 14 hours, 50 minutes of daylight.

Hours of Daylight and Twilight

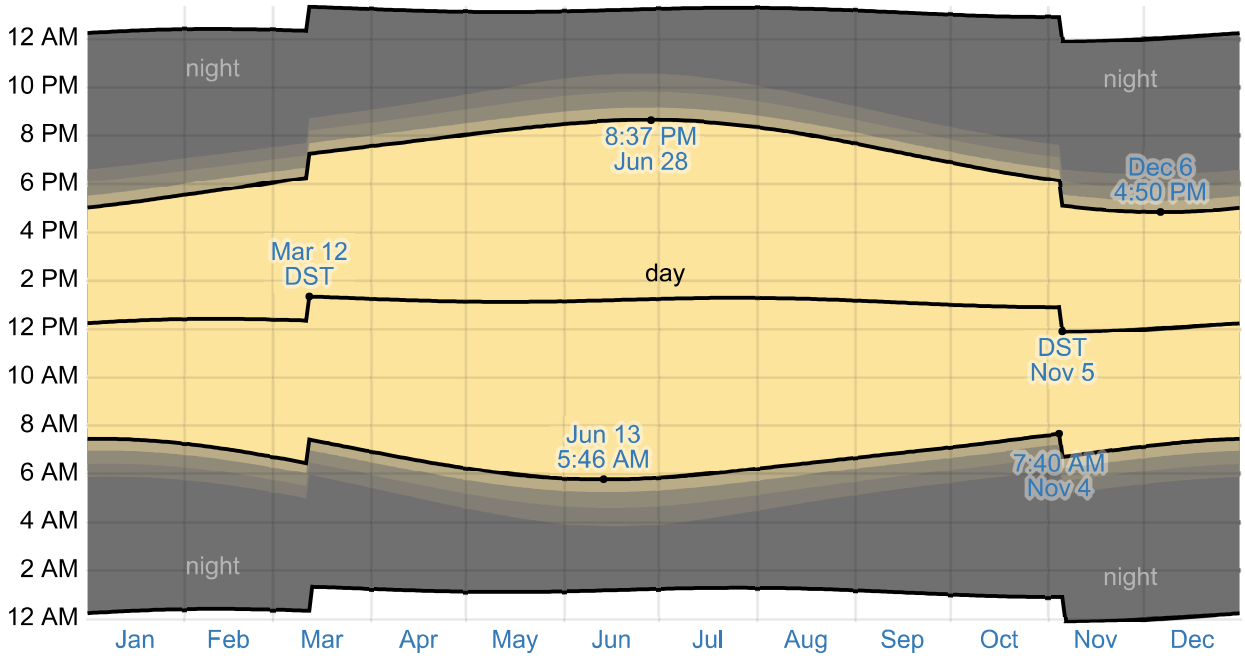


The number of hours during which the Sun is visible (black line). From bottom (most yellow) to top (most gray), the color bands indicate: full daylight, twilight (civil, nautical, and astronomical), and full night.

The earliest sunrise is at 5:46 AM on June 13, and the latest sunrise is 1 hour, 54 minutes later at 7:40 AM on November 4. The earliest sunset is at 4:50 PM on December 6, and the latest sunset is 3 hours, 48 minutes later at 8:37 PM on June 28.

Daylight saving time (DST) is observed in Petaluma during 2017, starting in the spring on March 12, lasting 7.8 months, and ending in the fall on November 5.

Sunrise & Sunset with Twilight and Daylight Saving Time



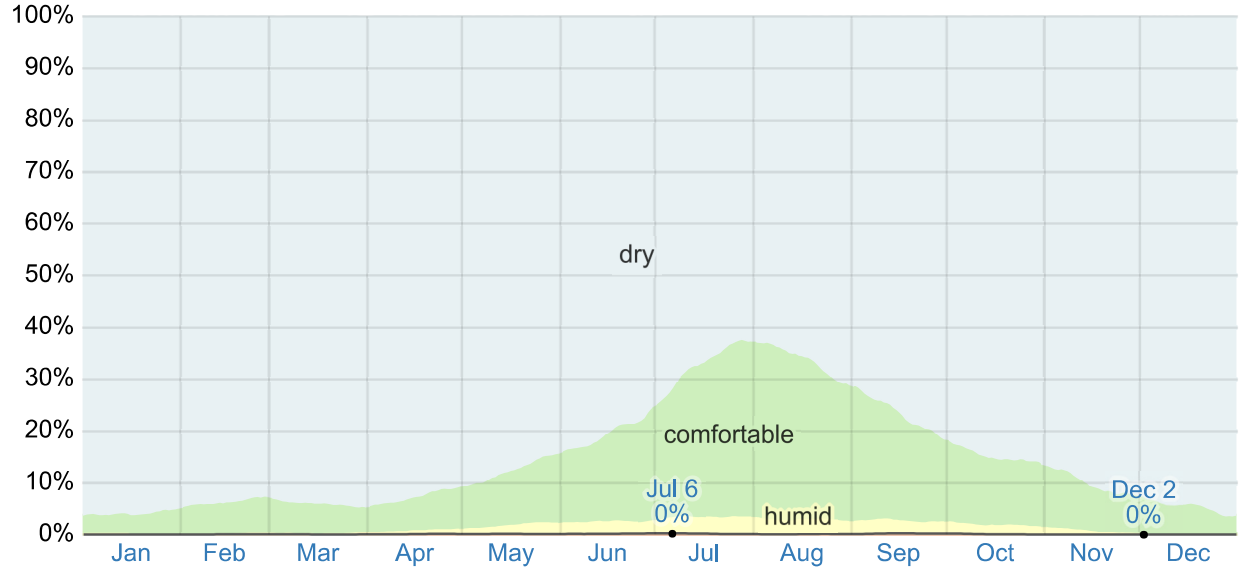
The solar day over the course of the year 2017. From bottom to top, the black lines are the previous solar midnight, sunrise, solar noon, sunset, and the next solar midnight. The day, twilights (civil, nautical, and astronomical), and night are indicated by the color bands from yellow to gray. The transitions to and from daylight saving time are indicated by the 'DST' labels.

Humidity

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night.

The perceived humidity level in Petaluma, as measured by the percentage of time in which the humidity comfort level is muggy, oppressive, or miserable, does not vary significantly over the course of the year, remaining a virtually constant 0% throughout.

Humidity Comfort Levels



The percentage of time spent at various humidity comfort levels, categorized by dew point: dry < 55°F < comfortable < 60°F < humid < 65°F < muggy < 70°F < oppressive < 75°F < miserable.

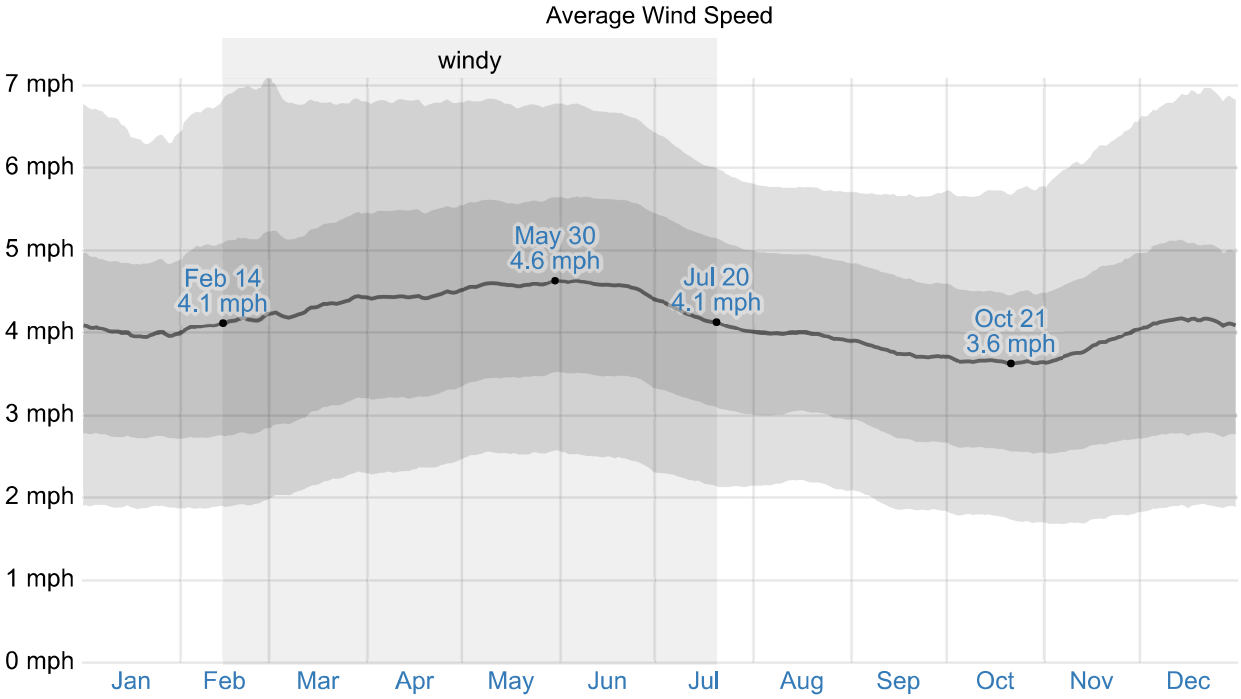
Wind

This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

The average hourly wind speed in Petaluma experiences mild seasonal variation over the course of the year.

The windier part of the year lasts for 5.2 months, from February 14 to July 20, with average wind speeds of more than 4.1 miles per hour. The windiest day of the year is May 30, with an average hourly wind speed of 4.6 miles per hour.

The calmer time of year lasts for 6.8 months, from July 20 to February 14. The calmest day of the year is October 21, with an average hourly wind speed of 3.6 miles per hour.

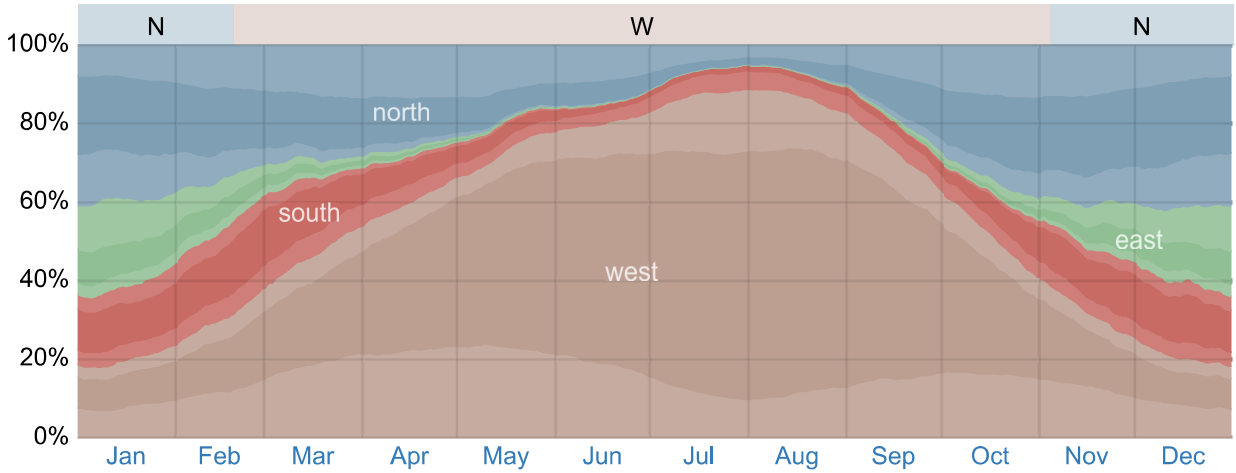


The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands.

The predominant average hourly wind direction in Petaluma varies throughout the year.

The wind is most often from the west for 8.5 months, from February 19 to November 4, with a peak percentage of 89% on July 30. The wind is most often from the north for 3.5 months, from November 4 to February 19, with a peak percentage of 41% on January 1.

Wind Direction



The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions (north, east, south, and west), excluding hours in which the mean wind speed is less than 1 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).

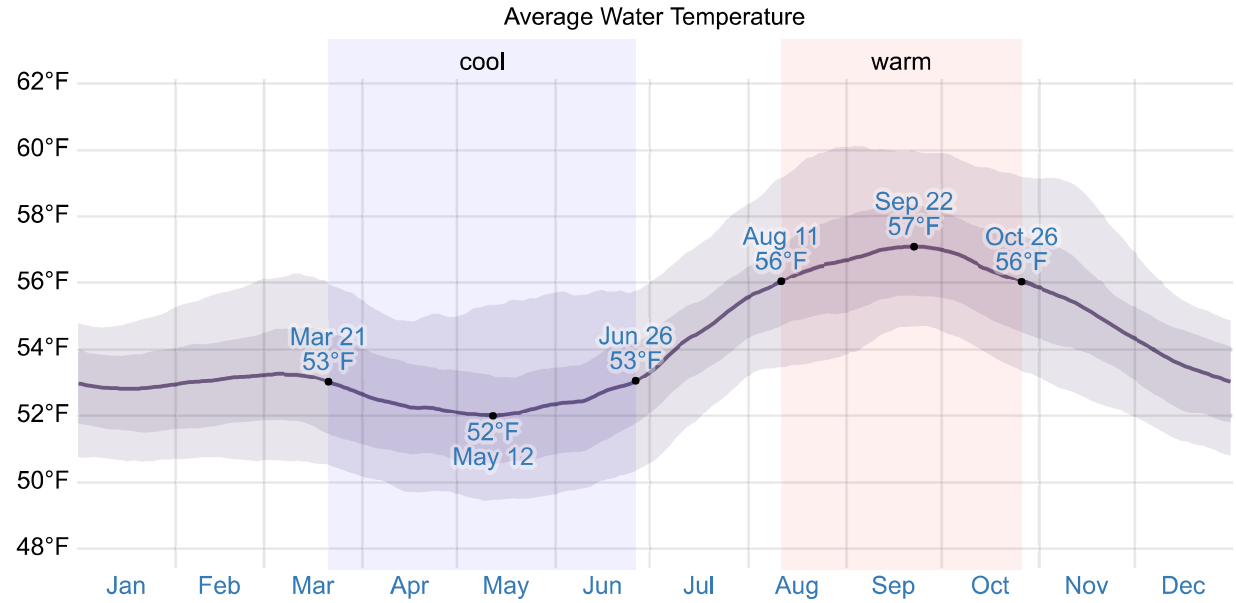
Water Temperature

Petaluma is located near a large body of water (e.g., ocean, sea, or large lake). This section reports on the wide-area average surface temperature of that water.

The average water temperature experiences some seasonal variation over the course of the year.

The time of year with warmer water lasts for 2.5 months, from August 11 to October 26, with an average temperature above 56°F. The day of the year with the warmest water is September 22, with an average temperature of 57°F.

The time of year with cooler water lasts for 3.2 months, from March 21 to June 26, with an average temperature below 53°F. The day of the year with the coolest water is May 12, with an average temperature of 52°F.



The daily average water temperature (purple line), with 25th to 75th and 10th to 90th percentile bands.

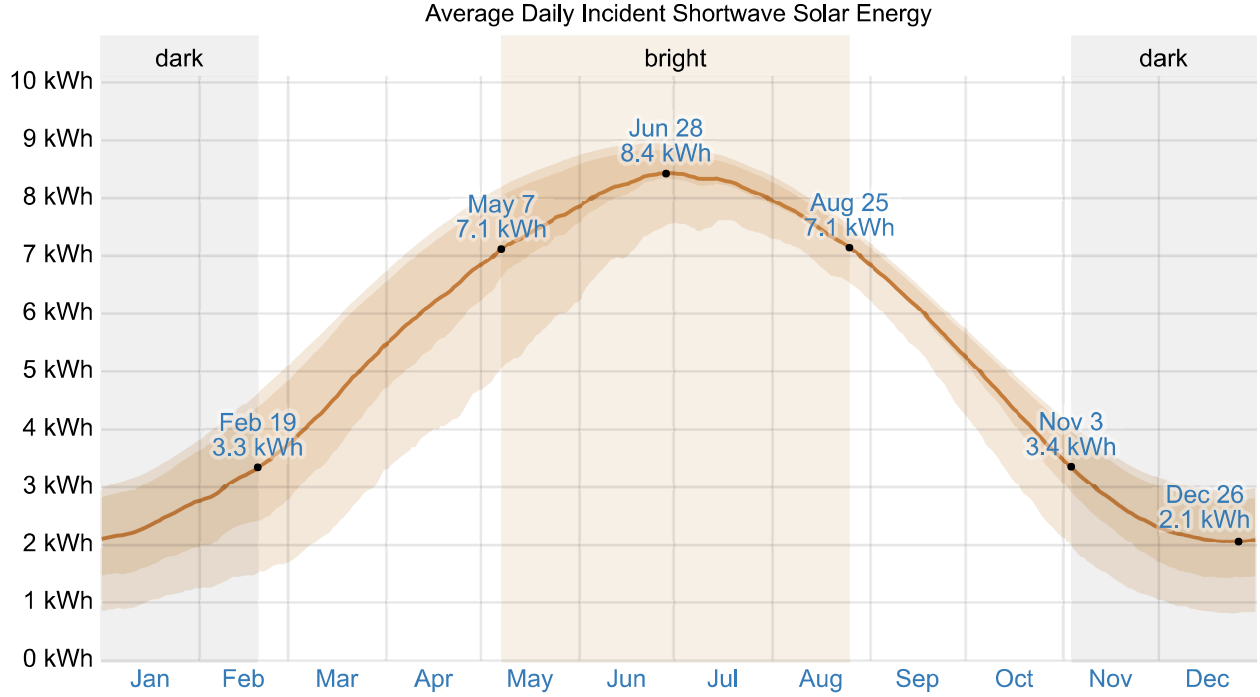
Solar Energy

This section discusses the total daily incident shortwave solar energy reaching the surface of the ground over a wide area, taking full account of seasonal variations in the length of the day, the elevation of the Sun above the horizon, and absorption by clouds and other atmospheric constituents. Shortwave radiation includes visible light and ultraviolet radiation.

The average daily incident shortwave solar energy experiences extreme seasonal variation over the course of the year.

The brighter period of the year lasts for 3.6 months, from May 7 to August 25, with an average daily incident shortwave energy per square meter above 7.1 kWh. The brightest day of the year is June 28, with an average of 8.4 kWh.

The darker period of the year lasts for 3.6 months, from November 3 to February 19, with an average daily incident shortwave energy per square meter below 3.4 kWh. The darkest day of the year is December 26, with an average of 2.1 kWh.



The average daily shortwave solar energy reaching the ground per square meter (orange line), with 25th to 75th and 10th to 90th percentile bands.

Topography

For the purposes of this report, the geographical coordinates of Petaluma are 38.232 deg latitude, -122.637 deg longitude, and 92 ft elevation.

The topography within 2 miles of Petaluma contains significant variations in elevation, with a maximum elevation change of 522 feet and an average elevation above sea level of 113 feet. Within 10 miles contains significant variations in elevation (2,454 feet). Within 50 miles contains large variations in elevation (4,701 feet).

The area within 2 miles of Petaluma is covered by artificial surfaces (56%), grassland (21%), and cropland (18%), within 10 miles by grassland (65%) and cropland (12%), and within 50 miles by water (35%) and grassland (19%).

Data Sources

This report illustrates the typical weather in Petaluma, based on a statistical analysis of historical hourly weather reports and model reconstructions from January 1, 1980 to December 31, 2016.

Temperature and Dew Point

There are 2 weather stations near enough to contribute to our estimation of the temperature and dew point in Petaluma.

For each station, the records are corrected for the elevation difference between that station and Petaluma according to the International Standard Atmosphere (https://en.wikipedia.org/wiki/International_Standard_Atmosphere), and by the relative change present in the MERRA-2 satellite-era reanalysis (https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/) between the two locations.

The estimated value at Petaluma is computed as the weighted average of the individual contributions from each station, with weights proportional to the inverse of the distance between Petaluma and a given station.

The stations contributing to this reconstruction are: Gnoss Field (/y/145214/Average-Weather-at-Gnoss-Field-California-United-States) (82%, 12 kilometers, southeast) and Sonoma County Airport (/y/145216/Average-Weather-at-Sonoma-County-Airport-California-United-States) (18%, 34 kilometers, northwest).

Other Data

All data relating to the Sun's position (e.g., sunrise and sunset) are computed using astronomical formulas from the book, Astronomical Tables of the Sun, Moon and Planets (https://www.amazon.com/Astronomical-Tables-Sun-Moon-Planets/dp/094339645X), by Jean Meeus.

All other weather data, including cloud cover, precipitation, wind speed and direction, and solar flux, come from NASA's MERRA-2 Modern-Era Retrospective Analysis (https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/). This reanalysis combines a variety of wide-area measurements in a state-of-the-art global meteorological model to reconstruct the hourly history of weather throughout the world on a 50-kilometer grid.

Land Use data comes from the Global Land Cover SHARE database (http://www.glcn.org/databases/lc_glcshare_en.jsp), published by the Food and Agriculture Organization of the United Nations.

Elevation data comes from the Shuttle Radar Topography Mission (SRTM) (http://www2.jpl.nasa.gov/srtm/), published by NASA's Jet Propulsion Laboratory.

Names, locations, and time zones of places and some airports come from the GeoNames Geographical Database (http://www.geonames.org/).

Time zones for aiports and weather stations are provided by AskGeo.com (https://askgeo.com/).

APPENDIX C

ENERGY EFFICIENCY IN CANNABIS CULTIVATION

N·E·X·U·S
GREENHOUSE SYSTEMS
SYSTEM 420 HYBRID GREENHOUSES

White Paper

Energy Efficiency in Cannabis Growing

November 24, 2015

Background

Energy efficiency in a cannabis greenhouse is a result of many varied functions. Similar to a home, there are extensive maintenance tasks, which if consistently implemented, can significantly reduce energy consumption as well as utility bills. Beyond maintenance, there are design and growing system components that also contribute to lower consumption patterns. When all of these areas are combined, then the cumulative impact can be substantial.

With a System 420™ hybrid greenhouse from Nexus, the grower can receive the privacy benefits of the indoor grow and the modern agricultural practices of the greenhouse. Cannabis crop efficiency, reduced operating costs, natural sunlight, and a healthier work atmosphere can be achieved in a hybrid greenhouse growing environment.

As a greenhouse manufacturer, Nexus designs high quality, commercial greenhouses for the traditional horticulture and the emerging cannabis markets. The company partners with supplemental equipment providers, and manages integrated greenhouse development. This white paper outlines several items to consider for increasing cannabis greenhouse energy efficiency.

Key Statistics

- Outside of licensing fees, energy ranks as one of the top expenses for marijuana cultivators in many states – in some cases hitting $10,000 or more a month for large growing operations

  http://mjbizdaily.com/zapped-by-escalating-energy-costs-marijuana-growers-seek-alternatives/

- Heating energy represents 70% to 80% of a greenhouse grower's total energy consumption

  https://articles.extension.org/sites/default/files/2.%20A3907-01.pdf

With this level of costs, developing an efficiency plan may determine whether a cannabis company financially survives. The days of easy money in the cannabis industry are nearing a close. Falling prices, oversupply, and rising utility costs are contributing to a tighter financial model. Reducing utility bills are about more than increasing profit. Energy efficiency may determine business survival.

Structure Types

Gutter-connected cannabis greenhouses, which cover one-half of an acre (21,780 sq. ft.) have 10% to 15% less surface area and a lower amount of heat loss than most stand-alone greenhouses, which cover the same area. Stand-alone greenhouses have a surface area-to-floor area ratio of approximately 1.6 and gutter-connected greenhouses have a ratio of less than 1.4.

A comparison of two greenhouse systems with 24,000 sq. ft. of floor space brings intriguing results. Each operation features LP gas power-vented unit heaters with a seasonal efficiency of 78%.

- **Grower #1** has eight 30 x 100 ft. greenhouses with 3-ft. sidewalls and 15-ft. peaks
- **Grower #2** has one five-bay gutter-connected 150 x 160 ft. greenhouse (30 ft. wide bays) with 10 ft. sidewalls and a 15 ft. peak

Grower #1 (stand-alone) will use 14,344 gallons of fuel and Grower #2 (gutter-connected) will use 11,929 gallons. Thus, the gutter-connected greenhouse will consume 2,415 less gallons for a 17% energy savings.

Roof & Wall Coverings

Cannabis greenhouse walls, which face north let in a smaller amount of light than the other walls, especially in the winter months. Insulation can be added to the north walls to reduce heat losses. If the walls have a white surface, light levels will be enhanced by reflecting winter sunlight that would have passed through the north wall. Using insulation between the metal side-walls and around heat plumbing provides significant energy savings. The addition of light deprivation or energy shade curtains is one of the most effective ways to conserve energy. This effort can reduce nighttime heat loss by about 50%.

Another cannabis greenhouse area where heat is lost is along the inside perimeter through the greenhouse ground and sidewall portions. Insulated boards that run from the bench height to slightly below the ground level contribute to about a 5% energy savings. Light deprivation curtains also contribute to energy efficiency by retaining heat during the night or blackout hours.

Heating

Cannabis greenhouse heating energy efficiency involves the type of heating system, location, and maintenance. Unit heaters are popular in greenhouses due to low capital and installation costs, dependability, and staging ease. Multiple heaters are highly recommended to reduce the potential for total heat loss from equipment failure. In larger greenhouses, a central hot water

boiler is a common choice. Heat is distributed through heated floors, radiant heat pipes, or water-to-air heat exchangers. An efficient boiler with consistent maintenance will keep energy costs at reasonable levels.

A productive heat distribution location can lower energy consumption while increasing plant growth and yields. Cannabis greenhouses frequently use one or two forced-air unit heaters that distribute air above the plant height level. When two unit heaters are used, then placement usually occurs in opposite corners on opposite ends of the greenhouse to create circular airflow. Heaters are often placed at elevated heights to allow more room for benching systems. Since heat rises, the entire greenhouse must be heated to maintain the desired temperature at the crop level.

Distributing heat from the floor, under benches, or bench-tops creates a growing climate that warms the plants and adjacent areas, yet does not heat up the entire greenhouse. Known as root-zone heating, this cannabis crop production method provides additional energy savings.

Forced Air Overhead Unit Heaters

Horizontal Air Flow (HAF) Fans

Reducing air leaks and heat loss makes a cannabis greenhouse tighter. Regardless of the heating system type used, placing a sufficient number of HAF fans to adequately circulate air inside the greenhouse will increase energy efficiency. Solid air circulation will improve greenhouse temperature and humidity consistency, which reduces the number of cold pockets and improves plant quality and uniformity. Keeping the humidity level below 80% by venting, when necessary, minimizes disease incidence.

Air circulation by the HAF fans should consist of two to three cu. ft. per min. over the greenhouse floor surface. A 28-ft. x 96-ft. greenhouse needs an airflow of 5,376 cu. ft. per min. (28 x 96 x 2 cu. ft. per min. per sq. ft. = 5,376 cu. ft. per min.). This cannabis greenhouse structure would require four HAF fans with a capacity of circulating air at 1,440 cu. ft. per min. HAF fans usually operate at two different speeds. Be sure to check the fan specifications to determine the necessary speed. These fans should be situated two to three feet above the plant

height level and aligned parallel to the greenhouse sidewalls so that air can flow in a circular pattern. Winter operation is recommended to improve temperature and humidity levels.

Supplemental Lighting

The use of supplemental lighting allows the cannabis grower to accomplish the following:

- Provide extra light on cloudy and low natural light days (winter, northern latitudes)
- Different growing environments require a varied amount of accumulated light
- Maintain consistent light levels during the year

High intensity discharge (HID) lights are mainly used in greenhouses, which consist of two types. These types are high pressure sodium and metal halide fixtures.

To decrease energy consumption, timers or light integral controls can be used. These types of controller measure the sunlight that enters the greenhouse on a daily basis and regulates the lights to ensure ample light reaches a minimum daily light integral, which determines plant growth.

LED

LED lighting technology is presently on the market and under testing in a wide range of scenarios. These lights are currently most effective in small batches where a modest number of lighting fixtures can enhance growth on a limited number of plants in concentrated areas. On a larger scale, more research needs to occur to justify the light fixture costs. The future potential for these lights is significant, yet wide-scale distribution will not occur until there is greater product quality consistency and more cost-effective prices.

Light Transmitting Coverings & Light Deprivation

The greatest benefit of a cannabis greenhouse is the energy saved by using the free light of the sun. Greenhouses are covered by light transmitting coverings, which allow in 80% to 90% of the available sunlight. The differences in light transmission are due to the variety of coverings used on the greenhouse roof and sidewalls. These coverings reduce the necessary amount of artificial and supplemental lighting that decrease overall energy consumption.

Light deprivation is a technique of altering the light cycle of flowering plants. These systems utilize the power of natural sunlight, an abundant source of free energy. Cannabis greenhouses use blackout curtains to block light and deny the crop an extended photoperiod.

A light deprivation system inside a cannabis greenhouse can reduce heating costs by at least 50%. The use of sunlight decreases the role of artificial lighting, which is a large part of the utility cost structure. As a result, greenhouses have increased overall energy efficiency. According to curtain manufacturer, Ludvig Svensson, the utility costs within a greenhouse are 50-75% lower than in an indoor warehouse growing environment.

The blackout curtains underneath the roof coverings and along the sidewalls help retain heat during the dark periods. Heat is retained in the growing area without losing heat energy through the roof. This process needs to be carefully managed to prevent extreme heat buildup, which can damage plants.

Blackout curtains as a part of a hybrid heat-saving curtain

Environmental Controls

There are many greenhouse environmental factors that need to be managed, especially air temperature, humidity, CO2 levels, lighting, and irrigation. To better control energy costs, several interactions need to be avoided. These interactions include running exhaust fans when the heater is on, cycling heaters and fans on and off, and operating fans while adding CO2. With manual controls, some interactions cannot be avoided. However, with a central controller, the control system can be optimized to prevent unnecessary conflicts.

A basic controller usually manages heaters and fans to permit the heater to have day and night set points. If the greenhouse fans are staged, a basic controller may also increase the number of operating fans as internal greenhouse temperatures rise. Sophisticated controllers may have outputs to control heaters, fans, louvers, CO2 enrichment lights, thermal or shade curtains, or irrigation, as well as inputs for temperatures, humidity, CO2 levels, daily light integrals, soil moisture, and a weather station. Proper measurement methods are vital to obtaining accurate temperature readings.

Whether using a mechanical thermostat or a sophisticated computer system, a regular tune-up is essential. An inspection by an environmental controls company with specialized knowledge may be necessary. However, any greenhouse manager can perform basic checks. For example, if the ventilation fans are running while the heat is on, then there is a concern.

Maintenance

Consistent maintenance is the most fundamental way to increase energy efficiency. Many tasks are surprisingly simple and cost-effective. By tightening up the cannabis greenhouse, a substantial impact can be made. Over time, greenhouse structures develop holes, cracks, and openings in the walls or roof, which permits the cold air to enter and the warm air to leak out. Fixing these leaks can be made with a can of spray foam and a tube of caulk. Tightening up the greenhouse also improves airflow patterns that contribute to more uniform temperatures and humidity levels. This effort can reduce heating bills by 5% to 10%.

Accumulating dust on greenhouse blades, louvers, and safety screens may increase energy usage by as much as 20%. A rag and cleaner solvent can correct this issue. When cleaning, check for any broken fan blades. Bent or malfunctioning louvers as well as drilled holes or gaps around the fan housing may be evident. These louver problems can contribute to higher winter heating bills. Malfunctioning louvers need repair and any holes or cracks should be covered up.

Heating maintenance is also crucial to cannabis greenhouse operations to prevent crop loss or inefficient energy costs. Inspecting the heaters on an annual basis will usually cover the maintenance costs in fuel savings and reduce emergency service calls. Heat exchangers and burners, need to be inspected and cleaned annually. In addition, the thermostats require calibration. Soot on boiler heat exchangers or fire tubes can raise energy consumption by 10%. With a central heating system, insulating pipes and ductwork is beneficial. Overall, proper heating system maintenance can decrease energy costs up to 20%.

View of greenhouse structure and equipment to show need for maintenance

About Nexus

Nexus Corporation has served the greenhouse industry as a top US manufacturer since 1967. With a corporate office and production facility in Northglenn, CO along with an advanced manufacturing plant in Pana, IL, the company brings innovative designs, high quality products, and exceptional customer service to its System 420™ hybrid greenhouse systems.

Nexus has a team of engineers (licensed in 49 states), sales, project management, customer service, and operations professionals dedicated to managing a greenhouse development project from start to finish. The team has expertise regarding the customized design components, efficiency features, and cost management strategies necessary to maximize crop yields and return-on-investment.

For more information on greenhouses from Nexus Corporation, click here.

Sources

www.nexuscann.com

www.nexuscorp.com

www.nexuscann.com/files/Components%20of%20a%20Marijuana%20Greenhouse.pdf

http://extension.psu.edu/publications/h-86

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http://www.technologyreview.com/view/528356/how-leds-are-set-to-revolutionize-hi-tech-greenhouse-farming/

https://vtechworks.lib.vt.edu/bitstream/handle/10919/23485/VCE430_101_2001.pdf?sequence=1

http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_023110.pdf

APPENDIX D

WELL COMPLETION LOGS

State of California

Well Completion Report

Form DWR 188 Submitted 6/20/2018
WCR2018-004761

Owner's Well Number 2018-1 Date Work Began 06/06/2018 Date Work Ended 06/12/2018

Local Permit Agency Department of Public Health Services - Environmental Health Department

Secondary Permit Agency Permit Number WEL18-0110 Permit Date 04/24/2018

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

Name [redacted]

Mailing Address [redacted]

City [redacted] State [redacted] Zip [redacted]

Planned Use and Activity

Activity New Well

Planned Use Water Supply Domestic

Well Location

Address 6095 Bodega AVE

City Petaluma Zip 94952 County Sonoma

Latitude ___ Deg. ___ Min. ___ Sec. N Longitude ___ Deg. ___ Min. ___ Sec. W

Dec. Lat. 38.2610270 Dec. Long. -122.7453287

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN 022-200-002-000

Township 05 N

Range 08 W

Section 21

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Direct Rotary Drilling Fluid Other - Mud

Total Depth of Boring 300 Feet

Total Depth of Completed Well 300 Feet

Water Level and Yield of Completed Well

Depth to first water 70 (Feet below surface)

Depth to Static Water Level (Feet) Date Measured 06/12/2018

Estimated Yield* 10 (GPM) Test Type Air Lift

Test Length 3 (Hours) Total Drawdown 300 (feet)

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

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	3	Top soil
3	12	Gray sandy clay
12	33	Brown sandy clay
33	47	Blue sandy clay
47	49	Stone and sandy clay
49	90	Blue sandy clay
90	91	Soft stone
91	93	Blue sandy clay
93	95	Blue sandy clay, stone and sea shell
95	96	Stone
96	300	Blue sandy clay stone with soft ledges

Well Permit Application

WLS-031

WEL18-011

[redacted] Site Address	Permit Number: 022-200-002
[redacted] City/Town, State, Zip: CA 94952	Assessor's Parcel Number
[redacted] Owner Name	Well Driller Name: Les Petersen Drilling & Pump, Inc
same as well location	Mailing Address: 5434 Old Redwood Hwy
Mailing Address	Mailing Address: Santa Rosa CA 95403
City/Town, State, Zip	City/Town: 261084 State Zip
Phone: 415-637-7516	License Number: 545-0246
[redacted] Contact Person	Phone: 573-9483 Fax

The validity of this permit depends upon the accuracy of the information provided by the applicant. A site plan must accompany this application. In addition to the information required on the Minimum Standard Site Plan (Form CSS-019), the site plan shall also include the proposed well location, existing well(s) location(s), GPS coordinates of proposed well, sewer mains and laterals, and other potential sources of contamination. If an inadequate site plan is provided and a second field visit is required, a charge at the current hourly rate will be assessed. The precise site location of the proposed well must be staked with the driller's name.

INDICATE TYPE AND NUMBER OF PROPOSED WELLS/BORINGS:

Indicate use: ☒ Residential ☐ Community ☒ Irrigation ☐ Industrial

Reason for new well: _____

☐ Destruct ☒ Class I Well ☐ Class II Well ☐ Reconstruction Reason for Class II: _____

[ ] Geotechnical Borings [ ] Geoexchange [ ] Monitoring [ ] Cathodic [ ] Dewatering

[ ] Performance Well [ ] Piezometer [ ] Inclinometer [ ] Other: _____

Total number of wells on property: 1 Number in use: 1 Number inactive: _____ Number abandoned: _____

Well located within an existing public water system boundary: Yes ☐ No ☒ Name of System: _____

CONSTRUCTION PROPOSED:

Casing: 4"/5" Diameter: 1.55" W/O Gauge: 200 Material: PVC Gravel Pack ☒ Sand Pack ☐ Conductor: Yes ☐ No ☒

Annular Space: Size: 2" Depth of Seal: 100 ft Seal Material: Bentonite

Method of Disinfection: CI Method of Sealing Access Opening: Cap Type of Joint: Mechanical

DESTRUCTION PROPOSED: Well Diameter: _____ Well Depth: _____ Well Casing: _____

Method of Destruction: _____

WORKER'S COMPENSATION DECLARATION

I hereby affirm under penalty of perjury one of the following declarations:

☐ I have and will maintain a certificate of consent to self-insure for worker's compensation, as provided for by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.

☐ I have and will maintain worker's compensation insurance, as required by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued. My worker's compensation insurance carrier and policy number are:

Carrier: Everest National Ins Co

Policy No. 7600017102181

(This section need not be completed if the permit is for one hundred dollars ($100) or less).

I hereby agree to comply with all laws and regulations of the County of Sonoma and State of California pertaining to water well construction. I will telephone (707) 565-1694 to notify the Environmental Health Specialist 24 hours prior to commencing this work. **I will furnish the Permit and Resource Management Department and the owner a copy of the State Well Completion Report within thirty (30) days in order to obtain final approval on this well as required by SONOMA COUNTY CODE, CHAPTER 25B.** I acknowledge that the application will become a permit only after site approval and payment of fee. I understand that this permit is not transferable and expires one year from the date of issuance.

Signature of Well Driller: [signature] Date: 3/20/18

WARNING: FAILURE TO SECURE WORKER'S COMPENSATION COVERAGE IS UNLAWFUL, AND SHALL SUBJECT AN EMPLOYER TO CRIMINAL PENALTIES AND CIVIL FINES UP TO ONE HUNDRED THOUSAND DOLLARS ($100,000), IN ADDITION TO THE COST OF COMPENSATION, DAMAGES AS PROVIDED FOR IN SECTION 3706 OF THE LABOR CODE, INTEREST, AND ATTORNEY'S FEES.

DO NOT WRITE BELOW THIS LINE - To Be Completed by PRMD Staff

Site approved by: [signature] Date: 4/24/18 Seal Inspection Date: EHS

Finaled by: Date: GW Zone: 1 2 3 4

Comments: Site #1 + #2 approved (not #3)

1:00 inspection 6/11/18 conf #109800

Sonoma County Permit and Resource Management Department
2550 Ventura Avenue ❖ Santa Rosa, CA ❖ 95403-2829 ❖ (707) 565-1900 ❖ Fax (707) 565-1399

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size If any (inches)	Description
1	0	120	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	120	300	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	3	Cement	Other Cement		
3	100	Bentonite	Other Bentonite		
100	300	Other Fill	See description.		8X16 AND 12X20

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	300	11

Certification Statement

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

Name: LES PETERSEN DRILLING & PUMP INC
Person, Firm or Corporation

5434 OLD REDWOOD HWY | SANTA ROSA | CA | 95403
Address | City | State | Zip

Signed: *electronic signature received* | 06/20/2018 | 261084
C-57 Licensed Water Well Contractor | Date Signed | C-57 License Number

DWR Use Only

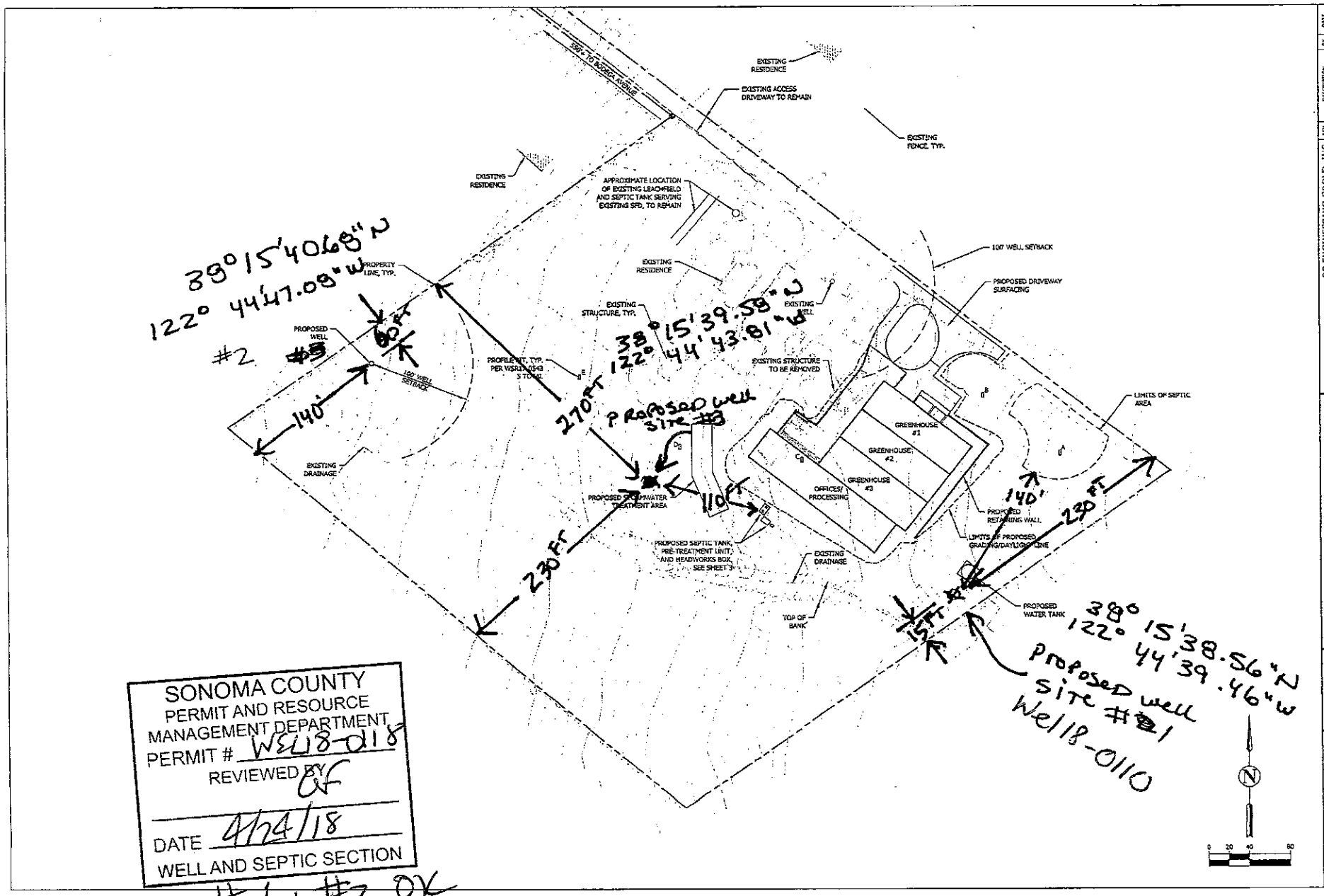
CSG #	State Well Number	Site Code	Local Well Number

N — Latitude Deg/Min/Sec

W — Longitude Deg/Min/Sec

TRS:

APN:



SONOMA COUNTY
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
PERMIT # WELL 18-0118
REVIEWED BY OK
DATE 4/24/18
WELL AND SEPTIC SECTION

#1 + #2 OK

REV.	DESCRIPTION	BY	DATE

BC ENGINEERING GROUP, INC.
CIVIL ENGINEERING & LAND PLANNING
www.bcengineeringgroup.com
Phone: (707) 542-1111
SANTA ROSA OFFICE:
3800 Cleveland Ave, Suite C, Santa Rosa CA 95403
UKIAH OFFICE:
603 S. State Street, Ukiah CA 95482

OVERALL SITE PLAN

FENIX FARMS, LLC
6095 BODEGA AVENUE
PETALUMA, CA 94952

Date: 1/2/18
Job: 384-17
Drawn: WTB
Scale: 1" = 40'
APN: 022-200-002
Permit #: SEP# V-J-E-R-V
Sheet: 2 OF 6

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 2
(Insert appropriate number)

RECEIVED
REGIONAL WATER POLLUTION CONTROL BOARD #2
MAY 29 1957

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

Do Not Fill In
No. 2910
State Well No. 5N/8W-21L1
Other Well No.

2326

(1) OWNER
Name
Address

(2) LOCATION OF WELL:
County Sonoma Owner's number, if any—
R. F. D. or Street No. 6410 Bodega Ave., Petaluma.

about 6 miles west of Petaluma on Bodega Ave.

(3) TYPE OF WORK (*check*):
New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

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

(5) EQUIPMENT:
Rotary ☐
Cable ☒
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☒ DOUBLE ☐

From	ft. to	ft.	Diam.	Gage or Wall
0		20	8"	3/16

20 ft. of 8" pipe in well

Type and size of shoe or well ring 8" forged
Describe joint

If gravel packed

Diameter of Bore	from ft.	to ft.

Size of gravel:

(7) PERFORATIONS:
Type of perforator used no perfs.
Size of perforations in., length, by in.

From	ft. to	ft.	Perf. per row	Rows per ft.

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☒ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, note depth of strata

From	ft. to	ft.

Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found little at 12 ft.
Standing level before perforating ft.
Standing level after perforating 4 ft. ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: 225 gph gal./min. with 140 ft. draw down after 2 hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:
Total depth 155 ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material, and structure.*

ft. to	ft.	
0	3	top soil
3	5	hard pan
5	17	sandy yellow clay
~~17~~	~~48~~	
17	155	blue sandstone

Work started 1/7 19 57, Completed 1/10 19 57

FOR OFFICIAL USE ONLY

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

NAME Keyt-Well Driller
(Person, firm, or corporation) (*Typed or printed*)
Address 605 Sierra Ave., Cotati, Calif.

[SIGNED] N. F. Keyt
Well Driller
License No. 3160 Dated 5/18, 19 57

95689 3-54 50M QUIN ® SPO DWR FORM NO. 246 (REV. 3-54)

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No._____
(Insert appropriate number)

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

100

Do Not Fill In
No. 52699

State Well No._____
Other Well No. 5N/8W-2 1Q8

(1) OWNER
Name
Address

(2) LOCATION OF WELL: Sonoma
County [redacted] Owner's number, if any—
R. F. D. or Street No. 4381 Middle Two Rock Rd.;400 ft. North of Middle Two Rock Rd.; 100 ft. West of Bodega Rd.

(3) TYPE OF WORK (*check*):
New well ☐ Deepening ☑ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☑ agriculture

(5) EQUIPMENT:
Rotary ☐
Cable ☐
Dug Well ☑

(6) CASING INSTALLED:
SINGLE ☐ DOUBLE ☐

From	ft. to	ft.	Diam.	Gage or Wall
"	" None	"	"	"
	"	"	"	"
	"	"	"	"
"	"	"	"	"
"	"	"	"	"

If gravel packed

Diameter of Bore	from ft.	to ft.
	"	"
	"	"
	"	"
	"	"
	"	"

Type and size of shoe or well ring
Size of gravel:
Describe joint

(7) PERFORATIONS:
Type of perforator used
Size of perforations in., length, by in.

From	ft. to	ft.	Perf. per row	Rows per ft.
"	"	"	" " "	" " "
"	"	"	" " "	" " "
"	"	"	" " "	" " "
"	"	"	" " "	" " "

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☑ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☑ No If yes, note depth of strata

From	ft. to	ft.
"	"	"

Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found 14 ft.
Standing level before perforating ft.
Standing level after perforating ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☑ No If yes, by whom?
Yield: 3 gal./min. with ft. draw down after hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☑ No
Was electric log made of well? ☐ Yes ☑ No

(11) WELL LOG:
Total depth 30 ft. Depth of completed well 52 ft.
Formation: *Describe by color, character, size of material, and structure.*

ft. to	ft.	
22	52	very hard clamshell boulders in firm blue sand.

FOR OFFICIAL USE ONLY

Work started August 8, 1959 Completed August 11, 1959

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

NAME BALLARD & FOOTE
(Person, firm, or corporation) (*Typed or printed*)
Address 4625 Stoetz Lane
Sebastopol, Calif.

[SIGNED] Robert A. Foote Jr.
Well Driller
License No. 185456 Dated Sept. 6, 1959

57025 6-57 50M QUIN △ SPO DWR 188 (REV. 3-54)

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 066438

Notice of Intent No.
Permit No. or Date 139-79

State Well No.
Other Well No. SN 8W-21

(2) LOCATION OF WELL (See instructions): 22-330-08

County Sonoma Owner's Well Number
Well address if different from above 6025 Bodega Ave
Township Petaluma Range Section
Distance from cities, roads, railroads, fences, etc.

WELL LOCATION SKETCH

(3) TYPE OF WORK:

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

(4) PROPOSED USE:

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

(5) EQUIPMENT:

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

(6) GRAVEL PACK:

Yes ☒ No ☐ Size fine pea
Diameter of bore 12" to 9 7/8"
Packed from 30 to 185 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	185	6 5/8	CL160

(8) PERFORATIONS: saw cut

Type of perforation or size of screen

From ft.	To ft.	Slot size
65	85	1/8 x 3
105	125	"
145	165	"

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 30 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ft.
Method of sealing concrete on pack

(10) WATER LEVELS:

Depth of first water, if known ft.
Standing level after well completion 40 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Weeks
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test 40 ft. At end of test 175 ft.
Discharge 7 gal/min after 2 hours Water temperature cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG:

Total depth 185 ft. Depth of completed well 185 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	Top soil
3	28	Yellow & Brown Sand
28	42	Blue Sand Seams in Brown Sandstone
42	130	Clay Blue Sand w/Sandstone Ledges
130	185	Clayee Blue Sand, Traces of Shells & Sandstone Ledges

Work started 4-10-79 19 Completed 4-11-79 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 Gerald G. Thompson by Mary E. Thompson (Well Driller)
NAME Weeks Drilling and Pump Company (Person, firm, or corporation) (Typed or printed)
Address 6100 Sebastopol Rd.
City Sebastopol, Ca. Zip 95472
License No. 177681 Date of this report 4-11-79

Mary E. Thompson

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

DUPLICATE
Retain this copy

CONFIDENTIAL LOG
Water Code Sec. 13752

Do Not Fill In
№ 91008

State Well No.
Other Well No. 5N/8W-21 H

(2) LOCATION OF WELL:
County Sonoma Owner's number, if any 22-339-04
Township, Range, and Section Green Valley Ranch
Distance from cities, roads, railroads, etc. Petaluma Valley Road Hwy 116

(3) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Destroying [ ]
If destruction, describe material and procedure in Item 11.

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

(5) EQUIPMENT:
Rotary [ ]
Cable [X]
Other [ ]

(6) CASING INSTALLED:
STEEL: SINGLE [X] DOUBLE [ ] OTHER:

From ft.	To ft.	Diam.	Gage Wall	Diameter of Bore	If gravel packed From ft.	To ft.
0	102	8	188	10	22	100

Size of shoe or well ring: 3/16 x 6 x 8 Size of gravel: pea
Describe joint Butt weld

(7) PERFORATIONS OR SCREEN:
Type of perforation or name of screen Machine sawed

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
50	102	3	10	1/8 x 3

(8) CONSTRUCTION:
Was a surface sanitary seal provided? Yes [X] No [ ] To what depth 22 ft.
Were any strata sealed against pollution? Yes [ ] No [X] If yes, note depth of strata
From ft. to ft.
From ft. to ft.
Method of sealing grout

(9) WATER LEVELS:
Depth at which water was first found, if known ft. 57
Standing level before perforating, if known ft.
Standing level after perforating and developing 10 ft. 45

(10) WELL TESTS:
Was pump test made? Yes [X] No [ ] If yes, by whom? Driller
Yield: 4 gal./min. with 60 ft. drawdown after 1 hrs.
Temperature of water Was a chemical analysis made? Yes [ ] No [X]
Was electric log made of well? Yes [ ] No [X] If yes, attach copy

(11) WELL LOG:
Total depth 200 ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material, and structure*

ft.	to ft.	
0	3	Top soil
3	52	Yellow sandstone
52	57	Broken yellow sandstone
57	200	Blue sandstone

Work started May 6 1975, Completed May 16 1975

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

NAME Rettler & Pullam (Person, firm, or corporation) (Typed or printed)
Address 1541 Mark West Springs Rd Santa Rosa Calif.
[SIGNED] Walter Rettler (Well Driller)
License No. 288649 Dated May 20 1975

SKETCH LOCATION OF WELL ON REVERSE SIDE

CONFIDENTIAL LOG
Water Code Sec. 13752

DWR 188 (REV. 9-68)

25179-950 9-68 50M TRIP △D OSP

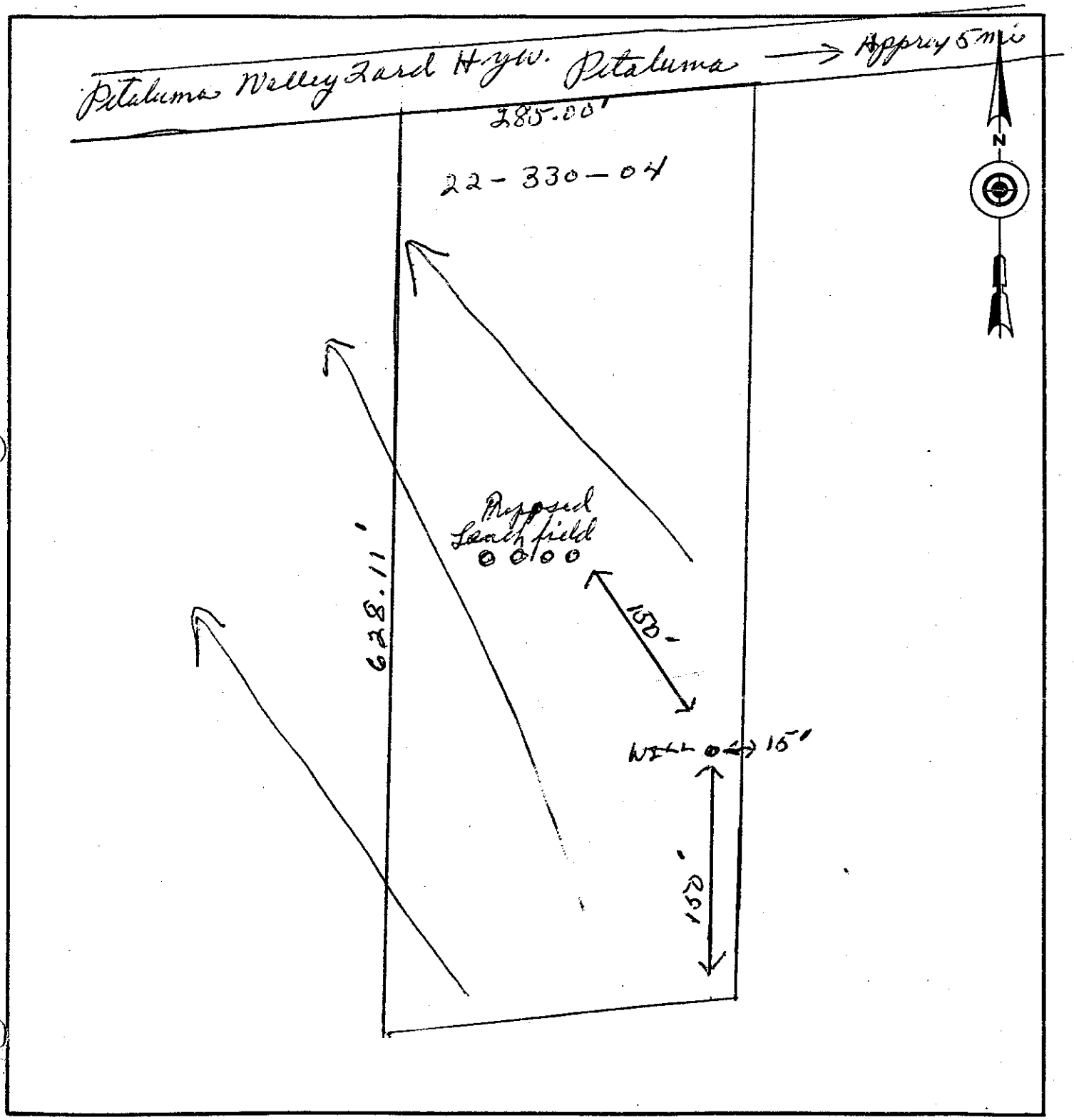
COUNTY OF SONOMA PUBLIC HEALTH SERVICE
3313 Chanate Road
Santa Rosa, California 95404
Telephone 527-2711

91088
Permit no. 153-25

WELL PERMIT APPLICATION
(Plot Plan or Sketch)

Well address Petaluma Valley Lard Hgwy. Green Valley Road Petaluma A.P. #22-330-04 Block Two

Indicate below the exact location of well with respect to the following items: property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems. INCLUDE DIMENSIONS.



Form-PHS-EH-W-2 (2/21/73) (2000)

ORIGINAL File with DWR

CONFIDENTIAL LOG
Water Code Sec. 13752

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 143889

State Well No.

Other Well No. 5N/8W-21

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any

Township, Range, and Section 4381 Middle Two Rocks Rd.

Distance from cities, roads, railroads, etc. 22—190—15

(3) TYPE OF WORK (*check*):

New Well [X] Deepening [ ] Reconditioning [ ] Destroying [ ]

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

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

(5) EQUIPMENT:

Rotary [ ]
Cable [X]
Other [ ]

(6) CASING INSTALLED:

STEEL: SINGLE [X] DOUBLE [ ] OTHER:

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	40	8	188			

If gravel packed

Size of shoe or well ring: 7x12x8 Size of gravel:

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
None				

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes [X] No [ ] To what depth 21 ft.

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

From ft. to ft.

From ft. to ft.

Method of sealing Grout

(9) WATER LEVELS:

Depth at which water was first found, if known ft. 40

Standing level before perforating, if known ft.

Standing level after perforating and developing ft. 30

(10) WELL TESTS:

Was pump test made? Yes [X] No [ ] If yes, by whom? Driller

Yield: 4 gal./min. with 90 ft. drawdown after 4 hrs.

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

Was electric log made of well? Yes [ ] No [X] If yes, attach copy

(11) WELL LOG:

Total depth 203 ft. Depth of completed well ft.

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

ft. to	ft.	
0	85	Hard brown sandstone
85	187	Blue & gray sandstone
187	203	gray sandstone & clay

Work started May 5 19 77, Completed May 20 19 77

WELL DRILLER'S STATEMENT:

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

NAME Pettis & Sullivan
(Person, firm or corporation) (*Typed or printed*)

Address 1541 Mark West Springs Rd
Santa Rosa, Ca.

[SIGNED] Walter Cutter
(Well Driller)

License No. 288649 Dated May 22 19 77

SKETCH LOCATION OF WELL ON REVERSE SIDE

CONFIDENTIAL LOG
Water Code Sec. 13752

DWR 188 (REV. 9-68)

8-72 30M TRIP ① T OSP

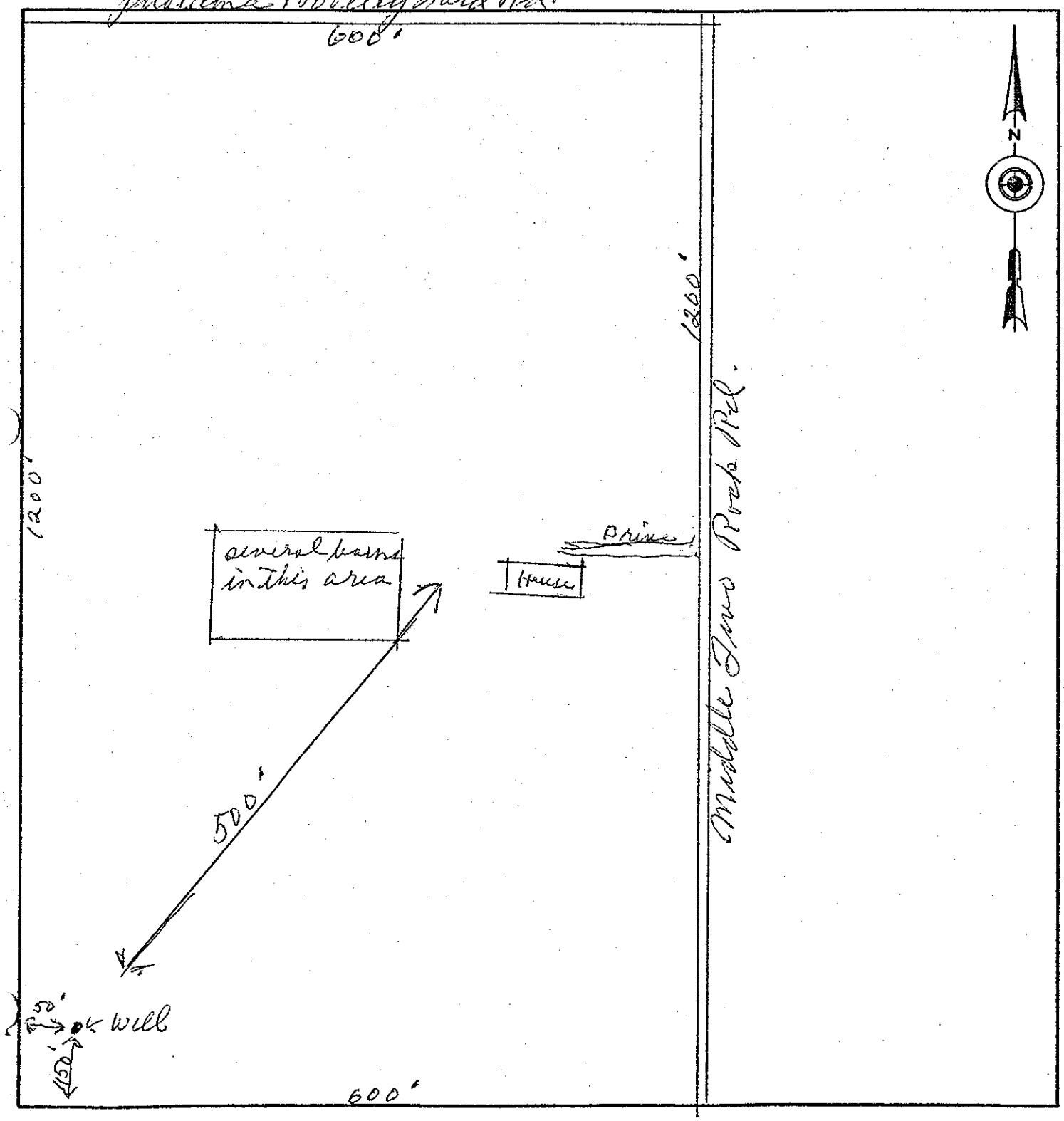
COUNTY OF SONOMA PUBLIC HEALTH SERVICE
3313 Chanate Road
Santa Rosa, California 95404
Telephone 527-2711

143889
Permit no. 139-77

WELL PERMIT APPLICATION
(Plot Plan or Sketch)

Well address 4381 Middle Two Rock Rd Petaluma A.P. # 022-190-15-1

Indicate below the exact location of well with respect to the following items: property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems. INCLUDE DIMENSIONS.



ORIGINAL File with DWR

CONFIDENTIAL LOG Water Code Sec. 13752

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 143891

State Well No.

Other Well No. 5N/8W-21

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any

Township, Range, and Section Green Valley Ranch.

Distance from cities, roads, railroads, houses Bodega Hwy Lot #2.

Petaluma 22-200-02

(3) TYPE OF WORK (check):

New Well [X] Deepening [ ] Reconditioning [ ] Destroying [ ]

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

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

(5) EQUIPMENT:

Rotary [ ]
Cable [ ]
Other [ ]

(6) CASING INSTALLED:

STEEL: SINGLE [X] DOUBLE [ ] OTHER:

From ft.	To ft.	Diam.	Gage Wall	Diameter of Bore	From ft.	To ft.
0	100	8	188			

If gravel packed

Size of shoe or well ring: 3/16 x 6 x 8 Size of gravel:

Describe joint Weld.

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
	None			

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes [X] No [ ] To what depth 22 ft.

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

From ft. to ft.

From ft. to ft.

Method of sealing grout

(9) WATER LEVELS:

Depth at which water was first found, if known ft. 108

Standing level before perforating, if known ft.

Standing level after perforating and developing ft. 100

(10) WELL TESTS:

Was pump test made? Yes [X] No [ ] If yes, by whom? drillers

Yield: 55 gal./min. with 60 ft. drawdown after 4 hrs.

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

Was electric log made of well? Yes [ ] No [X] If yes, attach copy

(11) WELL LOG:

Total depth 220 ft. Depth of completed well ft.

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

Depth	Formation
0-21	Gray sandstone
21-108	Brown sandstone
108-205	Blue sandstone
205-220	gray sandstone

Work started May 24 19 77, Completed May 26 19 77

WELL DRILLER'S STATEMENT:

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

NAME Rittler + Pullman (Person, firm, or corporation) (Typed or printed)

Address 1544 Mark West Springs Rd Santa Rosa, Ca

[SIGNED] Walter Rittler (Well Driller)

License No. 288649 Dated June 2, 19 77

SKETCH LOCATION OF WELL ON REVERSE SIDE

CONFIDENTIAL LOG
Water Code Sec. 13752

DWR 188 (REV. 9-68)

8-72 30M TRIP 1T OSP

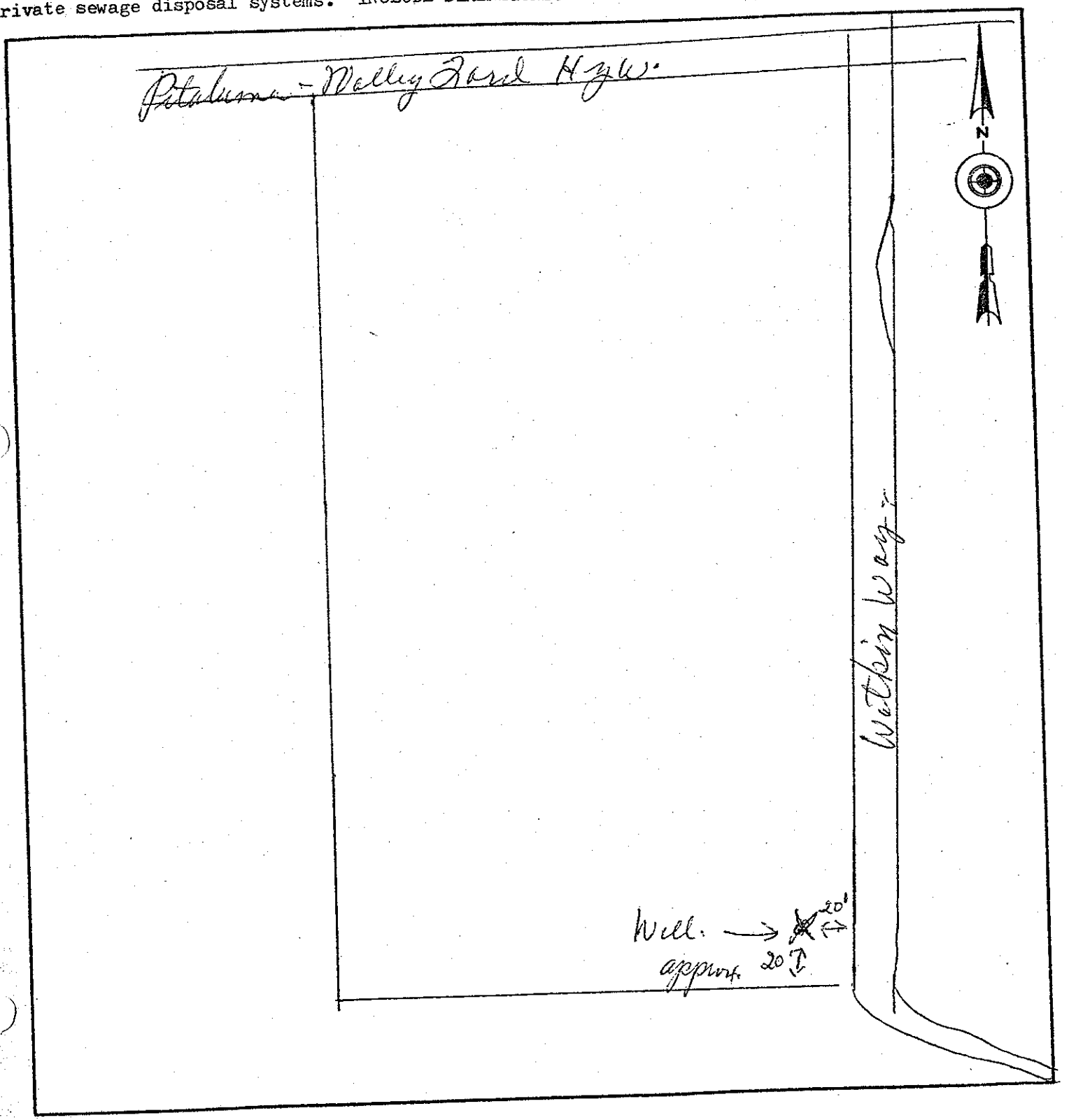
COUNTY OF SONOMA PUBLIC HEALTH SERVICE
3313 Chanate Road
Santa Rosa, California 95404
Telephone 527-2711

143891
Permit no. 640-77

WELL PERMIT APPLICATION
(Plot Plan or Sketch)

Well address Green Valley Ranch. Petaluma A.P. # 22-200-02.
No address number available until Time of Home Construction

Indicate below the exact location of well with respect to the following items: property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems. INCLUDE DIMENSIONS.



Form-PHS-EH-W-2 (2/21/73) (2000)

ORIGINAL
File with DWR

Page ____ of ____
Owner's Well No. ____
Date Work Began 8/16/00 Ended 8/17/00
Local Permit Agency permit & resource management
Permit No. WEL00-0352 Permit Date 5/29/00

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 812610

DWR USE ONLY — DO NOT FILL IN
05N08W21
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	55	yellow sandstone
55	110	blush yellow firm sandstone w/ occasional hard concretions 2 GPM
110	220	firm blue sandstone with occasional fractured concretions 6 GPM
220	240	firm blue sandstone with hard layers of fractured cemented gravel 20 GPM
240	250	yellow firm Franciscan shale

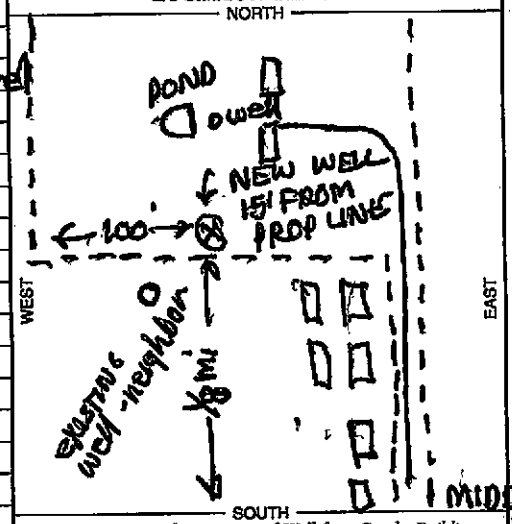
TOTAL DEPTH OF BORING 250 (Feet)
TOTAL DEPTH OF COMPLETED WELL 250 (Feet)

WELL OWNER

WELL LOCATION

Address Same
City ____
County Sonoma
APN Book 022 Page 190 Parcel 012
Township ____ Range ____ Section ____
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



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

ACTIVITY (✓)

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

PLANNED USES (✓)

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

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 75 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 30 (Ft.) & DATE MEASURED 8/17/00
ESTIMATED YIELD * 20 (GPM) & TEST TYPE air lift
TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 250 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	100	10"	✓				F480 PVC	5"	C1200	
100	130	8"	✓				"	"	"	
130	250	8"		✓			"	"	"	.032"

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	4	✓			
4	100		✓		
100	250	12/20			& 8/16 sand

ATTACHMENTS (✓)

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

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

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

NAME NUTTING & JENSEN DRILLING (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 1924 GRAVENSTEIN HWY SO CITY SEBASTOPOL STATE CA ZIP 95472
Signed Gary Jensen WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED 8/17/00 C-57 LICENSE NUMBER 340854

DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

21H ?

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 1
(Insert appropriate number)

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

4803

Do Not Fill In
No. 80477
State Well No.
Other Well No. 5/8-22M8

Name
Address

(2) LOCATION OF WELL:
County Sonoma Owner's number, if any— #1
R. F. D. or Street No.
6095 Bodega Avenue
Petaluma, California

(3) TYPE OF WORK (*check*):
New well XX Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):
Domestic XX Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary XX
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:
SINGLE XX DOUBLE ☐

From ft.	to ft.	Diam.	gage or wall	Diameter of Bore	from ft.	to ft.
0	160	6 5/8"	156	12 1/2"	0	160

Type and size of shoe or well ring None
Describe joint Welded

If gravel packed
Size of gravel: Pea

(7) PERFORATIONS:
Type of perforator used Torch
Size of perforations 6 in., length, by 3/16 in.

From ft.	to ft.	Perf. per row	Rows per ft.
40	100	3	1
120	160	3	1

(8) CONSTRUCTION:
Was a surface sanitary seal provided? XX Yes ☐ No To what depth 25 ft.
Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata
From ft. to ft.
Method of Sealing Cement on Pack

(9) WATER LEVELS:
Depth at which water was first found ft.
Standing level before perforating ft.
Standing level after perforating 7 ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes XX No If yes, by whom? Bailer
Yield: 9 gal./min. with 143 ft. draw down after hrs.
Temperature of water Cool Was a chemical analysis made? ☐ Yes XX No
Was electric log made of well? ☐ Yes XX No

(11) WELL LOG:
Total depth 160 ft. Depth of completed well 160 ft.
Formation: *Describe by color, character, size of material, and structure.*

ft. to	ft.	
0	5	Top Soil
5	11	Blue Sand
11	160	Blue Sandstone with Seams of Blue Sand

FOR OFFICIAL USE ONLY

Work started 11/30/ 1964. Completed 12/4/ 64

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

NAME WEEKS DRILLING & PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)
Address 6100 Sebastopol Road
Sebastopol, California
[SIGNED] Gerald Thompson
Well Driller
License No. 177681 Dated 12/5/, 1964

21H?

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 1
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

Do Not Fill In
No. 80482

State Well No.
Other Well No. 5/8-22M

Name
Address

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any— #4

R. F. D. or Street No.
6095 Bodega Avenue
Petaluma, California

(3) TYPE OF WORK (*check*):

New well XX Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

Domestic XX Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary XX
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:

SINGLE XX DOUBLE ☐

From	ft. to	ft.	Diameter	Gage or Wall
0	114	6 5/8"	12	

If gravel packed

Diameter of Bore	from ft.	to ft.
12 1/2"	0	114

Type and size of shoe or well ring None
Describe joint Welded

Size of gravel: Pea

(7) PERFORATIONS:

Type of perforator used Torch

Size of perforations 6 in., length, by 3/16 in.

From ft.	to ft.	Perf. per row	Rows per ft.
34	114	4	1

(8) CONSTRUCTION:

Was a surface sanitary seal provided XX Yes ☐ No To what depth 20 ft.

Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata

From ft. to ft.

Method of Sealing Cement on Pack

(9) WATER LEVELS:

Depth at which water was first found ft.

Standing level before perforating ft.

Standing level after perforating 20 ft.

(10) WELL TESTS:

Was a pump test made? ☐ Yes XX No If yes, by whom? Bailer

Yield: 5 gal./min. with 90 ft. draw down after hrs.

Temperature of water Cool Was a chemical analysis made? ☐ Yes XX No

Was electric log made of well? ☐ Yes XX No

(11) WELL LOG:

Total depth 114 ft. Depth of completed well 114 ft.

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

ft. to	ft.	
0	4	Top Soil
4	14	Brown Sandy Clay
14	114	Blue Sandstone with Traces of Shells

FOR OFFICIAL USE ONLY

Work started 12/17/ 19 64 Completed 12/8/ 19 64

WELL DRILLER'S STATEMENT:

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

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

Address 6100 Sebastopol Road
Sebastopol, California

[SIGNED] Gerald Thompson
GERALD THOMPSON Well Driller

License No. 177681 Dated 12/12/, 19 64

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 1
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

Do Not Fill In
No. 80488

State Well No.
Other Well No. 5/8-22M8

(1)
Name
Address

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any— #5

R. F. D. or Street No.
6095 Bodega Highway
Petaluma, California

(3) TYPE OF WORK (*check*):

New well XX Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

Domestic XX Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary XX
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:

SINGLE XX DOUBLE ☐

From	ft. to		ft.	Gage or Wall
0	8	8	5/8"	10

Type and size of shoe or well ring 12"

Describe joint None

If gravel packed

Diameter of Bore	from ft.	to ft.

Size of gravel:

(7) PERFORATIONS:

Type of perforator used None

Size of perforations in., length, by in.

From	ft. to	ft.	Perf. per row	Rows per ft.
0	H			
P	O			
E	L			
N	E			

(8) CONSTRUCTION:

Was a surface sanitary seal provided? XX Yes ☐ No To what depth 8 ft.

Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata

From	ft. to	ft.

Method of Sealing Cement on Ring

(9) WATER LEVELS:

Depth at which water was first found ft.

Standing level before perforating ft.

Standing level after perforating 90 ft.

(10) WELL TESTS:

Was a pump test made? ☐ Yes XX No If yes, by whom? Bailer

Yield: 10 gal./min. with 200 ft. draw down after hrs.

Temperature of water Cool Was a chemical analysis made? ☐ Yes XX No

Was electric log made of well? ☐ Yes XX No

(11) WELL LOG:

Total depth 295 ft. Depth of completed well 295 ft.

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

ft. to	ft.	
0	3	Top Soil
3	76	Brown Sandstone
76	98	Blue Sandstone & Shell
98	295	Blue Sandstone with Streaks of Sticky Blue Sand

FOR OFFICIAL USE ONLY

Work started 12/9/ 1964. Completed 12/14/ 1964

WELL DRILLER'S STATEMENT:

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

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

Address 6100 Sebastopol Road
Sebastopol, California

[SIGNED] Gerald Thomson
GERALD THOMSON (Well Driller)

License No. 177681 Dated 12/17/, 1964

57025 6-57 50M QUIN △ SPO

DWR 188 (REV. 3-54)

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 1
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

4820

Do Not Fill In
No. 80489

State Well No.
Other Well No. 5/8-32M1

(1)
Name
Address

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any— #6

R. F. D. or Street No.
6095 Bodega Highway
Petaluma, California

(3) TYPE OF WORK (*check*):

New well XX Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

Domestic XX Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary XX
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:

SINGLE XX DOUBLE ☐

From	ft. to	Diam.	Gage or Wall
0	204	6 5/8"	12"

If gravel packed

Diameter of Bore	from	to
12 1/2"	0	204 ft.

Type and size of shoe or well ring None
Size of gravel: Pea
Describe joint Welded

(7) PERFORATIONS:

Type of perforator used Torch

Size of perforations 6 in., length, by 3/16 in.

From	ft. to	ft.	Perf. per row	Rows per ft.
64	84	4	1	
104	144	4	1	
164	204	4	1	

(8) CONSTRUCTION:

Was a surface sanitary seal provided? XX Yes ☐ No To what depth 30 ft.

Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata

From ft. to ft.

Method of Sealing Cement on Pack

(9) WATER LEVELS:

Depth at which water was first found ft.
Standing level before perforating ft.
Standing level after perforating 65 ft.

(10) WELL TESTS:

Was a pump test made? ☐ Yes XX No If yes, by whom? Bailer

Yield: 8 gal./min. with 135 ft. draw down after hrs.

Temperature of water Cool Was a chemical analysis made? ☐ Yes XX No

Was electric log made of well? ☐ Yes XX

(11) WELL LOG:

Total depth 204 ft. Depth of completed well 204 ft.

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

ft. to	ft.	
0	3	Top Soil
3	78	Brown Sand
78	204	Blue Sandstone with Streaks of Soft Blue Sand

FOR OFFICIAL USE ONLY

Work started 12/14/ 1964, Completed 12/17/ 1964

WELL DRILLER'S STATEMENT:

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

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

Address 6100 Sebastopol Road
Sebastopol, California

[SIGNED] Gerald Thompson
(Well Driller)

License No. 177681 Dated 12/17/, 1964

57025 6-57 50M QUIN △ SPO DWR 188 (REV. 3-54)

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 1
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

2/8310 orgell

Do Not Fill In
No. 80491
State Well No.
Other Well No. 5/8-2 2M6

(1)
Name
Address

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any Well #7-Lot #7

R. F. D. or Street No.
6095 Bodega Highway
Petaluma, California

(3) TYPE OF WORK (*check*):

New well XX Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

Domestic XX Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary XX
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:

SINGLE XX DOUBLE ☐

From	to	Diameter of Bore	Gage or Wall
0 ft.	136 ft.	6 5/8"	12

If gravel packed

from	to
12 1/2" 0 ft.	136 ft.

Type and size of shoe or well ring None
Size of gravel: Pea
Describe joint Welded

(7) PERFORATIONS:

Type of perforator used Torch
Size of perforations 6 in., length, by 3/16 in.

From	to	Perf. per row	Rows per ft.
36 ft.	136 ft.	4	1

(8) CONSTRUCTION:

Was a surface sanitary seal provided? XX Yes ☐ No To what depth 20 ft.
Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata
From ft. to ft.
Method of Sealing Cement on Pack

(9) WATER LEVELS:

Depth at which water was first found ft.
Standing level before perforating ft.
Standing level after perforating 14 ft.

(10) WELL TESTS:

Was a pump test made? ☐ Yes XX No If yes, by whom? Bailer
Yield: 12 gal./min. with 116 ft. draw down after hrs.
Temperature of water Cool Was a chemical analysis made? ☐ Yes XX No
Was electric log made of well? ☐ Yes XX No

(11) WELL LOG:

Total depth 136 ft. Depth of completed well 136 ft.

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

ft. to	ft.	
0	4	Top Soil
4	18	Brown Sandstone
18	136	Blue Sandstone with Traces of Shells

FOR OFFICIAL USE ONLY

Work started 12/17/ 1964. Completed 12/21/ 1964

WELL DRILLER'S STATEMENT:

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

NAME WEEKS DRILLING & PUMP COMPANY
(Person, firm, or corporation) (*Typed or printed*)
Address 6100 Sebastopol Road
Sebastopol, California

[SIGNED] Gerald Thompson
GERALD THOMPSON (Well Driller)
License No. 177681 Dated 12/22/, 1964

CONFIDENTIAL LOG
Water Code Sec. 13752

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 143874

State Well No.
Other Well No. 5N/8W-22

(1
N
A

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any Lot #10
Township, Range, and Section Green Valley Ranch
Distance from cities, roads, etc. Petaluma Valley Ford Rd
22-330-16

(3) TYPE OF WORK (*check*):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐
If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

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

(5) EQUIPMENT:

Rotary ☐
Cable ☒
Other ☐

(6) CASING INSTALLED:

STEEL: SINGLE ☒ DOUBLE ☐ OTHER:

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	100	8	188			
		3				

If gravel packed

Size of shoe or well ring: 16x6x8 Size of gravel:
Describe joint Weld.

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen Mach sawed.

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
73	100	2	10	1/8x3

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth 20 ft.
Were any strata sealed against pollution? Yes ☐ No ☐ If yes, note depth of strata
From ft. to ft.
From ft. to ft.
Method of sealing grout.

(9) WATER LEVELS:

Depth at which water was first found, if known ft. 35
Standing level before perforating, if known ft.
Standing level after perforating and developing ft. 10

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Driller
d: 6 gal./min. with 100 ft. drawdown after hrs.
Temperature of water Was a chemical analysis made? Yes ☐ No ☒
Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 155 ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material, and structure*

ft. to ft.	
0-10	Brown sandstone
10-25	Green sandstone
25-35	Brown sandstone
35-150	Blue sandstone
150-155	Gray sandstone

Work started Dec 13 76, Completed Dec 16 76

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

NAME Pettila & Pullin
(Person, firm, or corporation) (*Typed or printed*)
Address 1541 Mark West Spr Rd
Santa Rosa Ca
[SIGNED] Walter Pettila
(Well Driller)
License No. 288649 Dated Dec 24 1976

SKETCH LOCATION OF WELL ON REVERSE SIDE

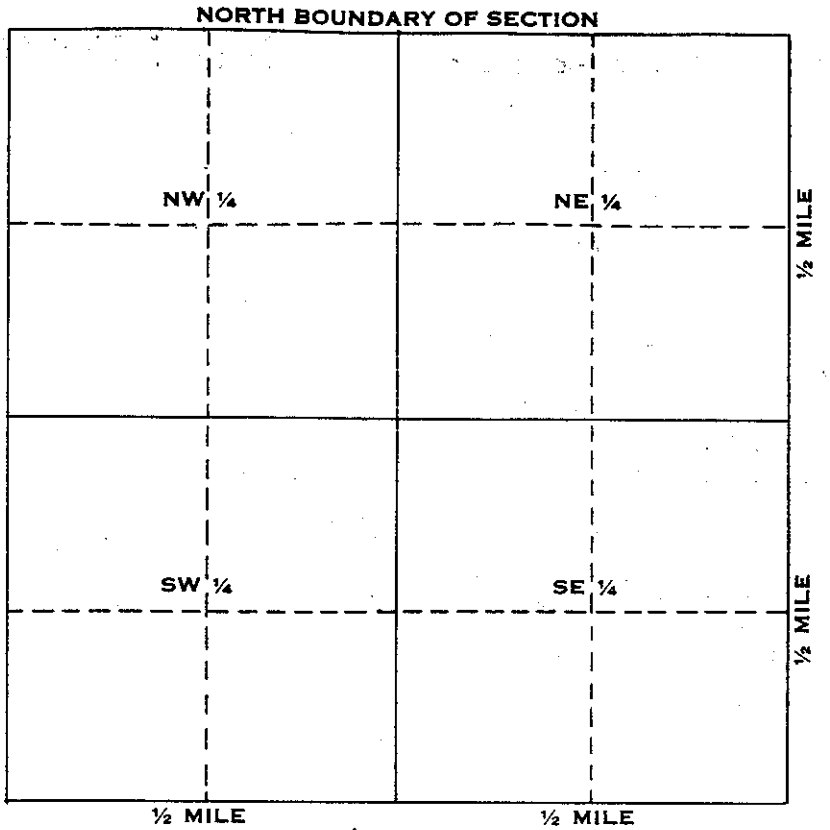
CONFIDENTIAL LOG
Water Code Sec. 13752

DWR 188 (REV. 9-68)

9-72 30M TRIP ① T OSP

WELL LOCATION SKETCH

143874



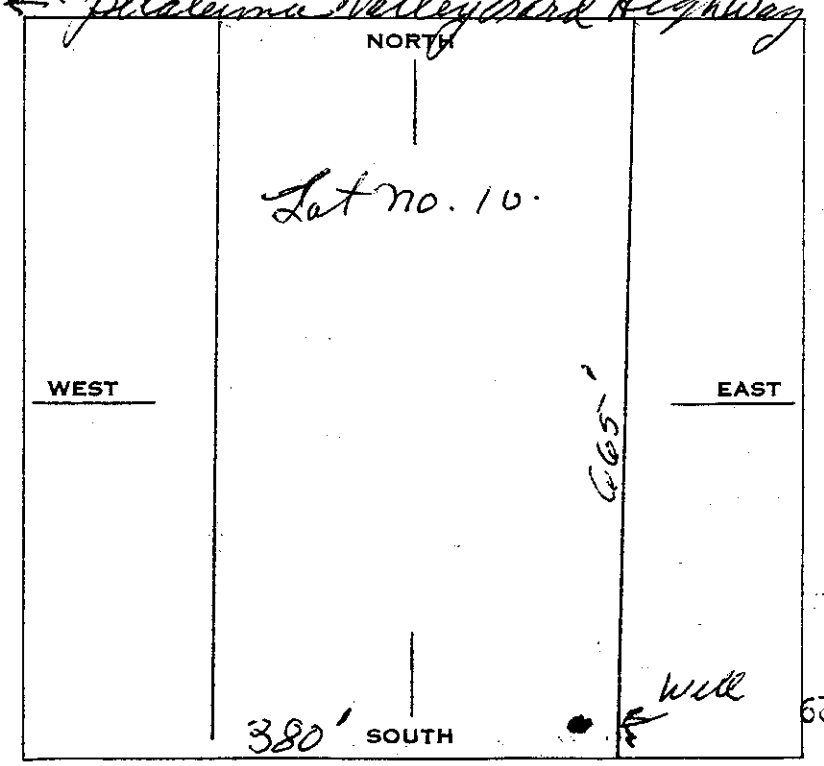
Township _____ N/S

Range _____ E/W

Section No. _____

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.

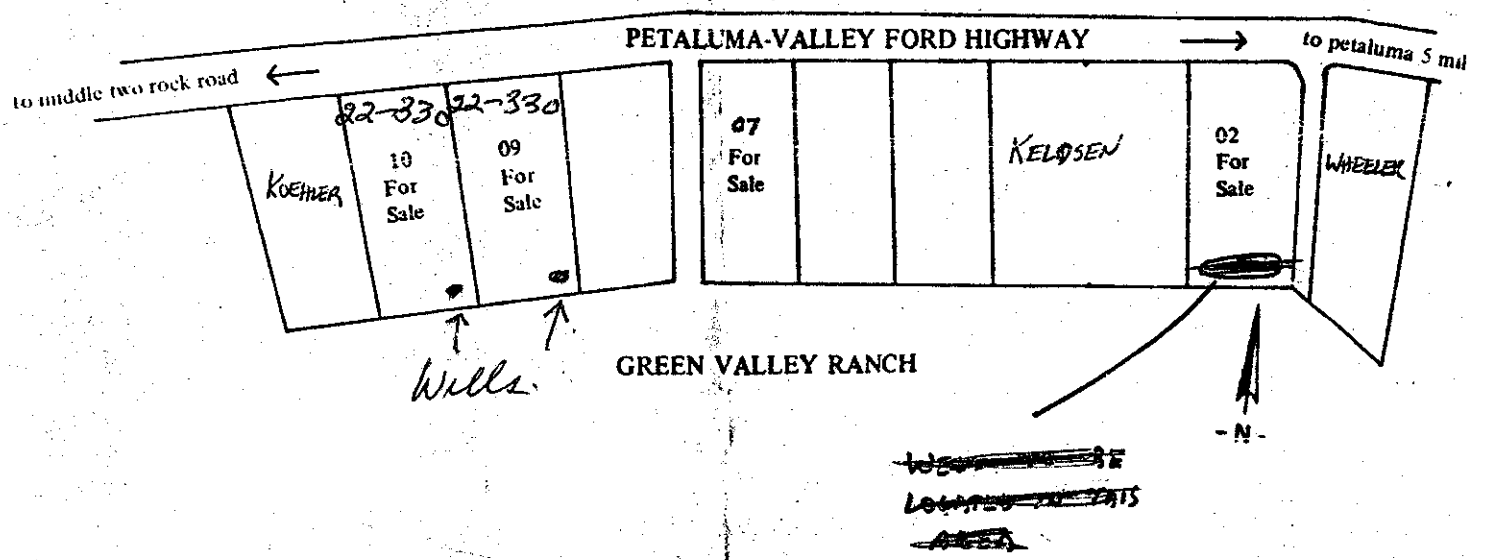
Petaluma Valley Bard Highway To Petaluma 5 mi →



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

143874

Permit # 1045-76



ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 338650

State Well No. 05N08W22

Other Well No.

Notice of Intent No.

Local Permit No. or Date 709-90

(12) WELL LOG: Total depth 257 ft. Completed depth 257 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	Topsoil
2	55	Yellow sandstone
55	80	Yellow clayee sands with small streaks of sandstone
80	257	Blue caly sands with streaks of sandstone

(2) LOCATION OF WELL (See instructions):

County Sonoma Owner's Well Number 022-330-01

Well address if different from above Same

Township Range Section

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

WELL LOCATION SKETCH

(3) TYPE OF WORK:

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

(4) PROPOSED USE:

Domestic ☒
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☐
Other ☐
(Describe)

(5) EQUIPMENT:

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

(6) GRAVEL PACK: Monterey Sand

Yes ☒ No ☐ Size 12 x 20

Diameter of bore 12½

Packed from 101 to 257 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	257	6"	CL200	117	257	.032

(8) PERFORATIONS:

Type of perforation or size of screen Micro

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 101 ft.

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

Method of sealing Sand Grout On Pack

(10) WATER LEVELS:

Depth of first water, if known ft.

Standing level after well completion 110? ft.

(11) WELL TESTS:

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

Type of test Pump ☐ Bailer ☒ Air lift ☐

Depth to water at start of test 110? ft. At end of test 160 ft.

Discharge 20 gal/min after 2 hours Water temperature cool

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

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

Work started 12-7 19 90 Completed 12-12 19 90

WELL DRILLER'S STATEMENT:

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

Signed Ward Thompson (Well Driller)

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

Address POB 176

City Sebastopol, CA ZIP 95473

License No. C57-177681 Date of this report 1-4-91

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 (REV. 12-86) 86 96355

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. _____
(Insert appropriate number)

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)
STATE OF CALIFORNIA

RECEIVED
REGIONAL WATER POLLUTION
CONTROL BOARD #2
DEC 6 1956

21/28/27 7

Do Not Fill In
No 24918
State Well No. 5N/8W-28
Other Well No. _____

(1) OWNER:

(2) LOCATION OF WELL:
County Sonoma Owner's number, if any— 4045
R. F. D. or Street No. 4045 Middle Two Rock Rd
Petaluma, Calif.

(3) TYPE OF WORK (*check*):
New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

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

(5) EQUIPMENT:
Rotary ☐
Cable ☒
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☒ DOUBLE ☐

From ft.	to ft.	Diam.	Gage or Wall
12	8	3/16	

If gravel packed

Diameter of Bore	from ft.	to ft.

Type and size of shoe or well ring 8" steel
Size of gravel:
Describe joint but weld

(7) PERFORATIONS:
Type of perforator used none
Size of perforations in., length, by in.

From ft.	to ft.	Perf. per row	Rows per ft.

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☒ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, note depth of strata

From ft.	to ft.

Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found 16 ft.
Standing level before perforating 10 ft.
Standing level after perforating ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: 1 gal./min. with 128 ft. draw down after 1 hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:
Total depth 130 ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material, and structure.*

ft. to	ft.	
0	3	top soil
3	10	yellow sand stone
10	130	blue " "

FOR OFFICIAL USE ONLY

Work started 9-15-56 19, Completed 9-19-56 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.

NAME Oberto's Well Drilling
(Person, firm, or corporation) (Typed or printed)
Address 421 Washington St
Petaluma, Calif.
[SIGNED] A. J. Oberto
Well Driller
License No. 81877 Dated 11-6-56, 19

95689 3-54 50M QUIN ® SPO DWR FORM NO. 246 (REV. 3-54)

APPENDIX E

WELL YIELD TEST

Report Date:	7/3/2018 11:57
Report User Name:	Matt
Report Computer Name:	RICH-PC
Application:	WinSitu.exe
Application Version:	5.6.29.3

Log File Properties

File Name	Fenix Farms Well 2018-06-26 wsl
Create Date	6/26/2018 8:41

Device Properties

Device	Level TROLL 700
Site	Fenix Farms Well
Device Name	
Serial Number	126700
Firmware Version	2.07
Hardware Version	
Device Address	
Device Comm Cfg	
Used Memory	
Used Battery	

Log Configuration

Log Name	Fenix Farms	
Created By	Matt	
Computer Name	Field PC	
Application	WinSituMobile.exe	
Application Version	5.5.1.13	
Create Date	6/26/2018 8:41:45 AM Pacific Daylight Time	
Log Setup Time Zone	Unknown	
Notes Size(bytes)		4096
Overwrite when full	Disabled	
Scheduled Start Time	Manual Start	
Scheduled Stop Time	No Stop Time	
Type	Linear	
Interval	Days: 0 hrs: 00 mins: 30 secs: 00	

Level Reference Settings At Log Creation

Level Measurement Mode	Level Depth To Water	
Specific Gravity		0.999
Level Reference Mode:	Set new reference	
Level Reference Value:		
Level Reference Head Pressure		

Other Log Settings

Pressure Offset:	
Depth of Probe:	280ft
Head Pressure:	
Temperature:	

Log Notes:

Date and Time	Note
	Manual Start Command
	Suspend Command
	Manual Stop Command

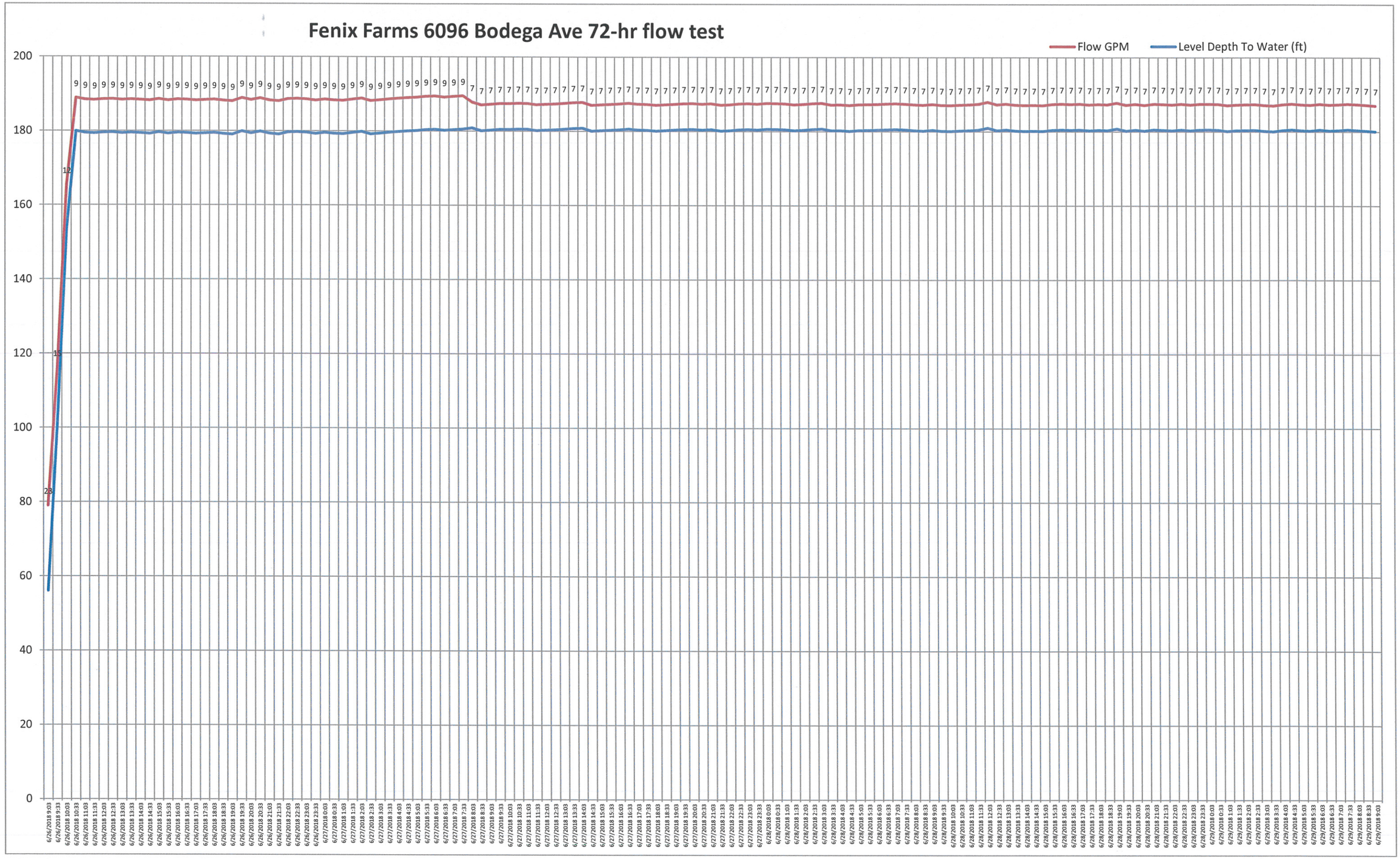
Log Data:

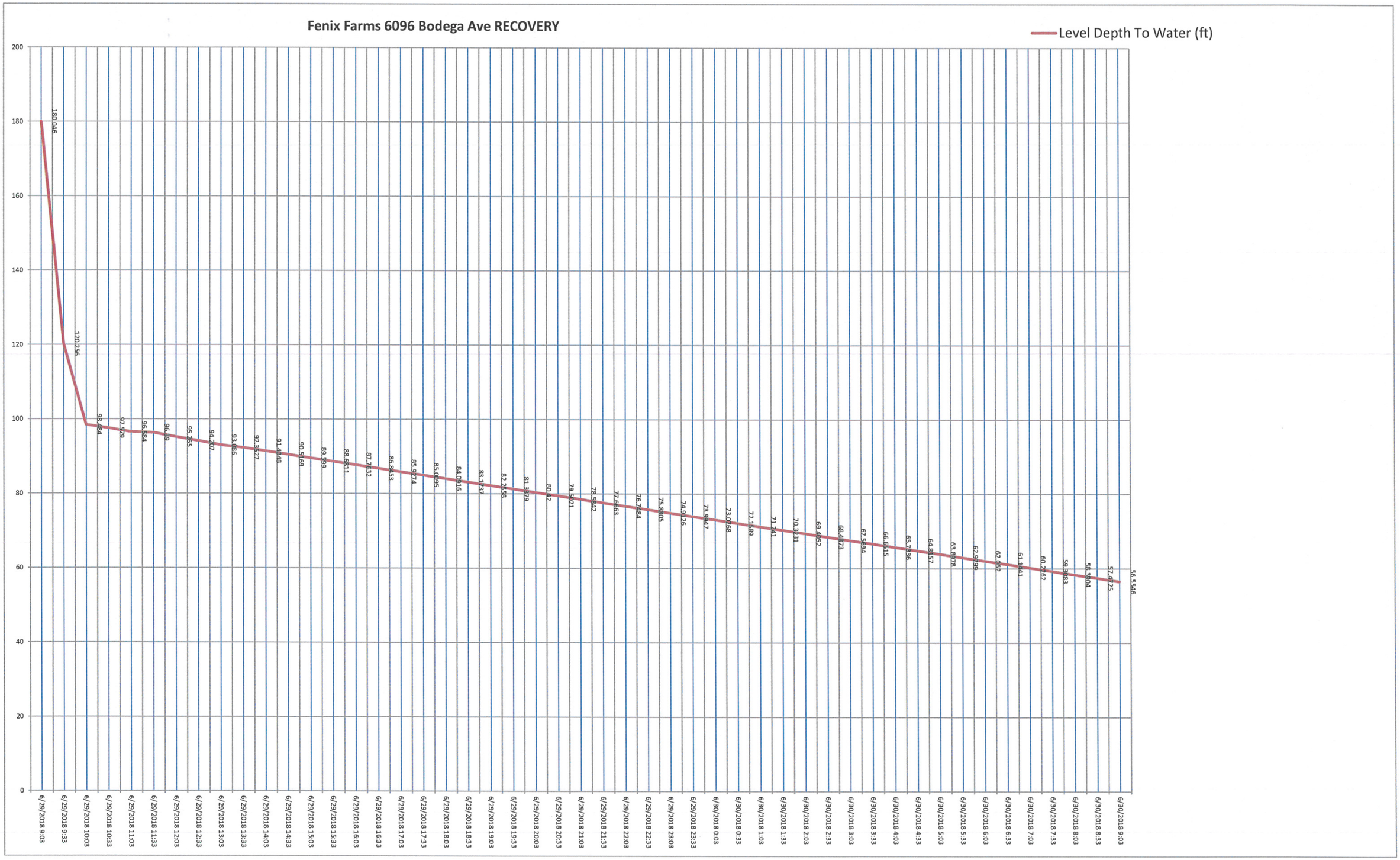
Record Count		
Sensors	1	
	1	126700 Pressure/Temp 300 PSIG (211m/692ft)

Time Zone: Pacific Daylight Time

Date and Time	Elapsed Time	Sensor: Pres(G) 692ft SN#: 126700	Sensor: Pres(G) 692ft SN#: 126700 Level Depth To Water (ft)	Flow GPM
6/26/2018 9:03			56.034	23
6/26/2018 9:33			101.209	15
6/26/2018 10:03			153.458	12
6/26/2018 10:33			179.89	9
6/26/2018 11:03			179.472	9
6/26/2018 11:33			179.326	9
6/26/2018 12:03			179.549	9
6/26/2018 12:33			179.559	9
6/26/2018 13:03			179.386	9
6/26/2018 13:33			179.489	9
6/26/2018 14:03			179.382	9
6/26/2018 14:33			179.223	9
6/26/2018 15:03			179.598	9
6/26/2018 15:33			179.231	9
6/26/2018 16:03			179.498	9
6/26/2018 16:33			179.432	9
6/26/2018 17:03			179.198	9
6/26/2018 17:33			179.34	9
6/26/2018 18:03			179.449	9
6/26/2018 18:33			179.181	9
6/26/2018 19:03			179	9
6/26/2018 19:33			179.869	9
6/26/2018 20:03			179.371	9
6/26/2018 20:33			179.813	9
6/26/2018 21:03			179.27	9
6/26/2018 21:33			179.047	9
6/26/2018 22:03			179.628	9
6/26/2018 22:33			179.684	9
6/26/2018 23:03			179.564	9
6/26/2018 23:33			179.248	9
6/27/2018 0:03			179.529	9
6/27/2018 0:33			179.309	9
6/27/2018 1:03			179.2	9
6/27/2018 1:33			179.545	9
6/27/2018 2:03			179.818	9
6/27/2018 2:33			179.154	9
6/27/2018 3:03			179.373	9
6/27/2018 3:33			179.635	9
6/27/2018 4:03			179.829	9
6/27/2018 4:33			179.981	9
6/27/2018 5:03			180.117	9
6/27/2018 5:33			180.337	9
6/27/2018 6:03			180.433	9
6/27/2018 6:33			180.166	9
6/27/2018 7:03			180.346	9
6/27/2018 7:33			180.525	9
6/27/2018 8:03			180.831	7
6/27/2018 8:33			180.058	7
6/27/2018 9:03			180.232	7
6/27/2018 9:33			180.429	7
6/27/2018 10:03			180.422	7
6/27/2018 10:33			180.503	7
6/27/2018 11:03			180.494	7
6/27/2018 11:33			180.161	7
6/27/2018 12:03			180.267	7
6/27/2018 12:33			180.345	7
6/27/2018 13:03			180.521	7
6/27/2018 13:33			180.723	7
6/27/2018 14:03			180.802	7
6/27/2018 14:33			180.018	7
6/27/2018 15:03			180.153	7
6/27/2018 15:33			180.271	7
6/27/2018 16:03			180.381	7
6/27/2018 16:33			180.583	7
6/27/2018 17:03			180.341	7
6/27/2018 17:33			180.276	7
6/27/2018 18:03			180.075	7
6/27/2018 18:33			180.197	7
6/27/2018 19:03			180.33	7
6/27/2018 19:33			180.477	7
6/27/2018 20:03			180.516	7
6/27/2018 20:33			180.359	7
6/27/2018 21:03			180.487	7
6/27/2018 21:33			180.116	7
6/27/2018 22:03			180.206	7
6/27/2018 22:33			180.419	7
6/27/2018 23:03			180.528	7
6/27/2018 23:33			180.394	7
6/28/2018 0:03			180.599	7
6/28/2018 0:33			180.564	7
6/28/2018 1:03			180.473	7
6/28/2018 1:33			180.246	7
6/28/2018 2:03			180.346	7
6/28/2018 2:33			180.544	7
6/28/2018 3:03			180.656	7
6/28/2018 3:33			180.211	7
6/28/2018 4:03			180.24	7
6/28/2018 4:33			180.055	7
6/28/2018 5:03			180.263	7
6/28/2018 5:33			180.298	7
6/28/2018 6:03			180.373	7
6/28/2018 6:33			180.482	7

6/28/2018 7:03	180.556	7
6/28/2018 7:33	180.457	7
6/28/2018 8:03	180.284	7
6/28/2018 8:33	180.16	7
6/28/2018 9:03	180.366	7
6/28/2018 9:33	180.109	7
6/28/2018 10:03	180.06	7
6/28/2018 10:33	180.2	7
6/28/2018 11:03	180.286	7
6/28/2018 11:33	180.422	7
6/28/2018 12:03	180.98	7
6/28/2018 12:33	180.267	7
6/28/2018 13:03	180.478	7
6/28/2018 13:33	180.201	7
6/28/2018 14:03	180.106	7
6/28/2018 14:33	180.148	7
6/28/2018 15:03	180.085	7
6/28/2018 15:33	180.384	7
6/28/2018 16:03	180.467	7
6/28/2018 16:33	180.391	7
6/28/2018 17:03	180.471	7
6/28/2018 17:33	180.283	7
6/28/2018 18:03	180.382	7
6/28/2018 18:33	180.311	7
6/28/2018 19:03	180.75	7
6/28/2018 19:33	180.185	7
6/28/2018 20:03	180.443	7
6/28/2018 20:33	180.172	7
6/28/2018 21:03	180.494	7
6/28/2018 21:33	180.406	7
6/28/2018 22:03	180.267	7
6/28/2018 22:33	180.471	7
6/28/2018 23:03	180.259	7
6/28/2018 23:33	180.483	7
6/29/2018 0:03	180.498	7
6/29/2018 0:33	180.433	7
6/29/2018 1:03	180.124	7
6/29/2018 1:33	180.291	7
6/29/2018 2:03	180.352	7
6/29/2018 2:33	180.383	7
6/29/2018 3:03	180.148	7
6/29/2018 3:33	180.012	7
6/29/2018 4:03	180.364	7
6/29/2018 4:33	180.522	7
6/29/2018 5:03	180.319	7
6/29/2018 5:33	180.216	7
6/29/2018 6:03	180.498	7
6/29/2018 6:33	180.283	7
6/29/2018 7:03	180.356	7
6/29/2018 7:33	180.539	7
6/29/2018 8:03	180.399	7
6/29/2018 8:33	180.22	7
6/29/2018 9:03	180.046	7
6/29/2018 9:33	120.256	0
6/29/2018 10:03	98.484	0
6/29/2018 10:33	97.579	0
6/29/2018 11:03	96.584	0
6/29/2018 11:33	96.39	0
6/29/2018 12:03	95.265	0
6/29/2018 12:33	94.207	0
6/29/2018 13:03	93.086	0
6/29/2018 13:33	92.3527	0
6/29/2018 14:03	91.4348	0
6/29/2018 14:33	90.5169	0
6/29/2018 15:03	89.599	0
6/29/2018 15:33	88.6811	0
6/29/2018 16:03	87.7632	0
6/29/2018 16:33	86.8453	0
6/29/2018 17:03	85.9274	0
6/29/2018 17:33	85.0095	0
6/29/2018 18:03	84.0916	0
6/29/2018 18:33	83.1737	0
6/29/2018 19:03	82.2558	0
6/29/2018 19:33	81.3379	0
6/29/2018 20:03	80.42	0
6/29/2018 20:33	79.5021	0
6/29/2018 21:03	78.5842	0
6/29/2018 21:33	77.6663	0
6/29/2018 22:03	76.7484	0
6/29/2018 22:33	75.8305	0
6/29/2018 23:03	74.9126	0
6/29/2018 23:33	73.9947	0
6/30/2018 0:03	73.0768	0
6/30/2018 0:33	72.1589	0
6/30/2018 1:03	71.241	0
6/30/2018 1:33	70.3231	0
6/30/2018 2:03	69.4052	0
6/30/2018 2:33	68.4873	0
6/30/2018 3:03	67.5694	0
6/30/2018 3:33	66.6515	0
6/30/2018 4:03	65.7336	0
6/30/2018 4:33	64.8157	0
6/30/2018 5:03	63.8978	0
6/30/2018 5:33	62.9799	0
6/30/2018 6:03	62.062	0
6/30/2018 6:33	61.1441	0
6/30/2018 7:03	60.2262	0
6/30/2018 7:33	59.3083	0
6/30/2018 8:03	58.3904	0
6/30/2018 8:33	57.4725	0
6/30/2018 9:03	56.5546	0


Fenix Farms 6096 Bodega Ave 72-hr flow test
Flow GPM
Level Depth To Water (ft)
200
180
160
140
120
100
80
60
40
20
0


Fenix Farms 6096 Bodega Ave RECOVERY
Level Depth To Water (ft)
200
180
160
140
120
100
80
60
40
20
0
180.046
120.256
98.484
97.579
96.584
96.69
95.765
94.707
93.086
92.3577
91.4848
90.5169
89.599
88.6811
87.7632
86.8453
85.9274
85.0095
84.0916
83.1737
82.2558
81.3379
80.42
79.5021
78.5842
77.6663
76.7484
75.8305
74.9126
73.9947
73.0768
72.1589
71.241
70.3231
69.4052
68.4873
67.5694
66.6515
65.7336
64.8157
63.8978
62.9799
62.062
61.1441
60.2262
59.3083
58.3904
57.4725
56.5546
6/29/2018 9:03
6/29/2018 9:33
6/29/2018 10:03
6/29/2018 10:33
6/29/2018 11:03
6/29/2018 11:33
6/29/2018 12:03
6/29/2018 12:33
6/29/2018 13:03
6/29/2018 13:33
6/29/2018 14:03
6/29/2018 14:33
6/29/2018 15:03
6/29/2018 15:33
6/29/2018 16:03
6/29/2018 16:33
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6/29/2018 17:33
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6/29/2018 21:03
6/29/2018 21:33
6/29/2018 22:03
6/29/2018 22:33
6/29/2018 23:03
6/29/2018 23:33
6/30/2018 0:03
6/30/2018 0:33
6/30/2018 1:03
6/30/2018 1:33
6/30/2018 2:03
6/30/2018 2:33
6/30/2018 3:03
6/30/2018 3:33
6/30/2018 4:03
6/30/2018 4:33
6/30/2018 5:03
6/30/2018 5:33
6/30/2018 6:03
6/30/2018 6:33
6/30/2018 7:03
6/30/2018 7:33
6/30/2018 8:03
6/30/2018 8:33
6/30/2018 9:03

APPENDIX F

LABORATORY ANALYTICAL REPORTS

Analytical Sciences

Report Date: July 09, 2018

Laboratory Report

Linda Pool
Les Petersen Drilling
5434 Old Redwood Highway
Santa Rosa, CA 95403

Project Name: **6096 Bodega Ave.** **Fenix Farms, LLC #36359**

Lab Project Number: **8062913**

This 5 page report of analytical data has been reviewed and approved for release.

M Peters

Michele Peters
Laboratory Director

P.O. Box 750336
Petaluma, CA 94975-0336
Telephone: (707) 769-3128

110 Liberty Street
Petaluma, CA
94952

Total Coliform & E. Coli

Lab#	Sample ID	Compound Name	Result (MPN/100 mL)	RDL (MPN/100 mL)
8062913-01	**Well Head**	Total Coliform	>2400	1
		E. Coli	1	1

Date Sampled:	06/28/18	Date Analyzed:	06/30/18	QC Batch: B017805
Date Received:	06/29/18	Method:	SM 9223 B-2004	

Metals by Graphite Furnace

Lab#	Sample ID	Compound Name	Result (µg/L)	RDL (µg/L)
8062913-01	**Well Head**	Arsenic (As)	ND	2.0

Date Sampled:	06/28/18	Date Analyzed:	07/02/18	QC Batch: B017820
Date Received:	06/29/18	Method:	EPA 200.9	

Metals by ICP

Lab#	Sample ID	Compound Name	Result (µg/L)	RDL (µg/L)
8062913-01	**Well Head**	Aluminum (Al)	770	50
		Iron (Fe)	580	100
		Manganese (Mn)	ND	20
		Zinc (Zn)	ND	50

Date Sampled:	06/28/18	Date Analyzed:	07/02/18	QC Batch: B017821
Date Received:	06/29/18	Method:	EPA 200.7	

Metals (mg/L)

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
8062913-01	**Well Head**	Boron (B)	0.078	0.050
		Sodium (Na)	110	0.40

Date Sampled:	06/28/18	Date Analyzed:	07/05/18	QC Batch: B017821
Date Received:	06/29/18	Method:	EPA 200.7	

Silica

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
8062913-01	**Well Head**	Silica (SiO2)	35	0.50

Date Sampled:	06/28/18	Date Analyzed:	07/02/18	QC Batch: B017821
Date Received:	06/29/18	Method:	EPA 200.7	

Hardness

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
8062913-01	**Well Head**	Calcium (Ca)	3.4	0.25
		Magnesium (Mg)	0.59	0.10
		Hardness	11	1.0

Date Sampled:	06/28/18	Date Analyzed:	07/02/18	QC Batch: B017821
Date Received:	06/29/18	Method:	EPA 200.7	

pH

Lab#	Sample ID	Compound Name	Result (pH Units)		RDL (pH Units)
8062913-01	**Well Head**	pH	9.09	HT	1.00

Date Sampled:	06/28/18	Date Analyzed:	06/29/18	QC Batch: B017812
Date Received:	06/29/18	Method:	SM 4500-H B-2011	

Conductivity

Lab#	Sample ID	Compound Name	Result (µS/cm)	RDL (µS/cm)
8062913-01	**Well Head**	Conductivity	530	0.5

Date Sampled:	06/28/18	Date Analyzed:	06/29/18	QC Batch: B017812
Date Received:	06/29/18	Method:	SM 2510 B-2011	

Anions

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
8062913-01	**Well Head**	Chloride	20	1.0
		Nitrate as N	ND	0.15
		Sulfate as SO4	2.6	0.50

Date Sampled:	06/28/18	Date Analyzed:	06/29/18	QC Batch: B017810
Date Received:	06/29/18	Method:	EPA 300.0	

Total Dissolved Solids by EC

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
8062913-01	**Well Head**	Total Dissolved Solids	340	10

Date Sampled:	06/28/18	Date Analyzed:	06/29/18	QC Batch: B017786
Date Received:	06/29/18	Method:	EPA 120.1	

Notes and Definitions

HT	The recommended holding time prior to analysis for dissolved oxygen, pH and residual chlorine is 15 minutes. This analysis was performed outside the recommended 15 minute holding time.
RDL	Reporting Detection Limit
ND	Analyte NOT DETECTED at or above the reporting detection limit (RDL)
mg/L	milligrams per Liter
ug/L	micrograms per Liter

PLEASE NOTE: The drinking water Maximum Contamination Limits (MCL) set by the California State Water Resource Control Board are as follows:

Aluminum (1000 ug/L)
Arsenic (10 ug/L)
Bromate (0.010 mg/L)
Iron (300 ug/L)
Manganese (50 ug/L)
Nitrate as N (10 mg/L)
Nitrite as N (1.0 mg/L)
Lead (15 ug/L)
Copper (1300 ug/L)
Total Coliform (< 1 MPN/100 mL - Most Probable Number per 100 milliliters)
E. Coli (< 1 MPN/100 mL - Most Probable Number per 100 milliliters)

Analytical Sciences
P.O. Box 750336, Petaluma, CA 94975-0336
110 Liberty Street, Petaluma, CA 94952
(707) 769-3128
Fax (707) 769-8093

CHAIN OF CUSTODY

Lab Project Number: 8062913
Client's Project Name: 60916 Bodega Avenue
Client's Project Number: AKA Fenix Farms, LLC
WO# 36359

Temperature Received: 7.1

CLIENT INFORMATION

Company Name: Les Petersen Drilling & Pump
Address: 5434 Old Redwood HWY
Santa Rosa, CA 95403
Contact: Linda Pool
Phone #: 707-545-0246
Fax #: 707-573-9483
e-mail: lespetersendrilling@comcast.net

TURNAROUND TIME (check one)

Same Day ____ 72 Hours ____
48 Hours ____ 24 Hours ____
5 Days ____ Normal X

Page 1 of 1

ANALYSIS

Item	Client Sample ID	Date Sampled	Time	Matrix	# Cont.	Presv. Y/N	Bacteria	Arsenic	Nitrate	DOM#2										Comments	Lab Sample #
1	WELLHEAD	6/28	2:05	W						X											D1
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

SIGNATURES

Relinquished By: [signature] — Signature
Sampled By: Lupe Vasquez
6/29/18 — Date
12:15 — Time
Received By: [signature] — Signature
6/29/18 — Date
1215 — Time

Analytical Sciences

Report Date: July 09, 2018

Laboratory Report

Linda Pool

Les Petersen Drilling

5434 Old Redwood Highway

Santa Rosa, CA 95403

Project Name: **6096 Bodega Ave. - Fenix Farms** **Fenix Farms**

Lab Project Number: **8070609**

This 3 page report of analytical data has been reviewed and approved for release.

Michele Peters

Laboratory Director

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Petaluma, CA 94975-0336
Telephone: (707) 769-3128

110 Liberty Street
Petaluma, CA
94952

Total Coliform & E. Coli

Lab#	Sample ID	Compound Name	Result (MPN/100 mL)		RDL (MPN/100 mL)
8070609-01	**Well**	Total Coliform	<1	QT	1
		E. Coli	<1	QT	1

Date Sampled:	07/06/18	Date Analyzed:	07/07/18	QC Batch: B017827
Date Received:	07/06/18	Method:	SM 9223 B-2004	

Notes and Definitions

QT	The bacterial test utilized is a quantitative test. A result of less than 1 (<1) is indicating bacteria are "absent" in 100 milliliters of sample water.
RDL	Reporting Detection Limit
ND	Analyte NOT DETECTED at or above the reporting detection limit (RDL)
mg/L	milligrams per Liter
ug/L	micrograms per Liter

PLEASE NOTE: The drinking water Maximum Contamination Limits (MCL) set by the California State Water Resource Control Board are as follows:

Aluminum (1000 ug/L)
Arsenic (10 ug/L)
Bromate (0.010 mg/L)
Iron (300 ug/L)
Manganese (50 ug/L)
Nitrate as N (10 mg/L)
Nitrite as N (1.0 mg/L)
Lead (15 ug/L)
Copper (1300 ug/L)
Total Coliform (< 1 MPN/100 mL - Most Probable Number per 100 milliliters)
E. Coli (< 1 MPN/100 mL - Most Probable Number per 100 milliliters)

Analytical Sciences
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110 Liberty Street, Petaluma, CA 94952
(707) 769-3128
Fax (707) 769-8093

CHAIN OF CUSTODY

Lab Project Number: 8070609
Client's Project Name: 60960 Bodega Ave
Client's Project Number: Fenix Farms
36359

CLIENT INFORMATION

Company Name: Les Petersen Drilling & Pump
Address: 5434 Old Redwood HWY
Santa Rosa, CA 95403
Contact: Linda Pool
Phone #: 707-545-0246
Fax #: 707-573-9483
e-mail: lespetersendrilling@comcast.net

TURNAROUND TIME (check one)

Same Day ____ 72 Hours ____
48 Hours ____ 24 Hours ____
5 Days ____ Normal X

Temperature Received 6.1

Page 1 of 1

ANALYSIS

Item	Client Sample ID	Date Sampled	Time	Matrix	# Cont.	Presv. Y/N	Bacteria	Arsenic	Nitrate											Comments	Lab Sample #
1	Well	7/6/18	10:35	W			X														01
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

SIGNATURES

Relinquished By: L. Pool
Signature

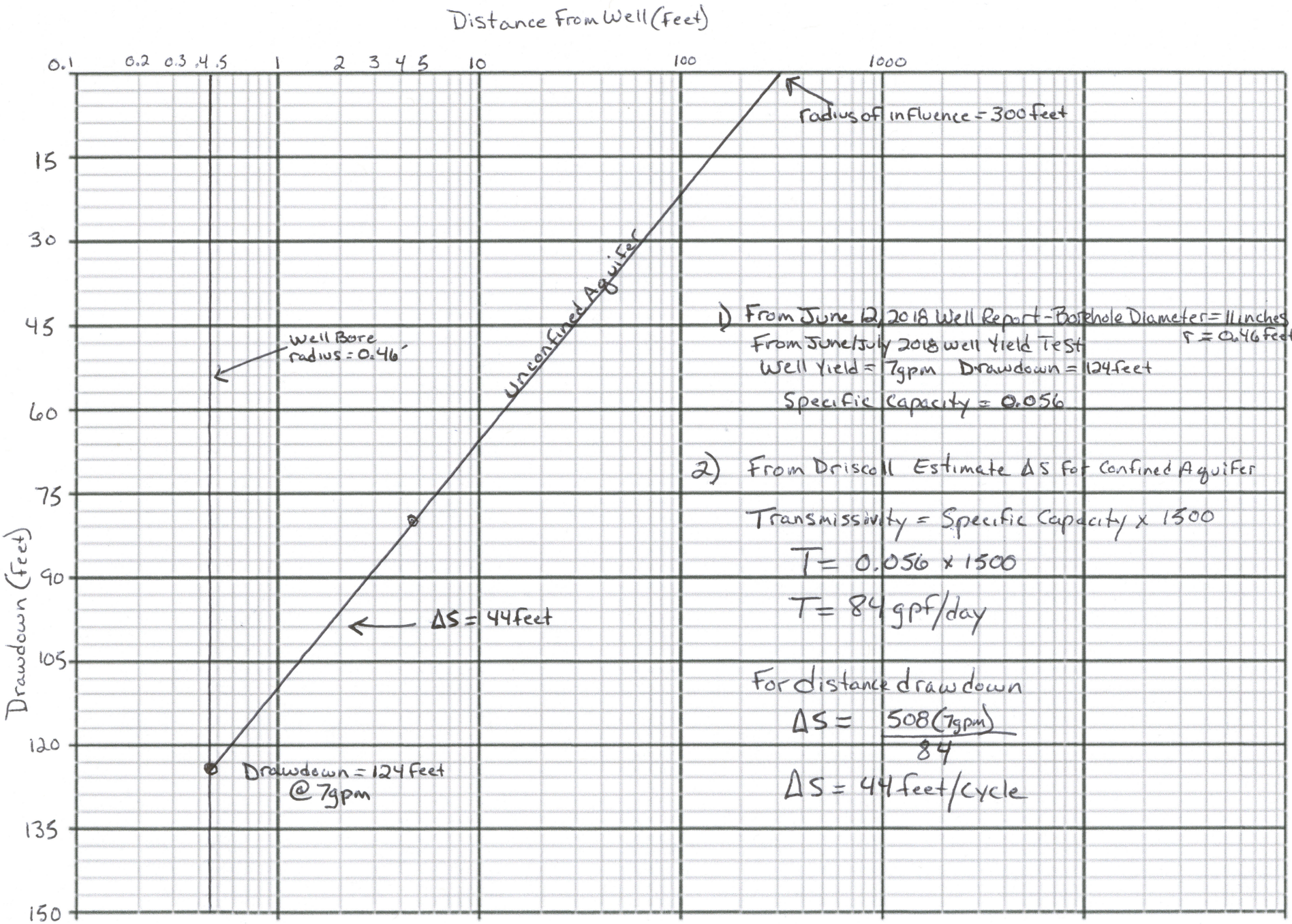
Sampled By: Lupe
Date 7/6/18 Time 1200

Received By: [illegible]
Signature

Date 7/6/18 Time 1220

APPENDIX G

RADIUS OF INFLUENCE GRAPH



1) From June 12, 2018 Well Report - Borehole Diameter = 11 inches or r = 0.46 feet
From June/July 2018 well Yield Test
Well Yield = 7gpm Drawdown = 124 feet
Specific Capacity = 0.056

2) From Driscoll Estimate ΔS for Confined Aquifer

Transmissivity = Specific Capacity x 1500

$T = 0.056 \times 1500$

$T = 84$ gpf/day

For distance drawdown

$$\Delta S = \frac{508(7gpm)}{84}$$

$\Delta S = 44$ feet/cycle

Radius of Influence
6095 Bodega Avenue
Petaluma, CA

APN: 022-200-002