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Tier 1 and Tier 2 Water Availability Analysis
Richard C. Slade & Associates LLC

and

Water Availability Analysis
Madrone Engineering

DRAFT

UPDATED DRAFT
MEMORANDUM

October 10, 2018

To: Mr. Steve Matthiasson
Matthiasson Family Vineyards
3175 Dry Creek Rd
Napa, Napa County, CA
Sent via email (steve@premiervit.com)

Job No. 663-NPA01

Cc: Mr. Joel Dickerson
Madrone Engineering
Sent via email (joel@madrone.engineering)

From: Chris Wick, Anthony Hicke and Richard C. Slade
Richard C. Slade & Associates LLC (RCS)

Re: Results of Napa County Tier 1 and Tier 2 Water Availability Analysis
Matthiasson Family Vineyards
3175 Dry Creek Rd
Napa County, California

Introduction

This Memorandum presents the key findings and conclusions, along with our preliminary recommendations, regarding the Water Availability Analysis (WAA) prepared by RCS for the Matthiasson Family Vineyards property in Napa County (County), California. This document was prepared in conformance with Napa County Tier 1 and Tier 2 requirements, as described in the Napa County WAA Guidelines (WAA 2015). The Matthiasson Family Vineyards property is comprised by 5.8 acres and is located at 3175 Dry Creek Rd, just west of the City of Napa in Napa County.

Figure 1, "Location Map," shows the boundaries of the subject property superimposed on the USGS topographic map for the Napa quadrangle. Property boundaries shown on Figure 1 were adapted from the County Assessor's parcel data that are freely available from the Napa County GIS website (the subject property is AP 035-460-022). Also shown on Figure 1 are the locations of the existing onsite water well (known herein as "Well 1"), offsite easement wells ("Well 2" and "Well 4), along with the locations for known and/or possible nearby but offsite wells owned by others.

Water demands at the subject property have reportedly been met historically via the use of onsite groundwater, and from groundwater pumped from other offsite wells via multiple existing water easement agreements with nearby parcels. According to the property owner, Well 1 has reportedly been used in the past (roughly 10 years ago or more) to supply groundwater for the subject property. More recently, onsite water demands have also been supplied by the use of the offsite easement wells. Figure 2, "Aerial Photograph Map," shows the same property boundaries and well locations as are illustrated on Figure 1, but the base map for Figure 2 is an aerial photograph of the area; this aerial photograph was obtained from the USGS EarthExplorer website (the date of the imagery is June 3, 2016).

As reported by project engineer, Mr. Joel Dickerson of Madrone Engineering (Madrone) of St. Helena, California, the 5.8-acre subject property is currently developed with the following: 3.85 acres of existing vineyards; one residence; and an existing winery. RCS understands the proposed project is to expand the existing winery from an existing production capacity of 5,000 gallons of wine per year to 18,000 gallons of wine per year; this expansion would include improvements to some of the onsite winemaking facilities. For this project, the future groundwater demands for the expanded winery are proposed to be met using the existing onsite Well 1.

As part of the permit submittal for the proposed winery expansion, a Water Availability Analysis (WAA) is required by the County. The basic purpose of this Memorandum is to comply with Napa County's WAA guidelines for a "Tier 1" WAA (Groundwater Recharge Estimate); those guidelines were promulgated by the County in May 2015. Also, and as shown on Figure 2, there are multiple known offsite wells located within 500 ft of onsite Well 1 (i.e., the "project well"); and, hence, a "Tier 2" WAA (Well Interference Evaluation) needed to be performed. Figure 2 shows the approximate locations of known and/or possible offsite wells located within 500 ft of the project onsite Well 1.

A previous "Water Availability Analysis" prepared by Madrone, dated November 10, 2017, was submitted to Napa County Planning, Building, and Environmental Services (PBES) as part of Use Permit No. P17-00349 for the Matthiasson Family Vineyards. Therein, Madrone reported the existing and proposed well configuration for groundwater use on the property. The Madrone WAA was reviewed by County staff, and as a result of that review, additional information and analyses were requested. The requests for additional data are outlined in an "Application Status Letter" sent to the applicant by the County on December 15, 2017. Key additional analyses/information requested by the County included the following:

a. A Tier 2 Analysis was requested because the County determined that the County that a Tier 2 analysis was required because the project parcel was considered to be "hillside".

b. The analysis should evaluate all nearby parcels that serve as potential water sources to the proposed project.

c. A discussion of why onsite Well 1 and easement Well 2 were not evaluated to continue to be used at the primary water source.

d. The specific evidence of rights to use easement Well 2 as a water source for the winery (this evidence is to be furnished by the Owner).

e. Include a copy of the well water rights agreements for easement Wells 3 and 4 (these are also to be furnished by the Owner).

f. A discussion of existing and proposed water uses associated with other nearby projects, namely the Wools Ranch Winery and Anthem Winery (see Figure 2).

RCS was then contracted by Mr. Matthiasson to review the project and a prepare a revised WAA to include both Tier 1 and Tier 2 analyses, and to also address the additional information requests made by the County (see "a" through "f" above).

Since issuance of the previous December 15, 2017 WAA by Madrone, the project has reportedly undergone minor configuration changes related to the proposed water system. Project water demands were revised and were ultimately reduced, and the proposed future use of the onsite well and offsite easement wells were reconfigured. Therefore, the estimates of water use and viable wells from which groundwater will be pumped for future use as described in the December 15, 2017 Madrone WAA are slightly different than described herein.

Specifically, for the revised project considered by this RCS-prepared WAA, groundwater for the subject discretionary project (i.e., the winery expansion) will be met by pumping groundwater from Well 1 only; hence, Well 1 is considered the "project well". All other existing (or "non-discretionary") onsite water demands including the vineyard irrigation and residential demands will continue to be met by using groundwater pumped from the offsite easement wells. Although not considered as a part of this analysis, the Owner also plans to begin "dry farming" the entire 3.85 acres of existing vines at some point in the future. Once "dry farming" begins, the total groundwater demand for the property will be reduced.

Site Conditions

From our field reconnaissance visit to the subject property on February 8, 2018, the following key items were noted and/or observed (refer to Figures 1 and 2):

g. The Matthiasson Family Vineyards property is comprised by a single parcel having a Napa County Assessor's Parcel Number (APN) of 035-460-022. This parcel is referred to herein as the "subject property." The total area of the subject property, per the Assessor's records, is 5.8 acres.

h. Topographically, the subject property is located in the foothills on the western side of Napa Valley, just northwest of the City of Napa. Based on the topographic contours presented on Figure 1, slopes in the property descend in moderate angles to the northeast towards Dry Creek Road. There were no drainages and/or creeks observed by RCS geologists on the subject property, and none are shown onsite on the topographic base map for Figure 1.

i. Currently, developments on the subject property consist of an existing winery and one single-family primary residence; these structures are generally located in the central and eastern portions of the property, respectively. There are also a reported 3.85 acres of existing vineyards located in the western portion of the subject property.

j. Offsite areas surrounding the subject property consist primarily of vineyards, wineries, and residences to the north, east, south, and west of the subject property. Naturally vegetated and/or wooded hillsides (i.e., undeveloped areas) were also observed farther offsite to the west.

k. As shown on Figures 1 and 2, a single water well (Well 1) was observed on the subject property. Specifically, this well is located in the eastern portion of the property between the existing winery and the onsite residence. Offsite easement

Well 2 (located on an adjacent parcel to the east) offsite Well 3[1], and offsite easement Well 4 (located east of the property on the eastside of Dry Creek Road) were also observed during the site visit.

I. During our February 8, 2018 site visit, the RCS geologist also traveled along onsite roads and offsite public roads in the area surrounding the subject property in an attempt to identify the possible locations and/or existence of nearby but offsite water wells owned by others, and to verify the offsite well locations provided by Madrone. As a result of these efforts, several privately-owned but offsite wells were directly observed by the RCS geologist during that visit, including several offsite wells within 500 ft of Well 1 (see Figure 2).

RCS geologists also contacted Napa County PBES in an attempt to acquire Well Completion Reports (also known as "driller's logs") that might exist for wells located on those neighboring but offsite properties. In addition, RCS geologists also used the California Department of Water Resources (DWR) in-progress online Well Completion Report website to download driller's logs for wells within the immediate vicinity of the subject property. As a result of those inquiries, several driller's logs and/or well drilling permits were obtained for wells historically drilled in the area.

Figures 1 and 2 show the approximate locations of known, reported, or inferred nearby offsite wells surrounding the subject property, as determined from the field reconnaissance and well log research. Note that five of these offsite wells (including nearby easement Well 2) are shown to lie within 500 ft of Well 1 (the project well).

Key Construction and Pumping Data for Existing Onsite Well

A DWR Well Completion Report is not available for existing onsite Well 1. Although several well drilling permits for the subject property and/or the surrounding offsite properties were received from the County and DWR inquiries, none of those well drilling permits contained data that correlated with the RCS field observations of Well 1 or with information reported to us by the Owner for Well 1. The property owner also provided RCS with historical pumping data for Well 1; those documents included limited well construction data for Well 1, also.

In attempt to gather more information about the construction of Well 1 (including the total casing depth, depths of perforated intervals, sanitary seal depth, etc.), RCS recommended that a color video survey and cement bond log be performed in Well 1. These surveys were performed on March 12, 2018 by Pacific Surveys (Pacific) of Auburn California. Copies of the color video survey report and cement bond log prepared by Pacific are appended to this report.

Table 1, "Summary of Well Construction and Pumping Data," provides a tabulation of available key well construction data and pumping data for Well 1 as derived from each of the data sources described above. The data presented on Table 1 are summarized below.

Well Construction Data Onsite Well 1

Key data for Well 1 (the onsite well proposed to be used to supply groundwater to the discretionary winery project) identified during the RCS site visit and/or interpreted from RCS review of the Pacific Surveys video survey and cement bond log include:

[1] Well 3 was previously an easement Well for the property, but is no longer.

a. Well 1 was constructed with steel well casing having a nominal diameter of 6 inches. Based on our review of the March 12, 2018 video survey, the current casing depth (or at least the depth to the top of sediment fill in the bottom of the casing) for Well 1 was observed to be approximately 175 ft below ground surface (bgs). Also, the static water level was recorded at a depth of 24.9 ft below the top of casing during the video survey. Pumping records from 1986 reported the bottom of Well 1 to be at a depth of 177 ft bgs.

b. Based on our review of the March 2018 video survey, perforations in the steel casing for Well 1 appear to be factory-cut slots. Perforations in this well were placed beginning at a depth of approximately 95 ft bgs, and these appear to extend continuously to a depth of approximately 175 ft bgs, which is the current bottom of the well and/or top of the sediment fill in the bottom of the well casing.

c. Based on the results of the March 12, 2018 cement bond log by Pacific Surveys, Well 1 reportedly appears to be constructed with a sanitary seal consisting of cement to a depth of approximately 60 ft bgs.

Historical Pumping Test Data Onsite Well 1

An older, short-term (approximately 80-minute long) constant drawdown pumping test was performed in Well 1 in May 1986 by Joe Imboden Well Testing (Imboden), of Napa, California. A pre-test static water level (SWL) of 31 ft below the wellhead reference point (brp) was recorded by Imboden at that time, just prior to pumping. During the pumping portion of the test, the pumping rate began at a rate of 15 gpm, but was reduced to 4 gpm after approximately 20 minutes to help “stabilize” the pumping water level (PWL). A final, “stable” PWL of 168 ft brp was recorded by Imboden at the end of the 80-minute testing period. Based on a SWL of 31 ft brp, and a final PWL of 168 ft brp (a total drawdown of 137 ft), the short-term specific capacity for Well 1 in May 1986 was calculated by RCS to be 0.03 gpm/ft ddn.

Onsite Well 1 Data from February 2018 Site Visit

As discussed above, a site visit to the subject property was performed by an RCS geologist on February 8, 2018. The following information for Well 1 was gleaned from that site visit:

- Well 1 was observed to be equipped with a permanent pump, but it was not pumping at the time of our visit.
- A SWL of 29.2 ft brp was measured by the RCS geologist on February 8, 2018; the reference point for this measurement is approximately 0.7 ft above ground surface (ags). This SWL is roughly: 4 ft deeper than that recorded by the video survey of March 12, 2018; and 2 ft shallower than the 31-foot SWL depth reported by Imboden in May 1986.
- At the time of our site visit, Well 1 was not equipped with a flowmeter device, which would otherwise be needed to identify flow rates and flow volumes.

Well Construction Data for Offsite Wells

DWR Well Completion Reports were also available for several nearby offsite wells that are referenced later in this Memorandum, some of which are easement wells that supply groundwater to the property for existing, non-project uses. Construction details for these offsite wells including driller's log numbers, drilling date, well depth, casing diameter, sanitary seal depth, and perforation intervals, etc (if available), are also summarized on Table 1. Copies of the available driller's logs and/or well permits for the offsite wells shown on Table 1 are appended to this Memorandum.

Local Geologic Conditions

Figure 3, "Geologic Map," illustrates the types, lateral extents, and boundaries between the various earth materials mapped at ground surface in the region by others. Specifically, Figure 3 has been adapted from the results of regional geologic field mapping of the Napa quadrangle, as published by the California Geological Survey (CGS) in 2004. Key earth materials mapped at ground surface in the area, as shown on Figure 3 include, from geologically youngest to oldest, the following:

a. Alluvial-type deposits. These deposits consist of the following: undifferentiated and/or undivided stream terrace deposits and alluvium and/or alluvial fan deposits (map symbols Qhty, Qha, Qpa, and Qoa). These deposits are generally unconsolidated, and consist of layers and lenses of sand, silt, clay, and gravel. No alluvial-type deposits have been mapped at ground surface anywhere on the subject property. These deposits generally exist to the east along the floor of the Napa Valley.

b. Landslide deposits. Landslide deposits[2] (map symbol Qls) have been mapped in the region by others (see the bright yellow-colored areas on Figure 3). Arrows within these mapped landslide areas show the general direction of downslope movement within each landslide mass. These deposits do not occur on the subject property but are shown on Figure 3 to be exposed offsite mainly to the south of the property.

c. Sonoma Volcanics. The Sonoma Volcanics (map symbol Tsvt) are comprised by a highly variable sequence of chemically and lithologically diverse volcanic rocks. These rock types include volcanic tuff and flow rocks, such as andesite and basalt. The Sonoma Volcanics, which are exposed at ground surface and mapped by the CGS (2004) as volcanic tuff deposits, are shown on Figure 3 to occur only to the south of the subject property, and hence, these rocks do not occur on and do not underlie the subject property. Further, the RCS geologist did not observe any outcrops of Sonoma Volcanics on the subject property during his site visit.

d. Domengine Sandstone. This sedimentary geologic unit (map symbol Td) is shown on Figure 3 to be exposed at ground surface offsite to the west and southwest of the subject property, within an area encompassed by mapped faults; the faults are

[2] Note that it was not a part of our Scope of Hydrogeologic Services for this project to study, investigate, analyze, determine, or opine on the potential activity of landslides, and/or on the potential impact that landslides might have on any of the onsite structures, or to any onsite and/or offsite wells used for the subject property.

shown as thick, black-colored dashed lines on Figure 3. The Domengine sandstone does not occur on or underlie the subject property.

e. Great Valley Sequence. The geologically old (Cretaceous-aged) Great Valley Sequence rocks (map symbol KJgv) are exposed at ground surface throughout the subject property, and also in areas to the north and south of the property, as shown on Figure 3. These rocks consist mainly of well-consolidated to cemented, thinly bedded mudstone, siltstone, and shale, with minor amounts of thinly bedded sandstone. These rocks are also known to be underlie all other geologically-younger rocks exposed across the region, and are considered to be the bedrock of the area.

   Due to their geologic age and the high degree of consolidation, these rocks are known to display relatively low permeability and very little intergranular (primary) porosity. Where groundwater is available from wells constructed within these Great Valley Sequence rocks, the quantity of groundwater that might be produced from this formation will depend on the fractured nature of the rocks and the amounts of average annual recharge (rainfall) experienced at the subject property.

Geologic Structure

Several faults[3], as mapped by others, have been interpreted to exist in the vicinity of the subject property as shown by the dark-colored, short dashed lines or black dots on Figure 3 (CGS 2004). Also shown on Figure 3 are several fault traces of the "West Napa fault, Browns Valley section (Class A) No. 36a"; these fault traces, shown as pink-colored lines (mainly along the floor of Napa Valley, just east of the subject property), were mapped by the USGS in conjunction with the CGS in 2000 and are available as GIS files via the USGS "Quaternary Fault and Fold Database" website. Specifically, one of these northwest-southeast trending fault traces is shown to be mapped along the eastern edge of the subject property. The possible impacts of these faults on groundwater availability in the region are unknown due to an absence of requisite data. Faults can serve to increase the number and frequency of fracturing in the Great Valley Sequence rocks. If such fractures were to occur, they would tend to increase the amount of open area in the rock fractures which, in turn, could increase the ability of the local earth materials to store groundwater. Faults can also act as barriers to groundwater flow; it is unknown if these USGS-mapped (2000) faults impact groundwater flow, as necessary water level data to make such a determination are not available. .

Project Water Demands

For the purposes of this WAA, Well 1 is considered to be the "project well," as it will represent the only well that will be used to be meet the water demands of the existing winery and proposed winery expansion project (i.e., the discretionary project). Water demands for the onsite residence and existing onsite vineyards will continue to be met by groundwater pumped from the offsite easement wells. Although not considered as a part of this analysis, the Owner also plans to begin "dry farming" the entire 3.85 acres of existing vines at some point in the future. Once "dry farming" begins, the total groundwater demand for the property will be reduced to less than that which is estimated herein.

[3] Note that it is neither the purpose nor within our Scope of Hydrogeologic Services for this project to assess the potential seismicity or activity of any faults that may occur in the region

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Existing and proposed (future) onsite water demands for the subject property were previously estimated by Madrone in their revised report titled “Water Availability Analysis,” dated April 16, 2018; a copy of the Madrone report is appended to this report. Table 2, “Water Demand Estimates Matthiasson Family Vineyards,” has been adapted from those water use data. A summary of the water demand data is provided below:

Existing Water Demands

Water demands for the existing residence, winery, and vineyards have historically been met by pumping groundwater from onsite Well 1. More recently, the offsite easement wells (as available through existing water easements) have been used to meet these existing demands. It is our understanding that Well 1 has not been used as an onsite water source or the past ±10 years, and currently no groundwater is being regularly extracted from Well 1. Further, there are no historic groundwater extraction data for Well 1 or for any of the offsite easement wells due to a lack of flowmeters on those wells. Therefore, the actual long-term historic onsite groundwater use is not directly known.

Existing onsite water demands have therefore been estimated by Madrone[4] to be the following:

a. Existing residence = 0.750 acre feet per year (AF/yr)
b. Existing winery = 0.163 AF/yr
   - This includes 0.108 AF/yr for winery process water and 0.055 AF/yr for winery domestic water (domestic water used for employees and visitors).
c. Existing vineyard irrigation = 0.770 AF/yr
d. Total estimated existing water demand = a + b + c = 1.683 AF/yr

This total existing water demand of 1.683 AF/yr is currently met by pumping groundwater from the offsite easement wells.

Proposed (Future) Water Demands

All future winery water demands and new winery expansion project demands are proposed to be met by pumping groundwater from onsite Well 1. None of the offsite easement wells available to the property owner will be used for the discretionary winery expansion project. These proposed (new) water demands for the winery and winery expansion (both domestic and process water uses) were estimated by Madrone to be 0.583 AF/yr (see Table 2). The water demands for the onsite residence and vineyard irrigation will continue to be met by pumping groundwater from the offsite easement wells.

The total groundwater demand proposed to be met via pumping Well 1 (the onsite project well) for the discretionary Winery expansion project will be as follows:

Onsite Well 1 (project well)

a. Proposed winery water demand = 0.583 AF/yr

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4 These water demand estimates were reported by Madrone (Madrone 2018) and are based on those values presented for specified land uses provided in Appendix B of the County’s WAA Guidance Document (WAA 2015).

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- This includes 0.387 AF/yr for winery process water and 0.196 AF/yr for all winery domestic water (domestic water used for employees, visitors, landscaping, and events). The domestic use water demand for the winery of 0.196 AF/yr reportedly will not increase should any water quality treatment be necessary (see groundwater quality discussion herein).
- As reported by Madrone, water use for the discretionary project (the winery) is not expected to vary between normal water years and dry water years.

Therefore, as shown on Table 2, the total volume of groundwater proposed to be pumped from onsite Well 1 for the discretionary winery expansion project is 0.583 AF/yr.

All other existing groundwater demands for the property (all uses except the winery) will continue to be met using groundwater pumped from offsite easement wells, as follows:

Offsite Easement Wells (non-project wells)

a. Onsite residence water demand = 0.750 AF/yr
   - Unchanged from the existing demand estimate

b. Vineyard irrigation water demand = 0.184 AF/yr
   - Due to a proposed change in farming practice, the proposed future vineyard water demand (from offsite sources) is lower than the estimated existing vineyard water demand of 0.770 AF/yr (from offsite sources)

Thus, as shown on Table 2, the total future water demand for the property (1.517 AF/yr) represents a 10% decrease from the estimated existing water demand (1.683 AF/yr). In addition, the property Owner also plans to begin “dry farming” the entire 3.85 acres of existing onsite vines at some time in the future. Hence, the total water demand for the property will be even less when dry farming practices are implemented.

Proposed Pumping Rate for Well 1

To determine an appropriate estimated pumping rate necessary from Well 1 (the project well), it will be assumed that that future domestic water use and winery process water for the winery will be required year-round (365 days/year). Assuming the total annual water demand for the existing winery and proposed expanded winery operation (0.583 AF/yr) is to be met via pumping onsite Well 1 on a 100% operational basis (that is, pumping 24 hours per day, every day, 365 days per year), then Well 1 would need to pump at a rate of about 0.36 gpm. However, RCS does not recommend that a well be pumped 24 hours per day, every day (i.e., 100% of the time). On a more realistic operational basis, assuming Well 1 may only be pumping for 8 hours per day (i.e., 33% of the time), every day, throughout the year, Well 1 would need to pump at a rate of 1.08 gpm to meet the total groundwater demand for the project. For the purposes of this evaluation, RCS will conservatively assume Well 1 will be pumped at a rate of 1.5 gpm to meet the annual water demands of the existing winery and proposed winery expansion.

March 2018 Constant Rate Pumping Test of Well 1

On March 16, 2018, an 8-hour constant rate pumping test of Well 1 was performed by LGS Drilling, Inc (LGS) of Vacaville, California. Because Well 1 had not been operated for a number of years, RCS recommended that this pumping test be performed in this project well. Therefore, the basic purpose of this pumping test was to determine whether or not Well 1 could meet the proposed future winery demands.

As shown on Figures 1 and 2, five offsite wells are located to the east of the subject property, at distances ranging from approximately 260 ft to 340 ft from Well 1. Therefore, according to the Napa County WAA Guidelines, because these wells are located within 500 ft of the project well (onsite Well 1), a Tier 2 WAA ("Well Interference Evaluation") was required for this project.

Data from the pumping test was also used for Tier 2 WAA analyses. During the pumping test of Well 1 (the pumping well), RCS recommended using offsite easement Well 2 as an additional water level observation well. Well 2 is considered to be an appropriate candidate to serve as an observation well because it is a well for which the Owner has an easement, and therefore, the pumping of Well 2 could be controlled during the Well 1 pumping test.

The pumping test of Well 1 was designed by RCS to meet the following requirements:

1. Determine if Well 1 can pump at sufficient rates to meet the total winery groundwater demands of the proposed winery expansion during the year (about 1.5 gpm).
2. Monitor the amount of self-induced drawdown created in the pumping well by virtue of its own pumping.
3. Monitor water level recovery rates in the pumping well following the end of the pumping test.
4. Monitor the amount of water level decline (i.e., water level drawdown interference), if any, that might be induced in the offsite easement Well 2 (i.e., the additional water level observation well) by virtue of the subject pumping test of Well 1.
5. Help determine the aquifer parameters of transmissivity and possibly storativity for the Great Valley Sequence rocks encountered by Well 1. Storativity cannot be determined using water level drawdown data from the pumping well but, instead, can be calculated only if a water level drawdown interference is induced in another water level observation well being monitored during a pumping test.

Pumping Test Protocol

The protocol for the subject pumping test of Well 1 were developed by RCS geologists and provided to LGS, the pumping contractor retained by the Owner to perform the pumping test. Key portions of this pumping test included: minor pumping development work prior to the pumping test; the 8-hour constant rate pumping test; and a final period of water level recovery following the pumping test. Provided below is a summary of the pumping test protocol:

- Well development – LGS reportedly installed a temporary test pump to a depth of ±170 ft bgs in Well 1. In addition, a totalizer flowmeter device was installed near the wellhead so that flow rate and extraction volume data could be collected during pumping development and the subsequent pumping test. Pumping development was then performed in the well between March 13 and 14, 2018, until the well was producing relatively clear groundwater that was visually observed to be free of fine-grained sediment, as determined by the LGS pump operator.

- Pre-test water level recovery – Well 1 was not pumped between the end of pumping development at 2:00 PM on March 14, 2018, and the start of the constant rate pumping test at 8:00 AM on March 16, 2018 (a period of approximately 42 hours). Offsite easement Well 2 (the water level observation well) was not pumped for a period of approximately 16 hours prior to the start of the pumping test at Well 1.
- Constant rate pumping test – The 8-hour pumping portion of the constant rate pumping test was performed at Well 1 on March 16, 2018. Well 1 was continuously pumped at an RCS-recommended rate of 3 gpm[5] throughout the 8-hour pumping test; offsite easement Well 2 was not pumped during the entire 8-hour pumping period for Well 1. Manual water levels were occasionally collected by the LGS pump operator in both Well 1 and the offsite easement Well 2.
- Post-test water level recovery – Following the end of the pumping portion of the test in Well 1, water level recovery data were occasionally collected by the pumper in both Well 1 (the pumping well) and easement Well 2 (the observation well) for a period of approximately 12 hours.

Results of March 2018 Pumping Test

The constant rate pumping test for Well 1 began at 8:00 AM on March 16, 2018, and continued for 8 continuous hours (480 minutes) at an average rate of 3 gpm. The pumping rate was determined from totalizer readings recorded by the LGS pumper throughout the pumping period. Figure 4, "Water Levels During March 2018 Constant Rate Pumping Test," graphically illustrates the water level changes in Well 1 during the 8-hour constant rate pumping test period. Also shown on Figure 4 are the water level data collected from the water level observation Well 2 (i.e., one of the easement wells). Below is a summary of those data:

- Well 1 (the pumping well) – A pre-test SWL of 42.9 ft brp was measured in this well just before the pump was turned on to begin the subject pumping test. After 8 hours (480 minutes) of continuous pumping, the maximum PWL in Well 1 was measured at a depth of 126.5 ft brp, as shown on Figure 4. This represents a maximum water level drawdown of 83.6 ft during the 8-hour constant rate pumping test. As shown on Figure 4, pumping water levels in Well 1 did not appear to become stable or reach "equilibrium" by the end of the pumping test. Specifically, in the last 3 hours of the pumping test, water levels were still decreasing at a rate of about 3.2 ft per hour. Also, the maximum PWL was approximately 44 ft above the depth of the temporary test pump (at ±170 ft bgs).

  Following pump shut-off, water level data were then collected for an additional period of 12 hours. Water levels in the first 4 hours had recovered to a depth of 76.1 ft brp, and after 12 hours water levels had recovered to a depth of 46.0 ft brp; this depth is

[5] Note that RCS geologists selected a pumping rate for the test that was nearly 3 times the rate necessary for the project (approximately 1.08 gpm).

approximately 3.1 ft below the pre-test SWL (of 42.9 ft brp) and represents a water level recovery of 96% at that time.

- Offsite Easement Well 2 (the observation well) – As shown on Figure 4, water levels recorded by the LGS pumper in offsite easement Well 2 showed no definitive water level drawdown impact while pumping the 8-hour constant rate pumping test at Well 1. Specifically, water levels in easement Well 2 were actually recorded to have increased 0.4 ft (from 349.6 ft to 349.2 ft brp) during the 8-hour pumping period at Well 1. During the subsequent 12-hour water level recovery period, water levels continued to increase in Well 2 from 349.2 ft to 349.1 ft brp.

Also shown on Figure 4 are water level data for Well 1 and Well 2 collected by RCS during the February 14, 2018 site visit, and from an historic water level by others for Well 1. The May 1986 measurement by Imboden was derived from the well maintenance records provided by the Owner. The current data show that water levels in Well 1 are similar to those reported by others in May 1986.

Specific Capacity Data

A useful indicator of well performance or efficiency (in terms of changes in water level drawdown over time with respect to pumping rate) is the specific capacity of a well, which can be calculated from the results of the aquifer test or from data generated during regular periods of pumping and water level monitoring. In general, when groundwater is pumped from an active water well, a hydraulic gradient is established toward the well, and a cone of water level depression forms within the local aquifer system, with the pumping well located at the locus (center) of this cone. In general, the greater the pumping rate (and/or the longer the duration of pumping), the greater the water level drawdown will be in the pumping well (drawdown represents the vertical distance between the non-pumping (or static) water level and the resulting pumping water level in the well). As an indication of the relative efficiency or productivity of a well, the term “specific capacity” is commonly used to define the amount of water (in gallons per minute) that the well will yield for each foot of water level drawdown created while the well is pumping at a particular rate. The specific capacity[6] of a well is calculated using the pumping rate of the well (in gpm) divided by the total water level drawdown (in ft) created in that well while pumping at that rate, and is expressed in units of gallons per minute per foot of water level drawdown (gpm/ft ddn).

During the 8-hour pumping test of Well 1 in March 2018, the specific capacity was calculated to be 0.04 gpm/ft ddn. A specific capacity value of 0.03 gpm/ft ddn was calculated following the relatively short, 80-minute pumping test by Imboden in Well 1 in May 1986. The duration of pumping periods in these pumping tests performed in Well 1 vary significantly (between 2 and 8 hours). Longer pumping periods tend to create greater water level drawdowns than shorter pumping periods at similar pumping rates; hence, specific capacity values calculated for long-term pumping tests typically tend to be lower than calculations resulting from relatively short-

[6] The specific capacity of a well depends on several factors, including the hydrogeologic characteristics and thickness of the local aquifer system, the method of well construction, well design details such as gravel pack gradation and gravel envelope thickness, the type and degree of well development performed, the age and current condition of the casing perforations and gravel pack, and the pumping rate and pumping duration of the pumping event being monitored. Hence, it can be difficult to compare specific capacity values from one well to another even if the two wells are in the same aquifer system, but such comparisons can yield valuable information when conditions are similar.

term tests, assuming the tests were conducted at similar pumping rates. This relationship is illustrated by comparing the two known pumping tests performed in Well 1. Regardless, the specific capacity values calculated from the two pumping tests described above are considered to be relatively low and typical for the Great Valley Sequence geologic materials into which Well 1 has been constructed.

Calculation of Aquifer Parameters

Important aquifer parameters such as transmissivity (T) and storativity (S) can be determined using data collected during a pumping test of a well. Transmissivity is a measure of the rate at which groundwater can move through an aquifer system, and therefore is essentially a measure of the ability of an aquifer to transmit water to a pumping well. Transmissivity is expressed in units of gallons per day per foot of aquifer width (gpd/ft). Storativity (S) is a measure of the volume of groundwater taken into or released from storage in an aquifer for a given volume of aquifer materials; storativity is dimensionless and has no units. Storativity calculations can only be made using water level drawdown data, if any, monitored in an observation well during a pumping test of another well; storativity cannot be calculated using water level drawdown data acquired solely from a pumping well.

Water level drawdown and recovery data collected from Well 1 during the March 2018 constant rate pumping test were input into the software program AQTESOLV (version 4.5 Professional). (Note, the additional data collected from Well 2 could not be used to calculate T and/or S because no water level drawdown was observed in easement Well 2 while pumping Well 1). Numerous analytical solutions were then applied to the Well 1 data in attempt to determine transmissivity values using an automatic curve fitting procedure. The solutions utilized consisted of unconfined, confined, semi-confined, and/or fractured aquifer solutions; several variations of these solutions were analyzed by RCS. Typically, water drawdown data from an observation wells are used in these solutions, but, as stated above, no definitive water level drawdown was observed in easement Well 2.

Certain assumptions must be made about the aquifer when applying these solutions. In general, for the solutions listed below, key assumptions are: that the aquifer has an infinite areal (lateral) extent; that the aquifer is isotropic (the same in all directions); that the pumping well fully and/or partially penetrates the aquifer system(s); and that water is instantaneously released from storage with the decline of hydraulic head. Also, for the purposes of this analysis, the assumption is made that the saturated aquifer thickness at Well 1 is 132 ft. This saturated aquifer thickness was determined by taking the vertical distance between the static water level in Well 1 (approximately 43 ft brp on March 16, 2018) and the bottom of the casing perforations in Well 1 (at a depth of approximately 175 ft bgs; see Figure 4).

Listed below are the curve-fitting solutions used, the transmissivity values calculated, and the figure number in this Memorandum on which the water level data and fitted-curve are presented. For each solution used, a storativity value could not be calculated because no definitive water level drawdown data were recorded in observation Well 2 during the subject pumping test.

- Theis/Hantush – Figure 5A, “Constant Rate Pumping Test Analysis, Theis/Hantush Solution, Confined Aquifer, Well 1 (Pumping Well).” – As shown on the figure, the curve for the confined aquifer solution has been “best fit” to the later-time water level drawdown data, and to the water level recovery data observed in Well 1. A transmissivity value of approximately 14 gpd/ft is calculated for these data.

- Papadopulos-Cooper – Figure 5B, "Constant Rate Pumping Test Analysis, Papadopulos-Cooper, Confined Aquifer, Well 1 (Pumping Well)." As shown on the figure, the curve for the confined aquifer solution has been reasonably matched to the later time portion of the water level drawdown data collected during the pumping period in Well 1, and the water level recovery data. A transmissivity value of approximately 18 gpd/ft is calculated for these data.
- Hantush-Jacob – Figure 5C, "Constant Rate Pumping Test Analysis, Hantush-Jacob, Leaky Aquifer, Well 1 (Pumping Well)." – As shown on the figure, the curve for the confined aquifer solution has been reasonably fit to much of the water level drawdown and recovery data acquired during the pumping test of Well 1. A transmissivity value of approximately 14 gpd/ft is calculated for these data.

Based on the analytical solutions described above, the transmissivity values range from 14 gpd/ft to 18 gpd/ft. These values are relatively low, but are typical of those for Great Valley Sequence rocks. In similar analyses performed for other RCS projects in wells constructed within these Great Valley Sequence rocks. Transmissivity values have varied from about ±5 gpd/ft to ±300 gpd/ft. Therefore, the transmissivity values determined from the recent pumping test performed in Well 1 fall within the lower end of this range.

An independent evaluation of transmissivity (T) using data from the subject pumping test, were made via the empirical relationship $T \approx 1{,}750*(Q/s)$[7], where (Q/s) is the specific capacity of the pumping well and 1,750 is an empirical constant for the semi-confined aquifer system assumed to exist in the rocks of the Great Valley Sequence. Applying this relationship to the specific capacity value calculated for the subject pumping test of Well 1 yields a transmissivity value on the order of 70 gpd/ft. This theoretical transmissivity value is somewhat higher than values of T determined via the analytical solutions determined using AQTESOLV software and the pumping test data. This empirical method to estimate transmissivity only considers drawdown and does not factor in any water level recovery, whereas the curve-fitting solutions used in AQTESOLV utilize both drawdown and recovery to determine transmissivity. Transmissivity values determined by the curve-fitting solutions are considered to be more representative of the regional spatial area and more indicative of long-term pumping conditions. .

Theoretical Drawdown in Nearby Wells

As shown on Figures 1 and 2 there are a total of five offsite wells located within 500 ft of Well 1. RCS assigned designations of "Well A" through "Well D" to four of these wells for the purposes of our analyses of theoretical drawdown; Well 2 is an easement well to which the subject property has access. The approximate distance and direction of these five wells, relative to Well 1, are as follows:

- Well 2 (290 ft east)
- Well A (340 ft northeast)
- Well B (260 ft northeast)
- Well C (320 ft northeast)

[7] This methodology is described in Driscoll (1986)

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- Well D (335 ft southeast)

To calculate the theoretical drawdown in the onsite Well 1 and the five nearby offsite wells that might possibly be induced by the future pumping of Well 1, and to help satisfy requirements of the County's Tier 2 WAA, RCS used the AQTESOLV software to perform a "predictive simulation" of the potential (theoretical) water level drawdowns that might occur in the region due to future pumping by Well 1. For the subject simulations, RCS specifically used the Theis (1935)/Hantush (1961) solution in the AQTESOLV software, the known construction of the onsite Well 1, and a number of other assumptions related to the hydrogeologic properties of the local Great Valley Sequence rock aquifer system into which the wells are constructed. Below is a list of the inputs/assumptions used as part of our theoretical drawdown calculations:

- Inherent Theis Assumptions – Again, the Theis (1935)/Hantush (1961) solution assumes numerous conditions about the aquifer system, including that aquifer is homogeneous and isotropic (the same in all directions) and that the aquifer is of infinite areal extent.
- Well Penetration – For the purposes of the simulation, Well 1 is assumed to be a "partially penetrating" well. AQTESOLV states that the perforations of a partially penetrating well only extend over a portion of an aquifer's saturated thickness. Casing perforations for Well 1 reportedly begin at a depth of 95 ft bgs, and the top of the aquifer is assumed to be at a depth of roughly 43 ft bgs. The top of perforations for Well 1 were determined by our review of the March 12, 2018 downwell video survey performed in this well by Pacific Surveys. Well construction data for the nearby offsite wells are unknown, with the exception of "Well A". A driller's log for "Well A" reviewed by RCS revealed that this well is constructed with 6-inch diameter casing to a total depth of 520 ft bgs. However, we do not have a current static water level for "Well A". In order to assume that the observation wells are also "partially penetrating", it is necessary to know static water level depth and the depth of the well. Therefore, for the purposes of this simulation, these five observation wells are assumed to be "fully penetrating" wells.
- Aquifer Thickness – The thickness of the saturated Great Valley Sequence rock aquifer system near Well 1 is estimated to be 132 ft. This is equal to the difference between the SWL water level in Well 1 (about 42 ft bgs), and the ±175-foot depth to the bottom of Well 1.
- Transmissivity and Storativity – To perform the required calculations, it was first necessary to calibrate the theoretical equations by simulating an 8-hour pumping period in Well 1 and then attempt to reproduce the water level drawdown values that were actually recorded by the LGS pumper in the pumping well during the 8-hour pumping test. Based on the results of the previous curve-fitting procedures to determine the aquifer parameters (see the previous section "Calculation of Aquifer Parameters"), the representative value of transmissivity (T) initially used for this simulation was 14 gpd/ft. Because no definitive water level drawdown impact was observed in the monitored offsite easement Well 2 (observation well) during the 8-hour pumping period of Well 1 (pumping well), a value for storativity could not be determined. Therefore, a storativity value of $1x10^{-6}$ cubic feet per square foot per foot, which represents a dimensionless value, is

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assumed for the local aquifer system. Note that this is a conservative assumption for storativity.[8]

Using a T value of 14 gpd/ft and an S value of $1x10^{-6}$, the self-induced water level drawdown in Well 1 was theoretically predicted by the AQTESOLV software to be on the order of 500 ft; this calculated drawdown value for Well 1 is much larger than the 83.6 ft of drawdown that was actually observed during the Well 1 pumping test. Figure 6A, "Theoretical Drawdown Calculations/3gpm/T=14 gpd/ft," has been prepared to illustrate the theoretically-predicted water level drawdown value in Well 1 after 8 hours of continuously pumping Well 1 at a constant rate of 3 gpm, based on a transmissivity of 14 gpd/ft and a storativity of $1x10^{-6}$. This scenario does not match the actual conditions observed, and therefore, better calibration of the aquifer parameters was determined to be necessary.

To better calibrate the software to the actual drawdown values that were recorded by the LGS pumper in Well 1 during the 8-hour pumping test, adjustments were made to the assumed transmissivity value used in the AQTESOLV simulation. After an iterative process, a transmissivity value of 91 gpd/ft was found to provide drawdown values that were more comparable to those that were actually monitored in the field. This transmissivity value of 91 gpd/ft yielded a theoretical water level drawdown value of 84 ft; this value is very similar to the 83.6 ft of drawdown actually observed during testing. Figure 6B, "Theoretical Drawdown Calculations/3 gpm/T=91 gpd/ft," shows the calculated water level drawdown value in Well after 8 hours of pumping Well 1 at a constant rate of 3 gpm, based on a transmissivity of 91 gpd/ft and a storativity of $1x10^{-6}$.

Once the transmissivity value was better calibrated to actual field drawdown values observed in Well 1, the predictive water level drawdown simulation was performed to include nearby offsite Well 2, along with offsite Well A, Well B, Well C, and Well D (see Figure 2). Figure 6C, "Theoretical Drawdown Calculations in Offsite Wells," has been prepared to show the theoretically-calculated water level drawdown values in Well 1 and also in the five offsite observation wells after pumping Well 1 for a continuous period of 8 hours at a more realistic constant rate of 1.5 gpm (not 3 gpm, which is the rate at which the actual test was performed). The simulation shown on Figure 6C is considered to be more representative of the actual operational pumping rate and pumping duration that are proposed for Well 1 for the winery expansion project (as mentioned above, the pumping rate estimated to be needed from Well 1 is 1.08 gpm, pumping 8 hours per day during the entire year; 1.5 gpm is used here to present a conservative analysis). In this scenario, the offsite observation wells are assumed to be not pumping during the Well 1 pumping period. A summary of the results of this predictive simulation and comparisons to the actual water level drawdown values observed during testing are presented in Table 3, "Calculated Theoretical Water Level Drawdown in Offsite Wells." Results of the simulation are as follows:

- Well 1 (pumping well) – After pumping at a rate of 1.5 gpm for a period of 8 hours, an approximate theoretical water level decline (i.e., self-induced water level drawdown) of 42 ft is calculated for this well.

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[8] The WAA Guidance document provides a range of specific storage values for "rock, fissured" in Appendix F, Table F-3 (WAA 2015); the lowest value therein is $1x10^{-6}$ (ft^{-1}). Multiplying this specific storage value by the estimated aquifer thickness of 135 ft yields a dimensionless storativity value of $1.4x10^{-4}$. Therefore, using an S value of $1x10^{-6}$ is a conservative assumption for this analysis.

- Well 2 (easement well) – A theoretical water level drawdown value of 8.9 ft is predicted as a result of pumping Well 1 at 1.5 gpm for 8 hours. Recall that no water level decline was actually observed in this well during the pumping test of Well 1.
- Well A (offsite well) – A theoretical water level drawdown value of 8.2 ft is predicted as a result of the future pumping of Well 1 at 1.5 gpm for 8 hours.
- Well B (offsite well) – A theoretical water level drawdown value of 9.3 ft is predicted as a result of the future pumping of Well 1 at 1.5 gpm for 8 hours.
- Well C (offsite well) – A theoretical water level drawdown value of 8.5 ft is predicted as a result of the future pumping of Well 1 at 1.5 gpm for 8 hours.
- Well D (offsite well) – A theoretical water level drawdown value of 8.3 ft is predicted as a result of the future pumping of Well 1 at 1.5 gpm for 8 hours.

Because no water level drawdown was detected in easement Well 2 (290 ft east of Well 1) during the 8-hour long March 2018 pumping test of Well 1 (performed at a rate of 3 gpm), then it is clear that the theoretical calculations clearly overestimated actual conditions. Therefore, water level drawdown impacts to the nearby offsite wells, if any, experienced during future pumping of the onsite Well 1 are anticipated to be less than the values that have been theoretically predicted by the calculations

These theoretical water level drawdown values, which ranged between 8.2 ft and 9.3 ft for the five wells, are also less than the range of acceptable values defined in the "Default Well Interference Criteria" shown on Table F-1 of the May 12, 2015 Napa County WAA Guidelines (WAA 2015). Those drawdown criteria in the WAA Guidelines (WAA 2015) show that drawdown is not considered significant by the County if less than 10 ft for offsite wells with a casing diameter of six inches or less, and less than 15 ft for offsite wells with a casing diameter greater than six inches.

Static Water Level Elevation Difference

A relatively significant difference in water level elevation exists between onsite Well 1 and offsite Well 2. The static water level elevation in Well 1, approximately 157 ft above sea level (asl), is based on a well site elevation of 200 ft asl and a static water level of 43 ft brp). That ±157-foot elevation is significantly higher than the water level elevation of offsite Well 2 (approximately 164 ft below sea level, based on a well site elevation of 186 ft asl and a static water level depth of about 350 ft brp). This represents a water level elevation difference of 321 vertical feet, while these two wells are only separated by a horizontal distance of 290 ft. Therefore, the static water level of 350 ft brp in Well 2 is still approximately 187 ft deeper in elevation than the bottom of perforations in Well 1 (at a depth of approximately 175 ft bgs); the depth to the top of perforations in Well 2 is unknown.

These observations suggest that the fractured rock aquifer systems in the vicinity of the subject property are likely discontinuous and variable in the region. Therefore, groundwater in Well 1 may not be in direct hydraulic communication with that in easement Well 2 and/or with those in the other four nearby offsite wells used for the simulations. That is, it is possible the wells are perforated in different fracture systems, and they may have only a few sets of fractures in common; such a large discrepancy in water level elevations could also be caused by a fault that is a barrier to groundwater flow. However, no evidence of such a fault was observed by RCS, and such a fault is not shown to exist between Well 1 and offsite Well 2 on published geologic mapping of the area.

Rainfall

Long-term rainfall data are essential for estimating the average annual recharge that may occur at the Matthiasson Family Vineyards property. Average annual rainfall totals that occur specifically at the subject property are not directly known because no onsite rain gage exists. However, a rain gage with over 100 years of available data is reported to exist roughly 6 miles to the southeast of the subject property. Data for this gage are available from the California Data Exchange Center (CDEC) website maintained by DWR, and the gage is named “NSH – Napa Fire Department.” Data from the CDEC website for this gage are available beginning in 1904, but Water Year (WY) 1980-81 (October 1980 – September 1981) and WY 1981-82 appear to be missing several months of rainfall data. Note that RCS only removed rainfall totals; no rainfall data were “added” to the data set. With these assumed erroneous data points removed from the data set, then an average rainfall of 24.5 inches (2.04 ft) from WY 1904-05 through WY 2016-17 is calculated at this gage. This rain gage is located at a lower elevation (±60 ft asl) than that of the subject property (between ±150 ft and ±300 ft asl, depending on location on the property), and therefore the average annual rainfall at the subject property could be slightly higher than that experienced at this known gage location.

Another rain gage, labeled as “Redwood Creek at Mt. Veeder,” exists along the Napa Valley floor approximately 1 mile west of the subject property. Rainfall data for this rain gage are available on the Napa One Rain website; this website is maintained by Napa County. Data for this rain gage are available for the relatively short period of WY 2000-01 through WY 2016-17. The average annual rainfall at this Napa One Rain Redwood Creek at Mt. Veeder rain gage is calculated to be approximately 35.9 inches (2.99 ft). Because the period of rainfall record for this is gage is relatively short (17 years) and includes 5 years of drought (as defined by DWR), RCS does not consider these data to be representative of the long-term annual average rainfall in the area surrounding the subject property. This rainfall gage is also located at a slightly higher elevation (±360 ft asl) than that of the subject property, and therefore the average annual rainfall at the subject property could be similar to and/or slightly lower than that experienced at this known gage location.

To help corroborate the average annual rainfall data derived from the CDEC and/or Napa One Rain gages, RCS reviewed the precipitation data published by the PRISM Climate Group at Oregon State University. This data set, which is freely available from the PRISM website contains “spatially gridded average annual precipitation at 800m grid cell resolution.” The date range for this dataset includes the climatological period between 1981 and 2010. These gridded data provide an average annual rainfall distributed across the subject property. Using this data set, RCS determined that the average rainfall for the subject property for the stated date range is approximately 29.8 inches (2.48 ft).

An additional rainfall data source, an isohyetal map (a map showing contours of equal average annual rainfall) was prepared by the County for all of Napa County, and is freely available for download from the online Napa County GIS database (a copy of this map is not provided herein). As described in the metadata for the file (also available via the download page at the web link shown above), the isohyets are based on a 60-year data period beginning in 1900 and ending in 1960. As stated in the metadata for the file, the contour interval for the map is reported to be "variable due to the degree of variation of annual precipitation with horizontal distance", and therefore the resolution of the data for individual parcels is difficult to discern. The subject property appears to be situated within the boundaries of the 35-inch average annual rainfall contour on the County map. Based on our interpretation of the actual isohyetal contour map, the long-term average annual rainfall at the subject property may be on the order of 30 inches (2.50 ft), using these rainfall data.

Table 4, "Comparison of Rainfall Data Sources," provides a comparison of the data collected from the different rainfall sources discussed above. Based on those rainfall data sources and as summarized on Table 3, RCS will consider the long-term average annual rainfall at the subject property to be 29.8 inches (2.48 ft), as derived from the PRISM data set. The 29.8-inch per year estimate is based on the data source with a relatively long period of record (29 years) and is more site-specific, when compared to the other rainfall data sources listed in Table 4 that: exist at different elevations; and/or are located a significant distance from the subject property; and/or have a shorter period of available data.

Estimates of Groundwater Recharge

Groundwater recharge on a long-term average annual basis at the property can be estimated as a percentage of average rainfall that falls on the subject property and becomes available to deep percolate into the aquifer over the long-term. The actual percentage of rain that deep percolates can be variable based on numerous conditions, such as the slope of the land, the soil type that exists at the property, the evapotranspiration that occurs on the property, the intensity and duration of the rainfall, etc. Therefore, RCS has considered various analyses of deep percolation into the rocks of the Great Valley Sequence, as relied upon by other consultants and government agencies for projects in Napa Valley.

Recharge volumes estimated in this Memorandum are based on the long-term average annual rainfall values determined for the subject property using the available data presented above. Note that a calculation of average annual rainfall for any long-term period always includes periods of below-average rainfall and above-average rainfall that occurred during the period over which the average was calculated. Therefore, the following recharge calculations also include consideration of drought year conditions.

Updated Napa County Hydrogeologic Conceptual Model (LSCE&MBK, 2013)

Estimates of groundwater recharge as a percentage of rainfall are presented for a number of watersheds (but not all watersheds) in Napa County in the report titled "Updated Napa County Hydrogeologic Conceptual Model" (LSCE&MBK, 2013) prepared for Napa County. Watershed boundaries within Napa County are shown on Figures 8-3 and 8-4 in that report. At the request of RCS, those watershed boundaries were provided to RCS by MBK Engineers (MBK). Figure 7, "Watershed Boundaries," was prepared for this project using those watershed boundaries for which data are available. As shown on Figure 7, the subject property is located approximately 1,500 ft east of the watershed referred to by MBK as "Redwood Creek." Further, review of the geology map on Figure 3 shows that the geology in the nearby Redwood Creek watershed is similar to that of the subject property (underlain by rocks of the Great Valley Sequence). As shown on Table 8-9 on page 97 of the referenced report (LSCE&MBK, 2013), 10% of the average annual rainfall that occurs within this nearby watershed is estimated to be able to deep percolate as groundwater recharge. Therefore, even though the subject property is not located within the Redwood Creek watershed, RCS assumes that a rainfall recharge of 10% for the subject property could be possible (no specific recharge percentage is reported for the region in which the subject property exists in the LSCE&MBK 2013 document).

As stated above, the total surface area of the subject property is 5.8 acres. Assuming a conservative volume of 29.8 inches (2.48 ft) of rainfall occurs on the subject property on a long-term average annual basis, then the total volume of rainfall that would fall each year directly on the property over the long term is approximately 14.4 AF (5.8 acres x 2.48 ft). Assuming 10% of the average annual rainfall would be able to deep percolate to the groundwater beneath the subject property, then the average annual groundwater recharge at the subject property would be approximately 1.44 AF/yr. This estimated annual future recharge volume is greater than the total proposed onsite groundwater demand of 0.583 AF/yr (to be provided by Well 1).

WAA Analyses for Neighboring Rainfall Recharge Estimates.

A "Water Availability Analysis" report was prepared by RCS (April 2017) for the adjacent Anthem Winery project located at 3454 Redwood Road and 3123 Dry Creek Road (County APNs 035-460-038 and 035-470-046); boundaries of that property are shown on Figures 2 and 3. The main part of the Anthem property is primarily located southwest of the subject property, but a narrow extension of the Anthem property traverses along the southerly side of the subject property. As seen on Figure 3, the easterly portion of the Anthem property is underlain by the same Great Valley Sequence rocks that are known to underlie the subject property. Using the information and data presented in the LSCE&MBK report (2013), RCS similarly used a conservative estimate of 10% of the average annual rainfall that occurs on the Anthem property is able to deep percolate as groundwater recharge; the Anthem Winery property is partially located within the Redwood Creek watershed (LSCE&MBK 2013). Groundwater recharge at the Anthem property on a long-term average annual basis was estimated to be 11.02 AF/yr. For that analysis, the average annual recharge volume was calculated to be higher than the estimated long-term groundwater demand for the Anthem property.

A Water Availability Analysis was also prepared for the Woolls Ranch Winery project by LSCE (2014), which is located west of the subject property (see Figure 2). That analysis used a slightly different methodology for determining annual the groundwater recharge volume that resulted from direct rainfall recharge onto the Woolls Ranch property than RCS has used for this document, or was used by RCS for our prior analyses for Anthem. In our opinion, based on our review of the data presented in the Woolls Ranch WAA, that analysis was quite conservative. Importantly, the Wools Ranch report relied on some of the same hydrologic data for the Redwood Creek Watershed that were used to develop the estimates in the "Napa Hydrogeologic Conceptual Model" also by LSCE&MBK (2013). Ultimately, the Woolls Ranch WAA concluded that the proposed water demands of that project were less than the 21.79 AF/yr of recharge estimated to occur at the property.

Possible Effects of "Prolonged Drought"

California has experienced a number of periods of extended drought throughout its history. Here, drought is defined as a meteorological drought, that is, a period in which the total annual precipitation is less than the long-term average annual precipitation (DWR 2015). For similar projects in the County, Napa County PBES has asked RCS to consider what the effects on groundwater availability at a particular property might be if a period of "prolonged drought" were

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to occur in the region, assuming the project were to operate in the future as described. Recharge volumes estimated in this document are based on the long-term average rainfall values determined for the subject property using available data. Recall that a calculation of average annual rainfall for any long-term period always includes periods of below-average rainfall and above-average rainfall that occurred during the same period for which the average was calculated. Therefore, it is our opinion that the preceding calculations for rainfall do inherently include consideration of drought year conditions.

However, to help understand what potential conditions might exist in the local sedimentary rocks beneath the property during a "prolonged drought period", a "prolonged drought" must be defined. As discussed by DWR, "there is no universal definition of when a drought begins or ends, nor is there a state statutory process for defining or declaring drought." (DWR 2015). California's most significant historical statewide droughts were defined by DWR as occurring during the following periods (DWR 2015):

- WY 1928-29 through WY1933-34 - six years
- WY 1975-76 through WY 1976-77 – two years
- WY 1986-87 through WY 1991-92 – six years
- WY 2006-07 through WY 2008-09 – three years
- Recent drought – WY 2011-12 through WY 2015-16[9] – five years

Table 5, "Drought Period Rainfall as Percentage of Average," shows the average amount of rainfall that occurred during each drought period for which rainfall data exist at the three rain gages discussed above and shown on Table 4; that drought period rainfall amount is also expressed on Table 5 as a percentage of the total rainfall that occurred. As shown on Table 5, determining the amount of rain that might fall during a "prolonged drought" is variable, and would depend on the period of record for the specific rain gage. Clearly, the WY 1975-76 to WY 1976-77 drought period recorded by the "NSH-Napa Fire Department" rain gage and reported by the CDEC had the lowest drought period rainfall at 48% (drought period average was 11.8 inches), compared to the long-term average (24.5 inches), and that drought lasted two years. The WY 1928-29 to WY 1933-34 drought period lasted for six years, but rainfall during this drought was 71% of the average annual rainfall at the CDEC rain gage. It is important to note that the drought year percentage listed on Table 5 is completely dependent on the period of record for each individual gage. An example of this is the Napa One Rain gage data; because the period of record for this gage is short, and includes many drought years, then the last available drought period (WY 2011-12 to WY 2015-16) rainfall percentage is shown to be 79% of the long-term average.

Hence, for the purposes of this report, a "prolonged" drought period rainfall is conservatively considered to be 48% of the average annual rainfall that occurs in the region (using the rainfall data from the CDEC NSH-Napa Fire Department rain gage). Further, to again be conservative, a "prolonged drought period" is estimated to last 6 years, which is the longest drought period on

[9] The DWR 2015 drought document was published in February 2015, and lists the recent drought through WY 2013-14 only; the drought continued throughout the State into WY 2015-16. Due to the rains in late-2016 and early-2107, various sources, including the National Drought Mitigation Center website (NDMC 2017), declared an end to the drought in Northern California, which would include Napa County.

record according to DWR (DWR 2015); see Table 5. This six-year period is a conservative estimate, because the 48%-average figure corresponds with a two-year drought period, not a six-year drought period.

To meet six years of estimated groundwater demand for the subject property, a total onsite groundwater extraction of 3.50 AF/yr is estimated to be needed for the subject property (0.583 AF/yr times 6 years). Assuming groundwater recharge is reduced to 48% of the average annual recharge during such a theoretical "prolonged drought period", then a total of approximately 4.14 AF of groundwater recharge might occur during the six-year drought period for the subject property, as calculated below:

- As shown herein under the heading "Estimates of Groundwater Recharge," a conservative estimate of the average annual groundwater recharge on the property is estimated to be 1.44 AF/yr. Taking 48% of this annual volume yields a drought period recharge volume of 0.69 AF/yr.
- Assuming a drought period duration of 6 years, then 4.14 AF of groundwater (0.69 AF/yr times 6 years) would be able to recharge the Great Valley Sequence rocks beneath the subject property by virtue of deep percolation of the direct rainfall that occurs solely within the boundaries of the subject property.

Therefore, assuming a theoretical six-year drought period in which only 48% of the average annual rainfall might occur, a conservative estimate of the total drought-period recharge at the subject property (4.14 AF) would still exceed the estimate of the total groundwater demand for the subject property (3.50 AF) that may occur over the same six-year period.

Groundwater Quality

Samples of groundwater were collected by others from Well 1 at the end of the 8-hour constant rate pumping test on March 16, 2018. Table 6, "Summary of Available Groundwater Quality Data - Well 1," summarizes water quality data available from the laboratory analyses of those groundwater samples; the laboratory analyses were performed by Caltest Analytical Laboratory of Napa, California. Data presented on Table 6 reveal the following with regard to key water quality constituents for groundwater pumped by Well 1:

- The character of the groundwater from the local bedrock aquifer system appears to be a sodium-bicarbonate ($Na\text{-}HCO_3$) type of water.
- Specific conductance (also known as electrical conductivity, or EC) was reported to be 710 microSiemens per centimeter (µS/cm).
- Total hardness (TH) was reported to be 52 milligrams per liter (mg/L). Water with a TH between 17.1 and 60 mg/L is considered to be "slightly hard."
- Total dissolved solids (TDS) was detected at 460 mg/L.
- The pH of groundwater was reported to be 8.2, indicating that the water is slightly acidic (below pH 7).
- Nitrate (as N) was reportedly detected at a concentration of 0.14 mg/L.
- The adjusted sodium adsorption ratio (SAR) was reported to be 8.8 (unitless).

- Arsenic (As) was detected at a concentration of 11 micrograms per liter (µg/L); arsenic has a State Primary Maximum Contaminant Level (MCL) of 10 µg/L for water used for domestic purposes. Thus, slightly elevated concentrations of arsenic were detected in onsite Well 1. Because Well 1 is to be used to supply the domestic use portion of the winery water demands (i.e., winery employees), treatment for this elevated constituent is required. Reportedly, treatment for arsenic of the groundwater pumped from Well 1 has been anticipated by the Owner; this treatment will reportedly not increase onsite water demands from this well.
- Boron was reportedly detected at a concentration of 320 µg/L.
- Iron (Fe) was reportedly not detected (ND) in Well 1. Iron has a State Secondary MCL of 300 µg/L for water to be used for domestic purposes.
- The manganese (Mn) concentration in Well 1 was reported to be 8.3 µg/L. The State Secondary MCL for this constituent is 50 µg/L for domestic use.

Key Conclusions and Recommendations

1. The existing 5.8-acre property is currently developed with a single-family residence, 3.85 acres of vineyards, and a winery with a current capacity of 5,000 gallons of wine per year.
2. The proposed winery expansion project consists of increasing winery production to a capacity of 18,000 gallons per year.
3. The estimated average annual water demand of the discretionary winery expansion project is estimated to be 0.583 AF/yr. This water demand will be met by pumping groundwater from Well 1, and represents the sole water pumped from within the boundaries of the subject property
4. To meet the estimated groundwater demand of the discretionary winery expansion project each year, Well 1 would need to pump at a rate of approximately 1.5 gpm, assuming the well is pumped on a 33% operational basis (8 hours per day, every day) throughout the year.
5. Groundwater recharge at the subject property on an average annual basis is estimated to be 1.44 AF/yr; this value is based on conservative estimates of average annual rainfall at the property and estimates of the percentage (approximately 10%) of rainfall (over a long-term average annual basis) that could be available to deep percolate into the fractured and jointed rocks of the Great Valley Sequence that underlie the subject property. This estimated annual future recharge volume is greater than the 0.583 AF/yr proposed onsite groundwater demand (to be pumped from onsite Well 1) for the discretionary winery expansion project.
6. Conservative estimates of recharge that may occur during a “prolonged drought” (as defined above) show that, over a theoretical six-year drought period in which only 48% of the average annual rainfall that might occur, a total of 4.14 AF of rainfall recharge would occur within the boundaries of the subject property. This recharge estimate of 4.14 AF is greater than the total estimated groundwater demand of 3.50 AF for that same six-year drought period. AQs reported by Madrone, water use for the discretionary

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winery expansion project is not expected to vary between normal water years and dry water years.

7.

8. Current water demands for all existing uses at the subject property are estimated by the project engineer to be 1.683 AF/yr. These existing water demands include: 0.750 for the residence; 0.770 AF/yr for vineyard irrigation; and 0.163 for the winery. These current demands are met via pumping groundwater from an offsite well (easement Well 2).

9. Overall, water demands of the property are estimated to decrease from 1.686 AF/yr to 1.517 AF/yr as result of this proposed winery expansion project. This represents an overall 10% decrease in water use from the existing water demand.

10. Based on the results of the March 2018 constant rate pumping test, the project well (Well 1) appears to be capable of pumping at rates needed to meet the future groundwater demands of the project; water level and flow rate monitoring during this pumping test were conducted by LGS. Well 1 was pumped at an average rate 3 gpm during its pumping test, but is required to pump only at a rate of roughly 1.08 gpm in the future. With an initial static water level of 42.9 ft brp, a maximum water level drawdown of 83.6 ft was created; this calculates to a current specific capacity value for Well 1 of 0.04 gpm/ft ddn. Results of the Well 1 pumping test also showed that water levels did not become stable at the end of the pumping portion of the pumping test, but the final pumping water level depth of 126.5 ft was also approximately 48 ft above the observed bottom-most perforations in the well, and therefore, additional water level drawdown is still available in Well 1. Following 12 hours of water level recovery, water levels in the well recovered to a level of 96% of the total drawdown during the testing period. Notably, future water demands for the project will require that this well be pumped at a rate that is much lower than that used during the pumping test.

11. Because there are at least five offsite wells (including easement Well 2) located within 500 ft of onsite Well 1, a Tier 2 WAA was performed. This Tier 2 WAA included the pumping test of Well 1. During the March 16, 2018 8-hour pumping test of Well 1, water level measurements were also manually recorded by LGS in easement Well 2 (the observation well). During the pumping portion of the Well 1 pumping test, no water level drawdown impacts were induced in the offsite easement Well 2.

12. Using data collected from the pumping test of Well 1, theoretical estimates of water level drawdown that could be induced while pumping Well 1 on the four offsite wells within 500 ft of Well 1 were estimated. As summarized on Table 3, results of these analyses showed that the theoretical drawdowns induced in the offsite wells by virtue of pumping the project well (Well 1) at the rate and duration necessary for the project would all be less than 10 ft (10 ft of drawdown is the minimum default well interference criteria listed on Table F-1 in the WAA guidance document).

13. Often, water levels in aquifer systems similar to those found beneath the subject property decline during the drier spring and summer months, when irrigation demand is higher, when rainfall recharge is low, and when wells constructed into these fractured rock aquifers are pumping. Water levels in the local aquifer systems tend to recover

once the rainy season is underway because that rainfall becomes available for deep percolation and recharge into these sedimentary rocks.

14. Based on the single historic groundwater level measurement for Well 1 recorded in May 1986, water levels do not appear to have changed significantly in this well over time.
15. In the future, RCS recommends monitoring on a regular basis of static and pumping water levels, and also of the instantaneous flow rates and cumulative pumped volumes from Well 1 via the use of dual-reading flow meters (that records both flow rate and totalizing values); Well 1 was not equipped with a flow meter dial device at the time of our February 2018 site visit. RCS also recommends that future water level measurements in Well 1 be recorded using a pressure transducer to permit the automatic, frequent, and accurate recording of water levels in the well. By continuing to observe the trends in groundwater levels and future well production rates over time evaluated by qualified professionals, the property owner can address potential declines in water levels and well production in the onsite well.

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References

- **(CGS 2004)** Clahan, K.; Wagner, D.; et al., 2004. Geologic Map of the Napa 7.5' Quadrangle, Napa County, California: A Digital Database. California Geological Survey.
- **(DWR 2015)** Jones, Jeanine, et al., February 2015. California's Most Significant Droughts: Comparing Historical and Recent Conditions, California Department of Water Resources
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- **(LSCE&MBK 2013)** Luhdorff & Scalmanini Consulting Engineers and MBK Engineers, January 2013. Updated Hydrogeologic Conceptualization and Characterization of Conditions, Prepared for Napa County.
- **(RCS 2017)** Richard C. Slade & Associates, LLC, April 2017. Results of Aquifer Testing of Project Wells and Napa County Tier 1 Water Availability Analysis (WAA).
- **(WAA 2015)** Napa County Board of Supervisors, Adopted May 12, 2015. Water Availability Analysis (WAA) – Guidance Document.

Websites:

- Napa County GIS database, 2017. https://gis.napa.ca.gov.
- EarthExplorer, United States Geological Survey 2017. https://earthexplorer.usgs.gov/
- California Data Exchange Center, California Department of Water Resources, 2017. https://cdec.water.ca.gov
- Napa One Rain, County of Napa, 2017. https://napa.onerain.com
- Western Regional Climate Center, 2017. https://www.wrcc.dri.edu
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- (NDMC 2017) National Drought Mitigation Center website, 2017 http://drought.unl.edu/

Table 1
Summary of Well Construction and Pumping Data
Matthiasson Family Vineyards

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	Reported Well Designation	DWR Well Log No.	Date Drilled	Method of Drilling	Pilot Hole Depth (ft bgs)	Casing Depth (ft bgs)	Casing Type	Casing Diameter (in)	Borehole Diameter (in)	Sanitary Seal Depth (ft bgs)	Perforation Intervals (ft bgs)	Type and Size (in) of Perforations	Gravel Pack Interval (ft) and Size	Current Status of Well	Post-Construction Yield Data					
															Date & Type of Yield Data	Duration of "Test" (hrs)	Estimated Flow Rate (gpm)	Static Water Level (ft)	Pumping Water Level (ft)	Estimated Specific Capacity (gpm/ft ddn)
Onsite	Well 1	ND				177 (approx.)	Steel	6	ND	60 (approx.)	95-175 (approx.)	Factory-cut ND	ND	Active	May 1986 Pump	1.3	4	31	168	0.03
															March 2018 Pump	8	3	42.9	126.5	0.04
Offsite	Well 2*	ND	January 1988	Mud Rotary	440	440	PVC	5	ND	25	60-440	ND	ND	Active	October 1987 Airlift	4	6	280	ND	ND
	Well 4	e0329616	November 2016	Mud Rotary	340	340	PVC	6	9	0-21 (cement) 21-51 (bentonite)	140-160 180-340	Factory-cut 0.032	ND	ND	11/15/2015 Airlift	6	8	223	ND	ND
	Well A	103059	July 1977	Mud Rotary	520	520	PVC	6	ND	0-25 (cement)	160-520	ND 0.125	ND	ND	July 1977 Bail	ND	8	90	ND	ND
	Well B*	No Available Data																		
	Well C	080084	December 1980	Cable	115	115	Steel	5	8	0-20 (cement)	84-104	ND 0.125	ND	ND	December 1980 Bail	1	15	25	ND	ND
	Well D	ND	May 1975	Mud Rotary	485	485	Steel	6	ND	0-20 (concrete)	ND	ND	ND	ND	May 1975 Bail	4	8	ND	ND	ND

Notes: ft bgs = feet below ground surface
SWL = static water level
brp = below reference point, generally top of wellhead
ND = No data available
* = Data derived from Napa County Well Permit, not a driller's log

Table 2
Water Demand Estimates
Matthiasson Family Vineyards

DRAFT

Groundwater Use	Estimated Water Demand (acre-feet/year)	
	Existing[(1)]	Proposed[(2)]
Winery Use		
Process Water	0.108	0.387
Domestic Water + Landscaping	0.025	0.090
Employees	0.024	0.054
Visitors	0.006	0.044
Event Visitors per Year	0.000	0.008
Total Winery Water Use	**0.163**	**0.583**
Residential		
Residence	0.750	0.750
Total Residential Water Use	**0.750**	**0.750**
Vineyards		
Vineyard Irrigation	0.770	0.184
Total Vineyard Irrigation Water Use	**0.770**	**0.184**
Total Combined Water Use	**1.683**	**1.517**

Notes:
This table has been adapted from table of "Water Availability Analysis" by Madrone, dated April 16, 2018.
Madrone estimates based on Napa County Water Availability Analysis Guidance Document (WAA 2015)
1 acre-foot = 325,851 gallons
1. All existing onsite water demands have historically been met by pumping groundwater from onsite Well 1 and/or offsite easement wells.

2. All future "Residential" and "Vineyard Irrigation" water demands will be met by pumping groundwater from the offsite easement wells; the Owner plans to begin "dry farming" of vineyards. All future "Winery" water demands will be met by pumping groundwater from onsite Well 1.

Table 3
Calculated Theoretical Water Level Drawdown in Offsite Wells
Matthiasson Family Vineyards

Well	Distance from Pumping Well (ft)	"Theoretical" Water Level Drawdown (ft)	Recorded "Actual" Water Level Drawdown (ft)
Well 1 (pumping well)	--	42	83.6
Well 2 (offsite easement well)	290	8.9	No drawdown observed
Well A (offsite well)	340	8.2	--
Well B (offsite well)	260	9.3	--
Well C (offsite well)	320	8.5	--
Well D (offsite well)	335	8.3	--

Note: Predictive simulation performed using AQTESOLV Pro Version 4.5 by Hydrosolve, Inc; simulation assumes a transmissivity (T) of 91 gpd/ft and storativity (S) $1x10^{-6}$ while pumping Well 1 at constant rate of 1.5 gpm for 8 continuous hours in the future.

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Table 4
Comparison of Rainfall Data Sources
Matthiasson Family Vineyards

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Rain Gage and/or Data Source	Years of Available Rainfall Record	Average Annual Rainfall in Inches (ft)	Elevation of Rain Gage (ft asl)	Distance of Rain Gage from Subject Property(1) (mi)	Elevation Relative to Subject Property
CDEC NSH-Napa Fire Dept.	WY 1904-05 through WY 2016-17(2)	24.5 (2.04)	60	6.0	Lower
Napa One Rain Redwood Creek at Mt. Veeder	WY 2000-01 through WY 2016-17(3)	35.9 (2.99)	360	1.0	Higher
PRISM	1981 to 2010	29.8 (2.48)	---	---	---
Napa County Isohyetal Map	1900 to 1960	35.0 (2.92)	---	---	---

Notes:

1. The subject property is located at elevations between ±150 and ±300 ft asl
2. Erroneous and/or missing rainfall data occur in WY 1986-87, WY 1987-88, WY 1988-89, and WY 1994-95.
3. Missing rainfall data occur in 1907, 1915-1922, 1979-1980, 1985-1988, 1992, and 2011-2012.

Table 5
Drought Period Rainfall as Percentage of Average

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Statewide Drought Period as Defined by DWR (DWR 2005)	Drought Duration (years)	Average Rainfall by Raingage					
		NSH-Napa Fire Deparment, CDEC Period of Record - WY 1904-05 through WY 2016-17			Redwood Creek and Mt. Veeder Road, Napa One Rain Period of Record - WY 2000-01 through WY 2016-17		
		[A] Total Gage Average (in)	[B] Drought Period Average (in)	[B÷A] Drought Period Rainfall as % of Average	[C] Total Gage Average (in)	[D] Drought Period Ave. (in)	[D÷C] Drought Period Rainfall as % of Average
WY 1928-29 to WY 1933-34	6	24.5	17.3	71%	ND	ND	ND
WY 1975-76 to WY 1976-77	2	24.5	11.8	48%	ND	ND	ND
WY 1986-87 to WY 1991-92	6	24.5	18.5	76%	ND	ND	ND
WY 2006-07 to WY 2008-09	3	24.5	19.0	78%	35.9	29.4	82%
WY 2011-12 to WY 2015-16	5*	24.5	21.1	86%	35.9	28.2	79%

ND= No rainfall data available for the corresponding drought period.

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Table 6
Summary of Available Groundwater Quality Data - Well 1
Matthiasson Family Vineyards

Constituent Analyzed	Units	Maximum Contaminant Level	Well 1
		Date of Sample:	**3/16/2018**
General Physical Constituents			
Electrical Conductivity	µmhos/cm	900; 1,600; 2,200(1)	710
pH	units	6.5 to 8.5	8.2
Turbidity	NTU	5	0.1
Adjusted Sodium Adsorption Ration (SAR)	unitless	None	8.8
General Mineral Constituents			
Total Dissolved Solids		500; 1,000; 1,500(1)	460
Total Hardness		None	52
Alkalinity (Total) as $CaCO_3$		None	239
Calcium		None	12
Magnesium		None	5.3
Sodium	mg/L	None	140
Sulfate		250, 500, 600(1)	54
Chloride		250, 500, 600(1)	34
Fluoride		2	0.44
Nitrate (as N)		1	0.14
Silica		None	70
Detected Inorganic Constituents (Trace Elements)			
Arsenic		10	11
Boron		1000 (NL)	320
Iron	µg/L	300	ND
Manganese		50	8.3
Zinc		5000	ND

Notes:

µmhos/cm = micromhos per centimeter, aka microSiemens per centimeter (µS/cm);
NTU = nephelometric turbidity units; mg/L = milligrams per liter;
µg/L = micrograms per liter

ND = constituent not deteceted

NL = State Notification Level

(1) The three listed numbers represent the recommended, upper and short-term State Maximum Contaminant

All laboratory analyses performed by Caltest Analytical Laboratory of Napa, California.

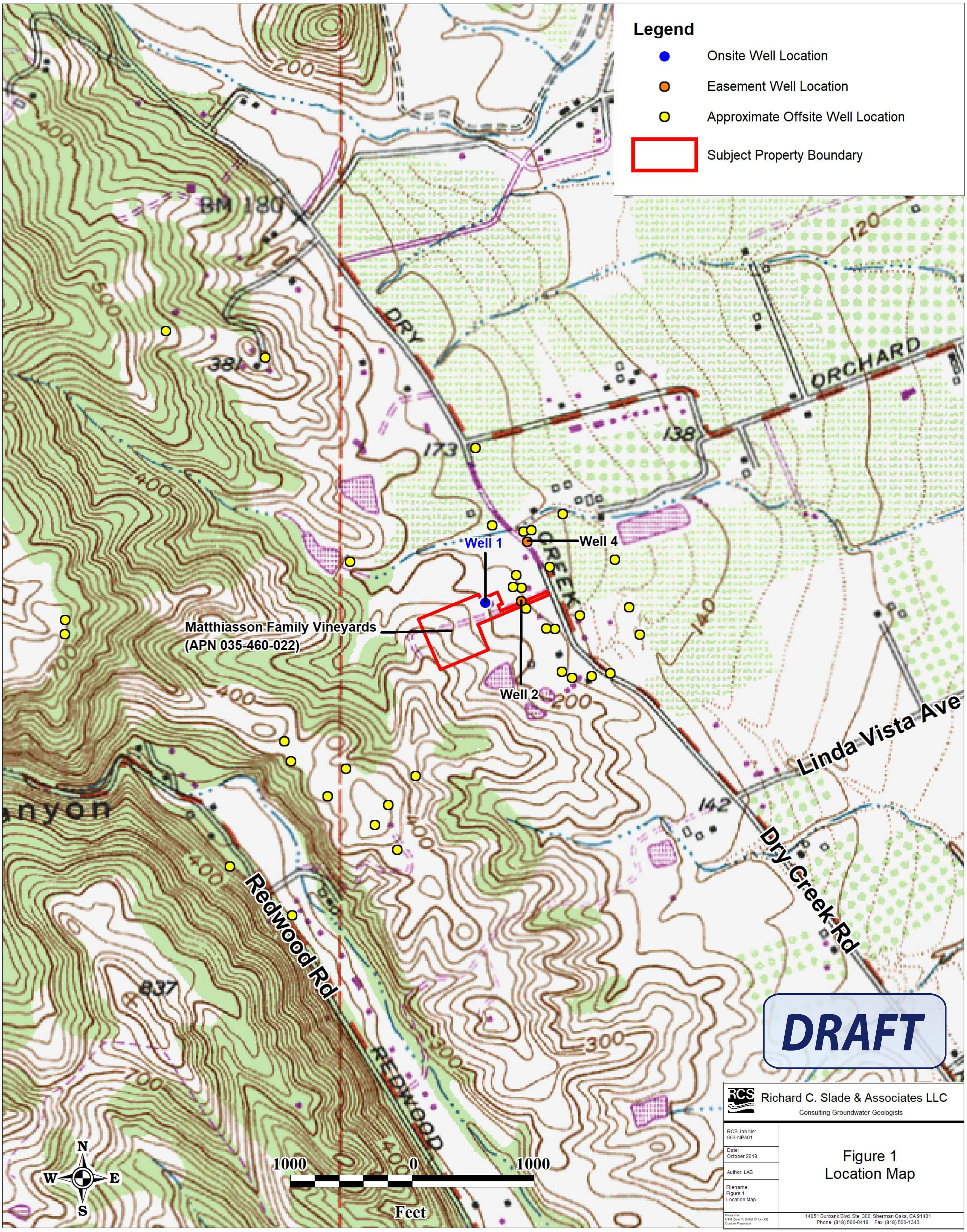
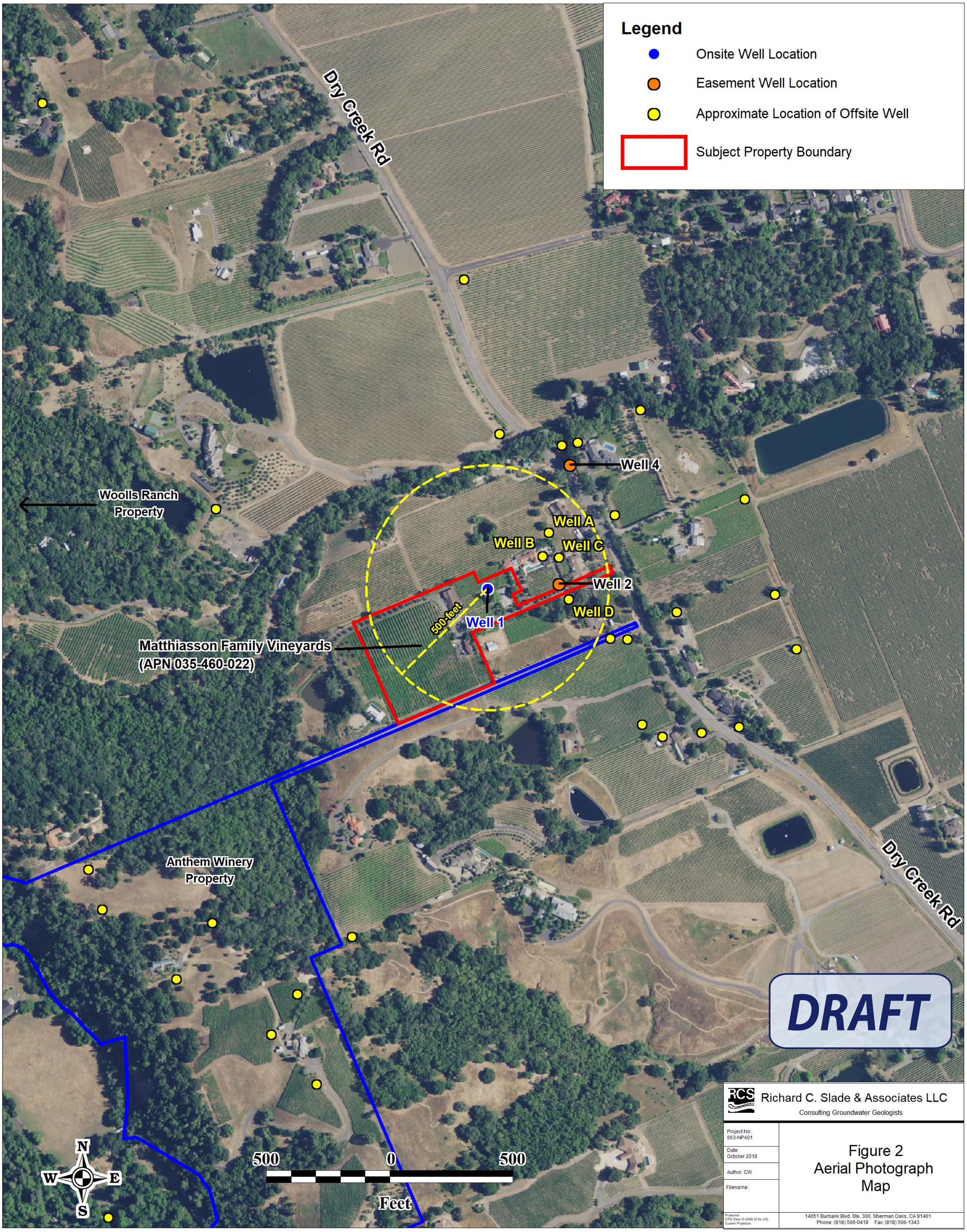
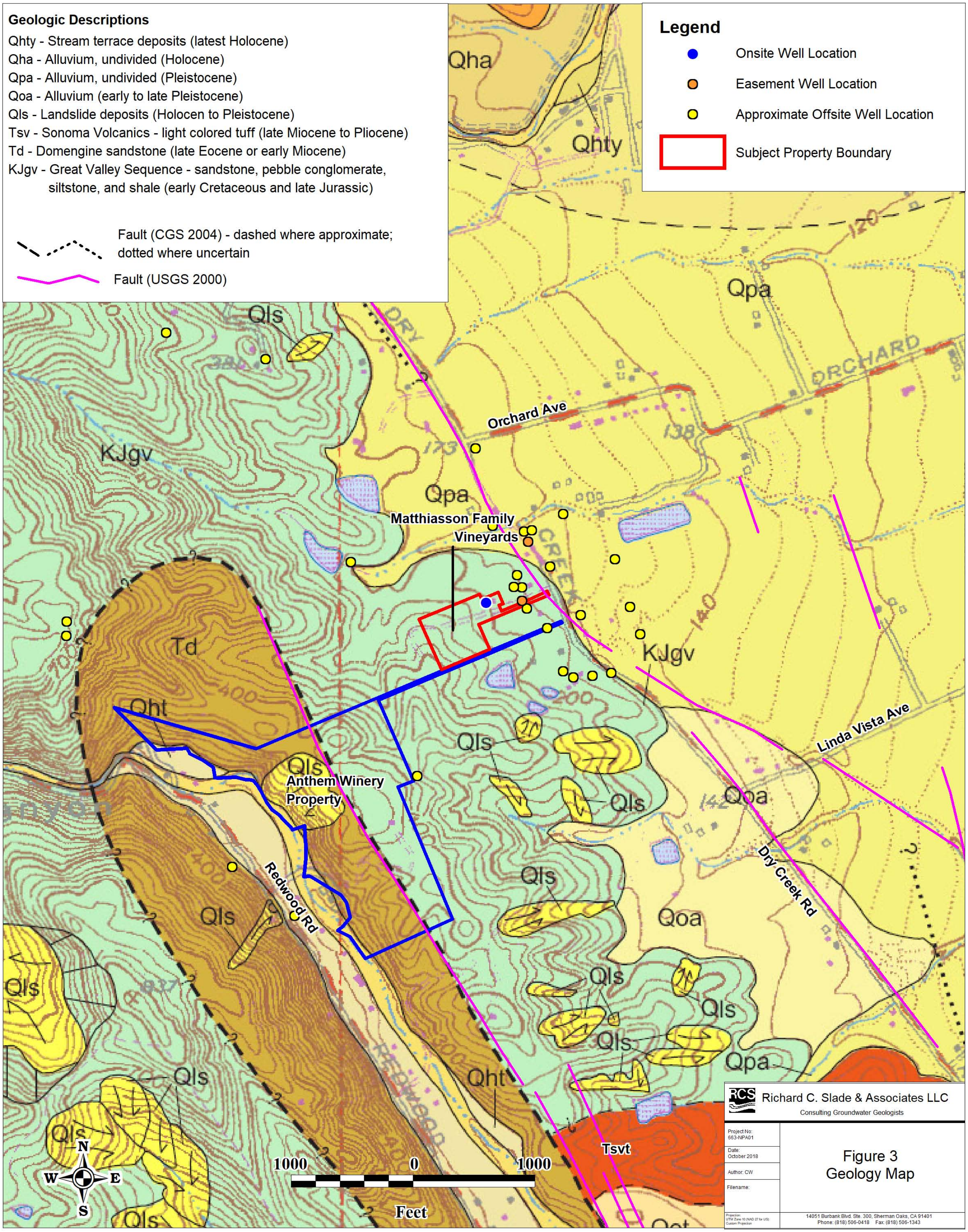


Figure 1
Location Map


Legend
Onsite Well Location
Easement Well Location
Approximate Location of Offsite Well
Subject Property Boundary
Dry Creek Rd
Woolls Ranch Property
Well 4
Well A
Well B
Well C
Well 2
Well 1
Well D
500-feet
Matthiasson Family Vineyards
(APN 035-460-022)
Anthem Winery Property
Dry Creek Rd
DRAFT
500 0 500
Feet
N
W E
S
RCS
Richard C. Slade & Associates LLC
Consulting Groundwater Geologists
Project No: 663-NPA01
Date: October 2018
Author: CW
Filename:
Figure 2
Aerial Photograph Map
14051 Burbank Blvd. Ste. 300, Sherman Oaks, CA 91401
Phone: (818) 506-0418 Fax: (818) 506-1343


Geologic Descriptions
Qhty - Stream terrace deposits (latest Holocene)
Qha - Alluvium, undivided (Holocene)
Qpa - Alluvium, undivided (Pleistocene)
Qoa - Alluvium (early to late Pleistocene)
Qls - Landslide deposits (Holocen to Pleistocene)
Tsv - Sonoma Volcanics - light colored tuff (late Miocene to Pliocene)
Td - Domengine sandstone (late Eocene or early Miocene)
KJgv - Great Valley Sequence - sandstone, pebble conglomerate, siltstone, and shale (early Cretaceous and late Jurassic)
Fault (CGS 2004) - dashed where approximate; dotted where uncertain
Fault (USGS 2000)
Legend
Onsite Well Location
Easement Well Location
Approximate Offsite Well Location
Subject Property Boundary
Qha
Qhty
Qpa
Qls
KJgv
Orchard Ave
ORCHARD
DRY CREEK
Matthiasson Family Vineyards
Td
Qht
Anthem Winery Property
Redwood Rd
Linda Vista Ave
Qoa
Dry Creek Rd
Tsvt
REDWOOD
1000
0
1000
Feet
N
S
W
E
Richard C. Slade & Associates LLC
Consulting Groundwater Geologists
Project No: 663-NPA01
Date: October 2018
Author: CW
Filename:
Figure 3
Geology Map
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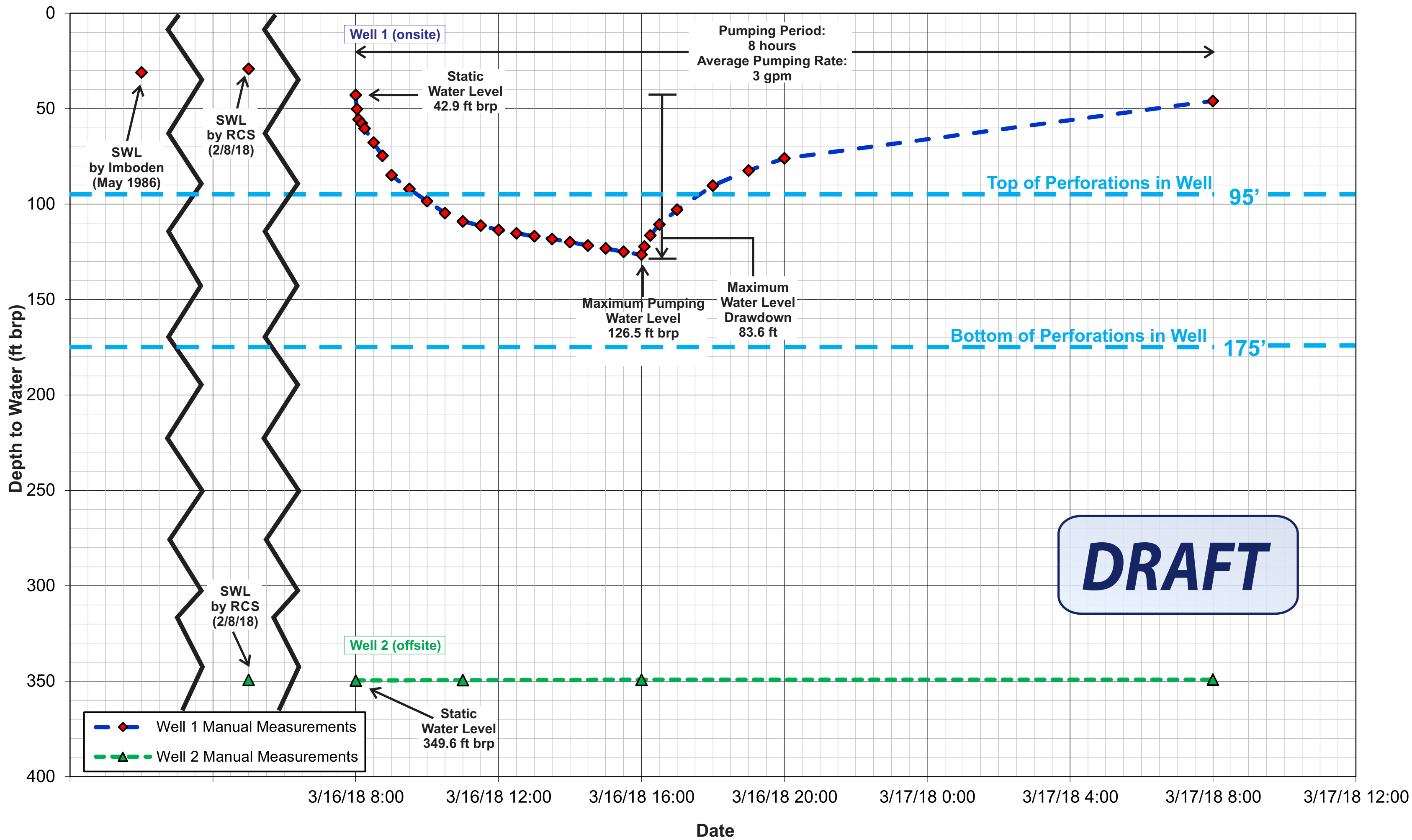
Phone: (818) 506-0418 Fax: (818) 506-1343



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CONSULTING GROUNDWATER GEOLOGISTS
14051 Burbank Blvd., Suite 300
Sherman Oaks, CA 91401
Southern California (818) 506-0418
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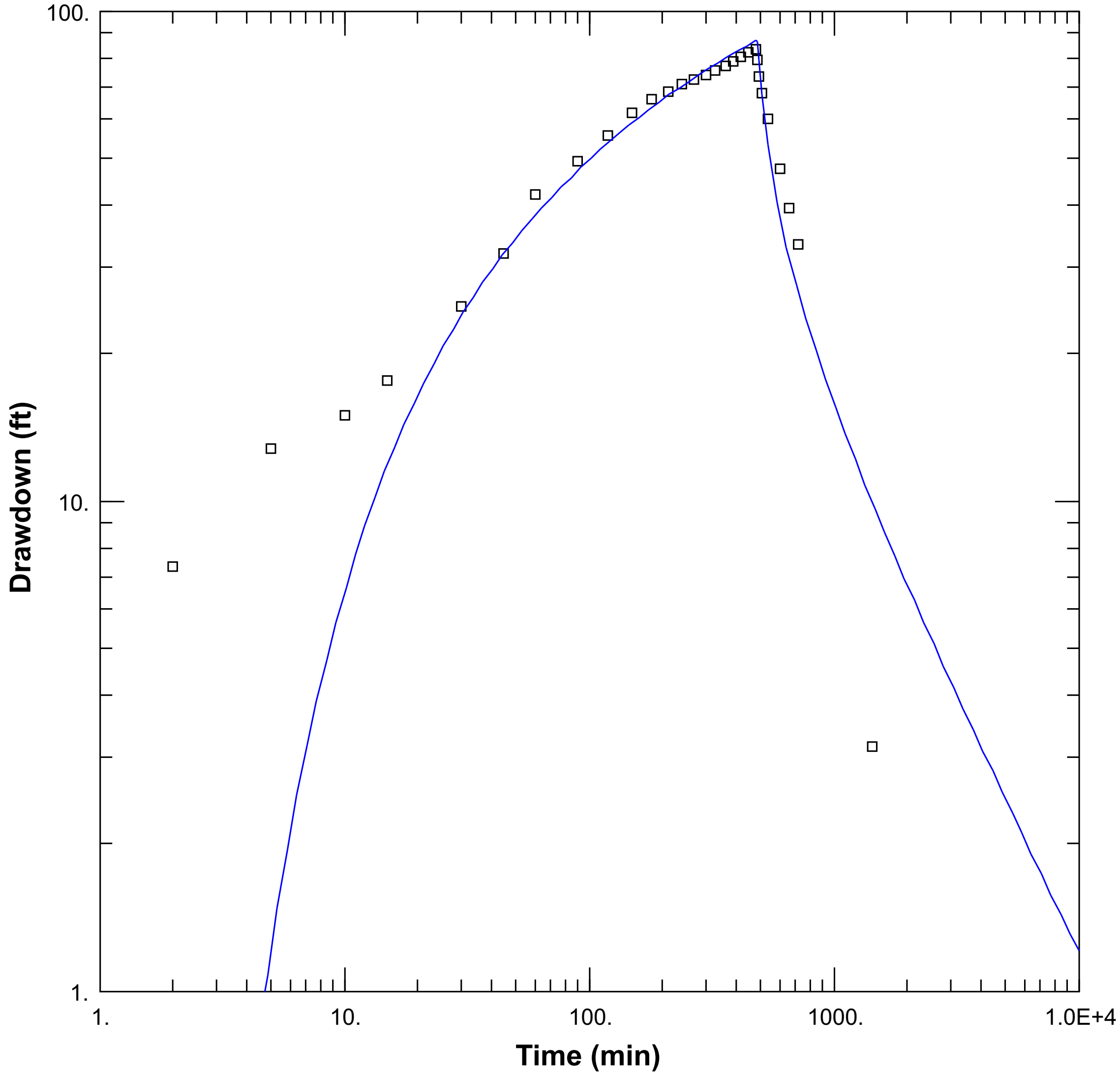
Figure 4
Water Level Data During March 2018
Constant Rate Pumping
Matthiasson Family Vineyards

Job No. 663-NPA01 **October 2018**



Obs. Wells

□ Well 1 (pumping well)

Aquifer Model

Confined

Solution

Theis/Hantush

Parameters

T = 14 gal/day/ft

*A storativity (S) value can only be calculated from the observation well water level data.

Test Date = March 16, 2018
(8-hour test)
Pre-Test
Static Water Level = 42.9 ft brp

Average pumping rate = 3 gpm

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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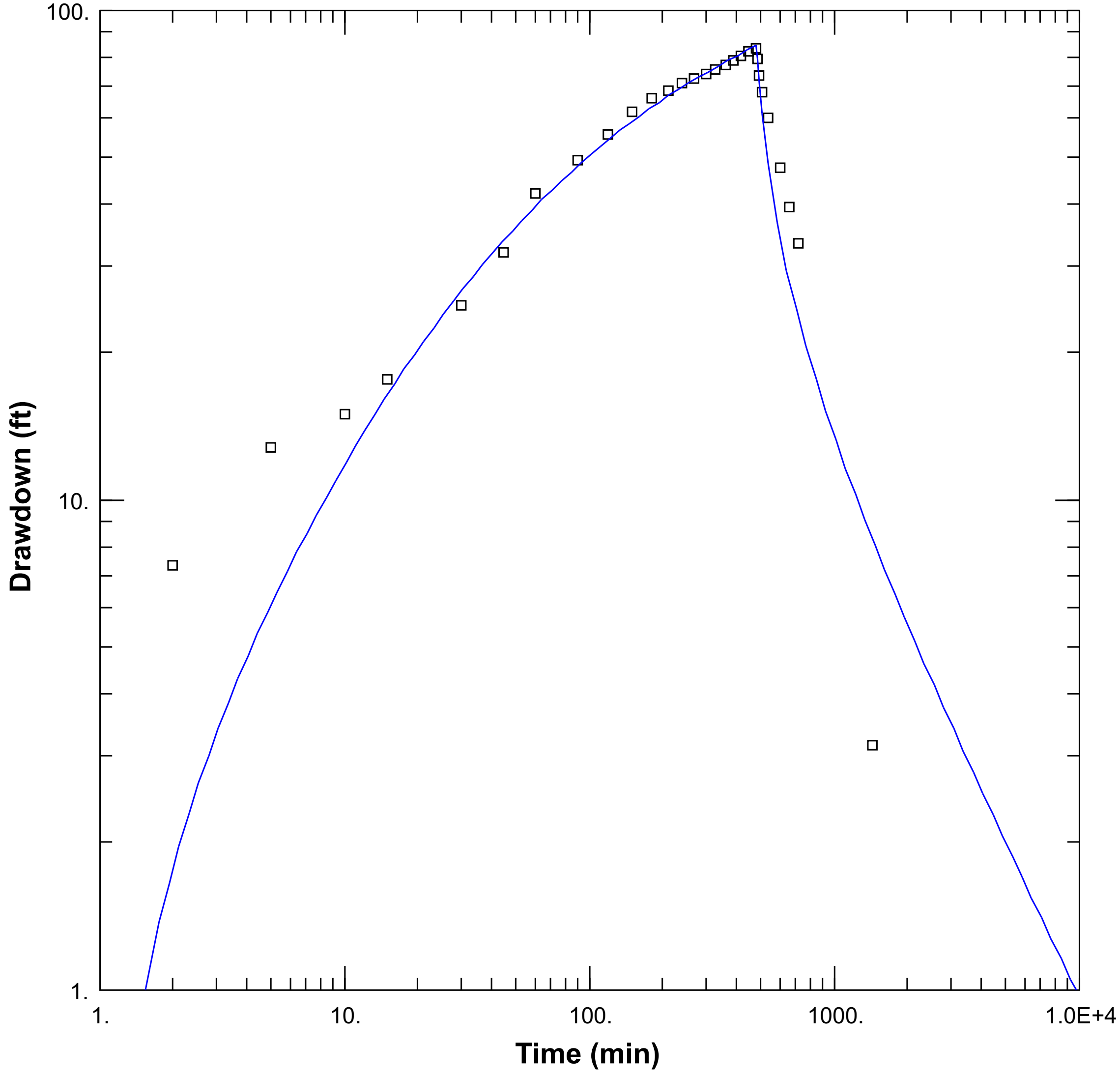
Figure 5A
Constant Rate Pumping Test Analysis
Theis/Hantush Confined Aquifer Solution
Well 1 (Pumping Well)

Job No. 663-NPA01

October 2018



Obs. Wells

□ Well 1 (pumping well)

Aquifer Model

Confined

Solution

Papadopulos-Cooper

Parameters

T = 18 gal/day/ft

*A storativity (S) value can only be calculated from the observation well water level data.

Test Date = March 16, 2018
(8-hour test)
Pre-Test
Static Water Level = 42.9 ft brp

Average pumping rate = 3 gpm

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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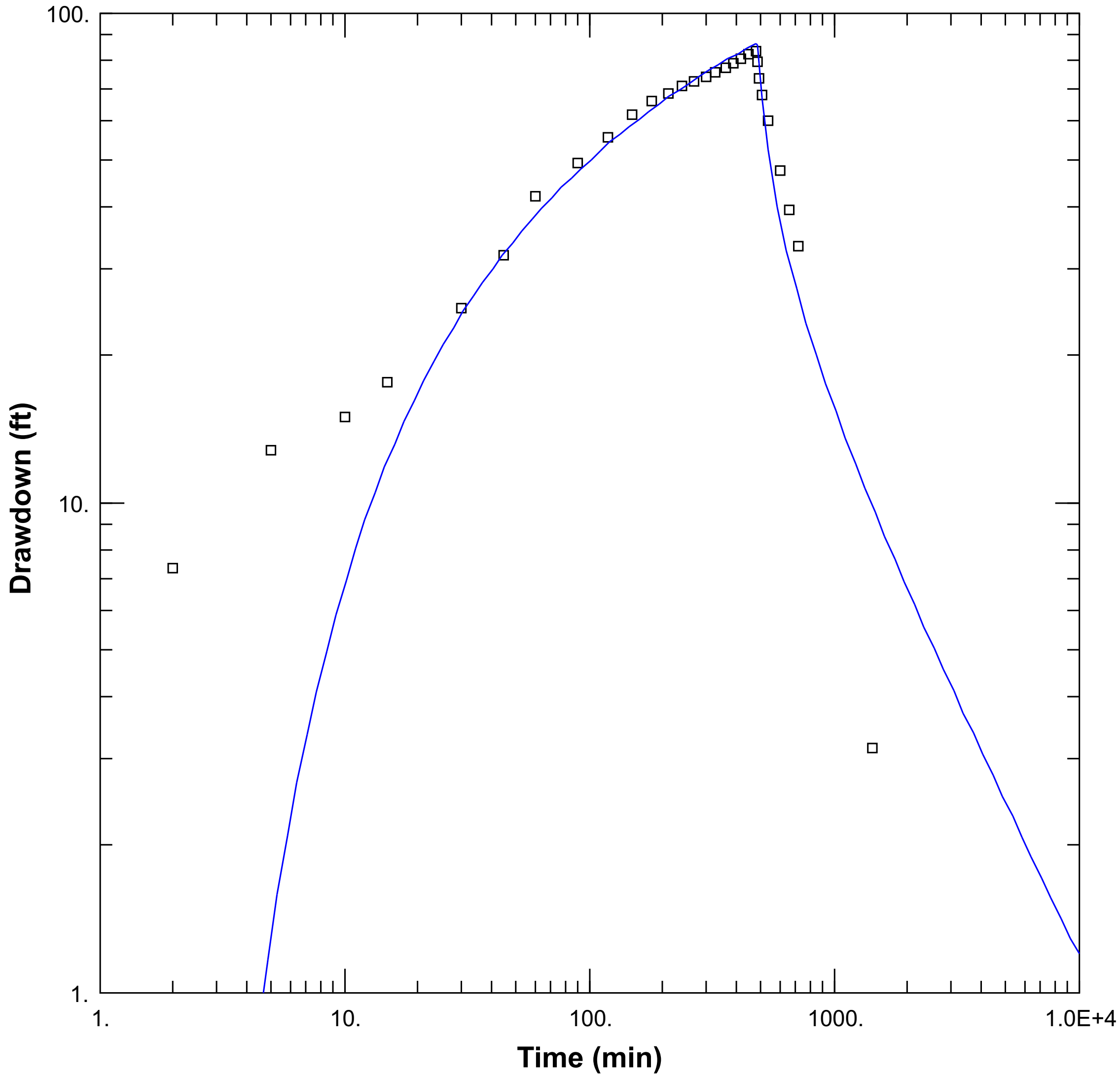
Figure 5B
Constant Rate Pumping Test Analysis
Papadopulos-Cooper Confined Aquifer Solution
Well 1 (Pumping Well)

Job No. 663-NPA01 October 2018



Obs. Wells

□ Well 1 (pumping well)

Aquifer Model

Leaky

Solution

Hantush-Jacob

Parameters

T = 14 gal/day/ft

*A storativity (S) value can only be calculated from the observation well water level data.

Test Date = March 16, 2018
(8-hour test)

Pre-Test
Static Water Level = 42.9 ft brp

Average pumping rate = 3 gpm

Graphical Solution by:
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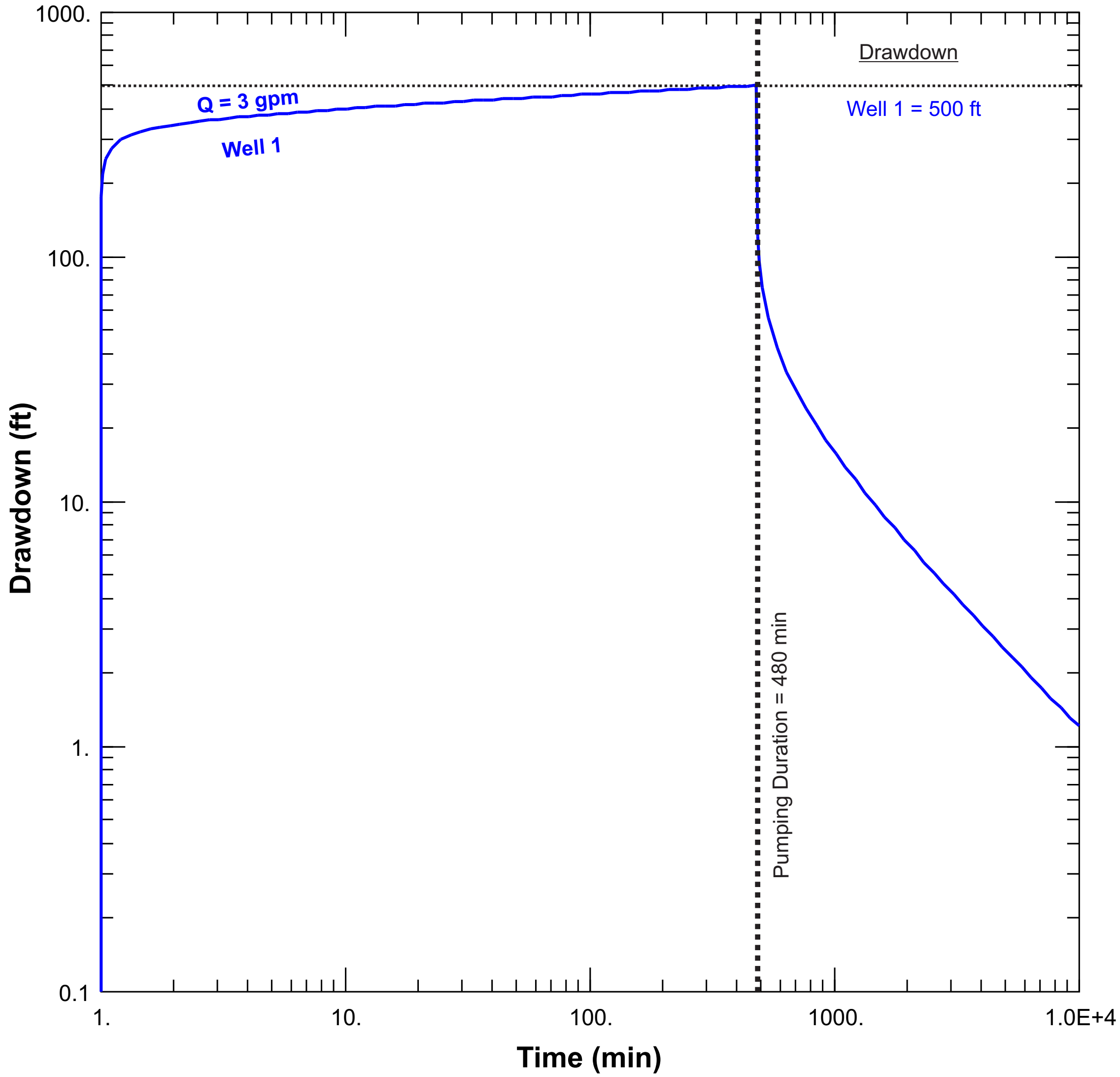
Figure 5C
Constant Rate Pumping Test Analysis
Hantush-Jacob Leaky Aquifer Solution
Well 1 (Pumping Well)

Job No. 663-NPA01

October 2018



Pumping Well

□ Well 1

Aquifer Model

Confined

Solution

Theis (1935)/Hantush (1961)

Parameters

T = 14 gal/day/ft

s = 0.000001 (unitless)

Pumping Rate = 3 gpm

Duration = 8 hours (480 minutes)

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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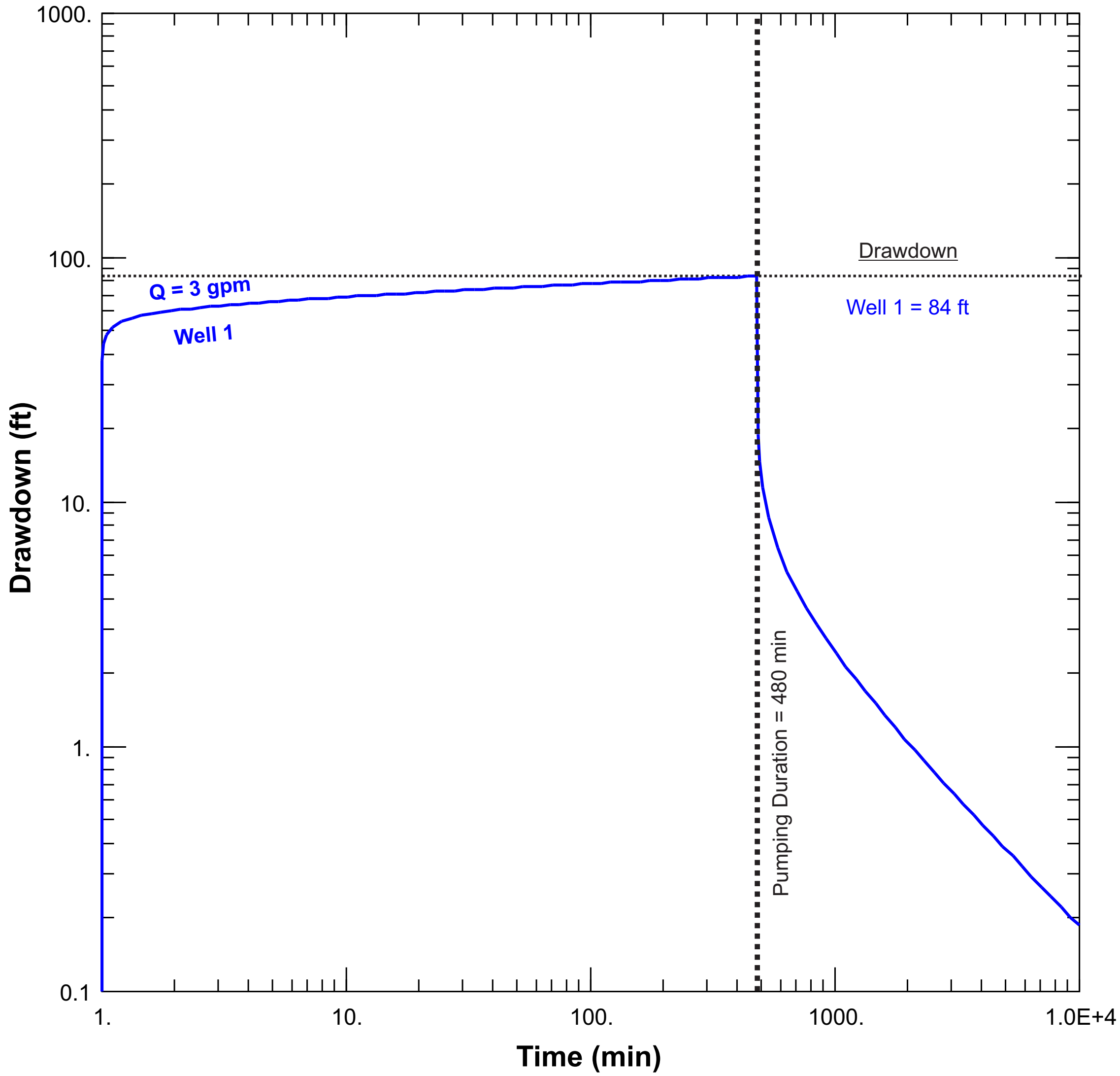
Figure 6A
Theoretical Drawdown Calculations
8 Hours/3 gpm/T=14 gpd/ft

Job No. 663-NPA01

October 2018



Pumping Well

□ Well 1

Aquifer Model

Confined

Solution

Theis (1935)/Hantush (1961)

Parameters

T = 91 gal/day/ft

s = 0.000001 (unitless)

Pumping Rate = 3 gpm

Duration = 8 hours (480 minutes)

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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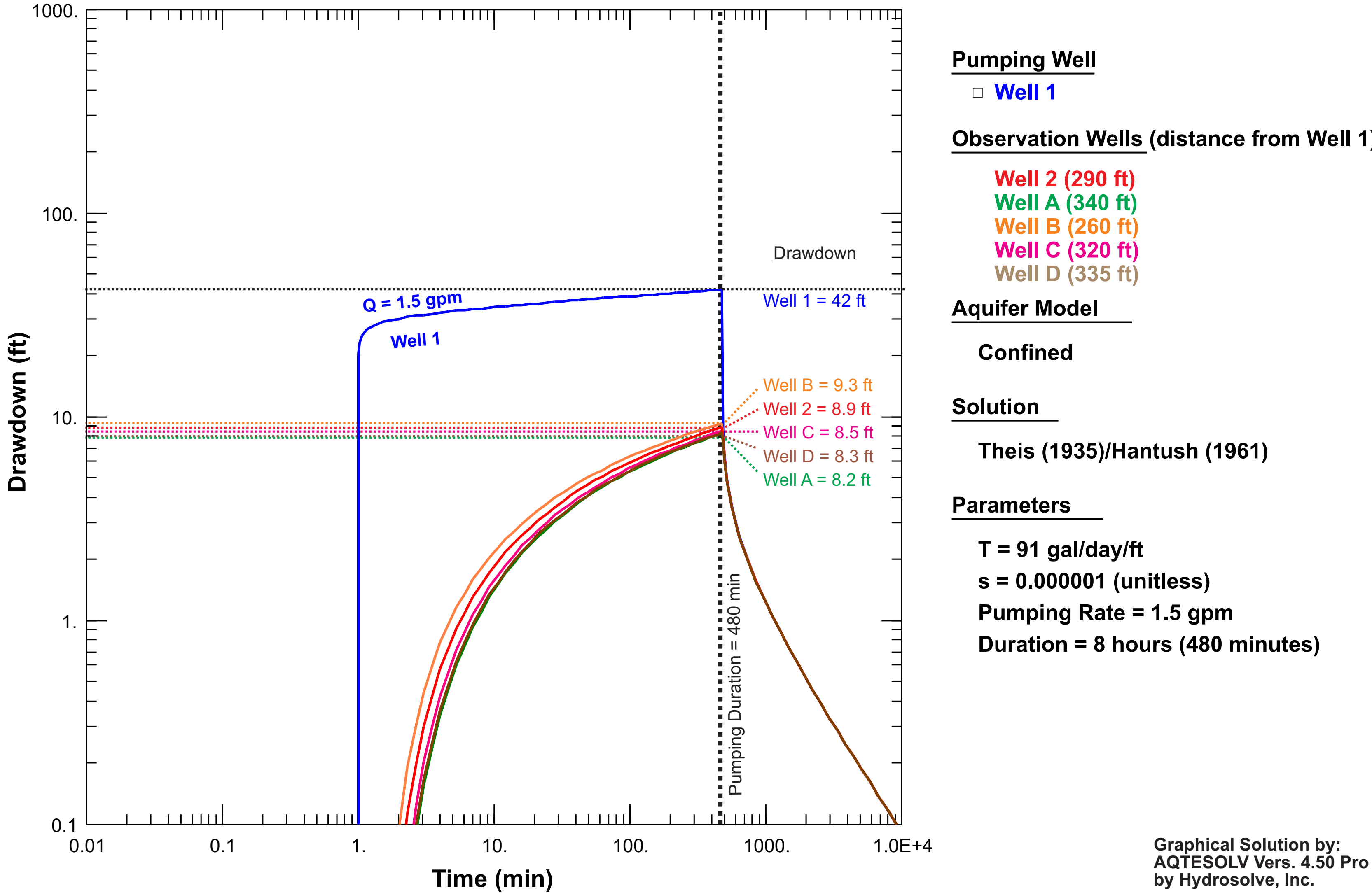
Figure 6B
Theoretical Drawdown Calculations
8 Hours/3 gpm/T=91 gpd/ft

Job No. 663-NPA01

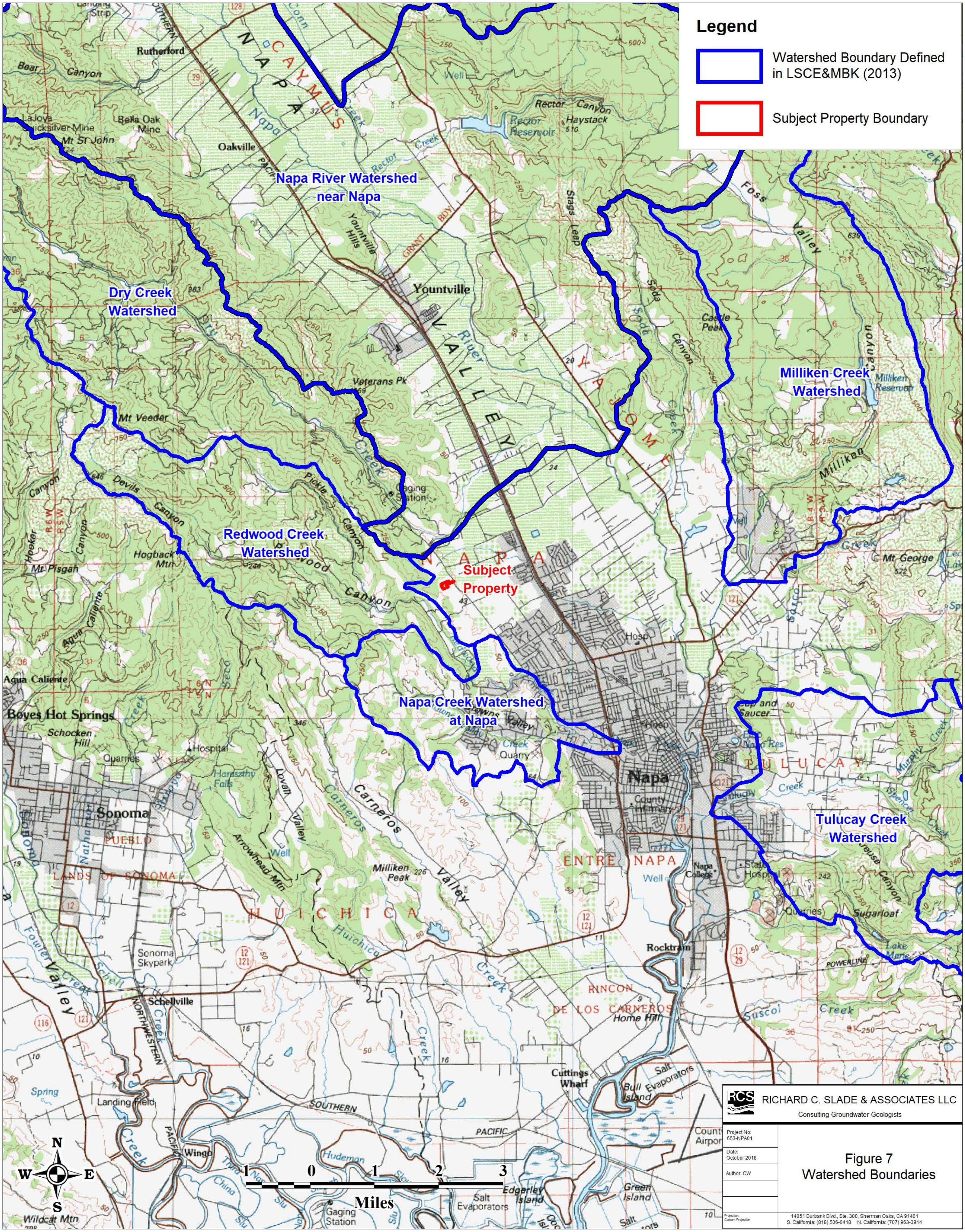
October 2018



RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS
14051 Burbank Blvd., Suite 300
Sherman Oaks, CA 91401
Southern California (818) 506-0418
Northern California (707) 963-3914
www.rcslade.com

Figure 6C
Theoretical Drawdown Calculations in Offsite Wells
8 Hours/1.5 gpm/T=91 gpd/ft

Job No. 663-NPA01 **October 2018**



Legend
Watershed Boundary Defined in LSCE&MBK (2013)
Subject Property Boundary
Napa River Watershed near Napa
Dry Creek Watershed
Milliken Creek Watershed
Redwood Creek Watershed
Subject Property
Napa Creek Watershed at Napa
Tulucay Creek Watershed
Yountville
Napa
Sonoma
Miles
1 0 1 2 3
N
S
E
W
RICHARD C. SLADE & ASSOCIATES LLC
Consulting Groundwater Geologists
Project No: 653-NPA01
Date: October 2018
Author: CW
Figure 7
Watershed Boundaries
14051 Burbank Blvd., Ste. 300, Sherman Oaks, CA 91401
S. California: (818) 506-0418 N. California: (707) 963-3914

APPENDIX
MARCH 12, 2018
COLOR VIDEO SURVEY REPORT
AND
CEMENT BOND SURVEY LOG

Pacific Surveys

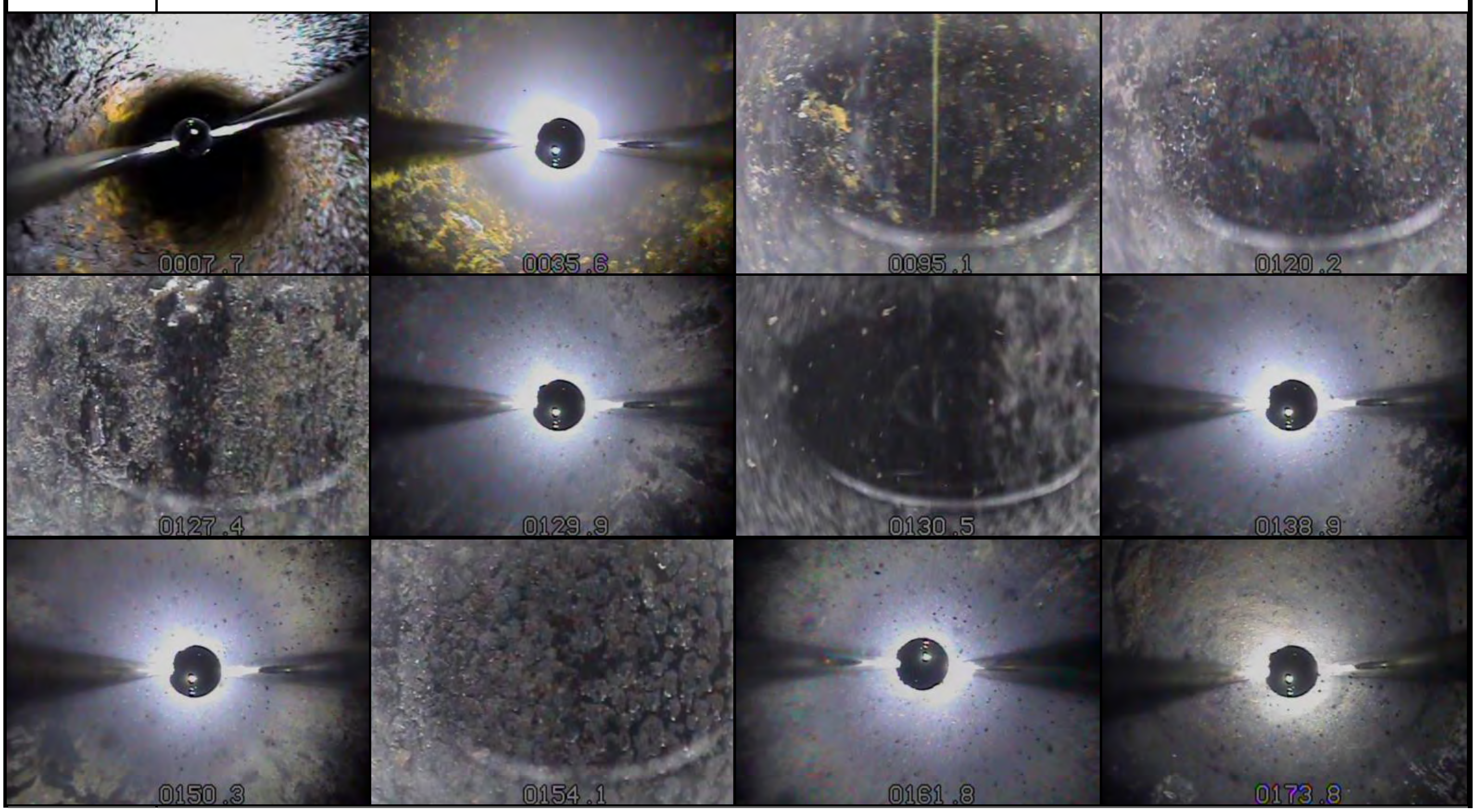
a full service geophysical well logging company

Video Survey Report

Company:	Matthiasson Family Vineyards	Date:	12-Mar-18
Well:	Well 1	Run No.	One — Truck PS-8
Field:	Napa	Job Ticket:	23841
State:	California	Total Depth:	175.1 ft
Location:	3175 Dry Creek Rd.	Water Level:	24.9 ft — SWL
		Oil on Water:	No — Amount:
GPS:	38.3387 -122.3503	Operator:	Schumacher
Zero Datum:	Top of CSG — Tool Zero: Side-Scan	Dead Space	1.25 ft
Reason for Survey:	General Inspection	Guides Set @	5.5 in

Depth	Observations
0.0 ft	Begin survey from the top of the 6-in casing.
8.0 ft	Begin to observe minor scale on casing wall.
24.9 ft	SWL; water is slightly cloudy with good visibility.
32.0 ft	Begin to observe an increase in scale. Scale appears darker. Water column begins to cloud. Fair visibility.
57.0 ft	Water column becomes very cloudy. Poor visibility.
80.0 ft	Water column begins to clear slightly.
95.1 ft	First visible perforations. Vertical slots appear open with a light-colored, fine material evident in the slot.
	Difficult to observe slots due to scale/build-up.
120.2 ft	Observe an apparent small hole in the casing.
175.1 ft	Soft fill encountered. Did not observe bottom of perforations.
	End survey.

Well Details	
Perforation:	From Survey
Vertical Mill Slot	95.10 ft to ?
Casing Size:	From Survey
6.25 in ID	0.00 ft to 175.10 ft
Casing Material	Mild Steel
Screen Material	Mild Steel



800.919.7555
909.625.6262
1785 w. arrow rte., bldg. d, ste. 3, 4
upland ca 91786
www.pacificsurveys.com
fax: 909.399.3180

PACIFIC SURVEYS

CEMENT BOND LOG

Job No. 23841	Company	MATTHIASSON FAMILY VINEYARDS
	Well	WELL 1
	Field	NAPA
File No.	County	NAPA State CA

Location

3175 DRY CREEK RD.
GPS: 38.3387 -122.3503

Other Services:

VIDEO

		Elevation		Elevation
Permanent Datum	T.O.C.		K.B.	
Log Measured From	T.O.C.		D.F.	
Drilling Measured From	N/A		G.L.	

Date	03-12-2018		
Run Number	ONE		
Depth Driller	175'		
Depth Logger	175'		
Bottom Logged Interval	145'		
Top Log Interval	0'		
Open Hole Size	N/A		
Type Fluid	WATER		
Density / Viscosity	N/A		
Max. Recorded Temp.	N/A		
Estimated Cement Top	0'		
Time Well Ready	1200		
Time Logger on Bottom	1400		
Equipment Number	PS-8		
Location	SAC		
Recorded By	SCHUMACHER		
Witnessed By	S. MATTHIASSON		

	Borehole Record			Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String				
Prot. String				
Production String	6.75" OD	0.25" WALL	0'	175'
Liner				

<<< Fold Here >>>

Comments

Calibration Report

Database File	22841.db
Dataset Pathname	cbl3
Dataset Creation	Mon Mar 12 15:17:26 2018

Segmented Cement Bond Log Calibration Report

Serial Number:	919	
Tool Model:	Pacific	
Calibration Casing Diameter:	6.750	in
Calibration Depth:	80.343	ft

Master Calibration, performed Mon Mar 12 14:43:11 2018:

	Raw (v)		Calibrated (mv)		Results	
	Zero	Cal	Zero	Cal	Gain	Offset
3'	0.012	0.568	0.000	63.547	114.294	-1.402
CAL						
5'	0.012	0.370	0.000	63.547	177.847	-2.173
SUM						
S1						
S2						
S3						
S4						
S5						
S6						
S7						
S8						

Internal Reference Calibration, performed (Not Performed):

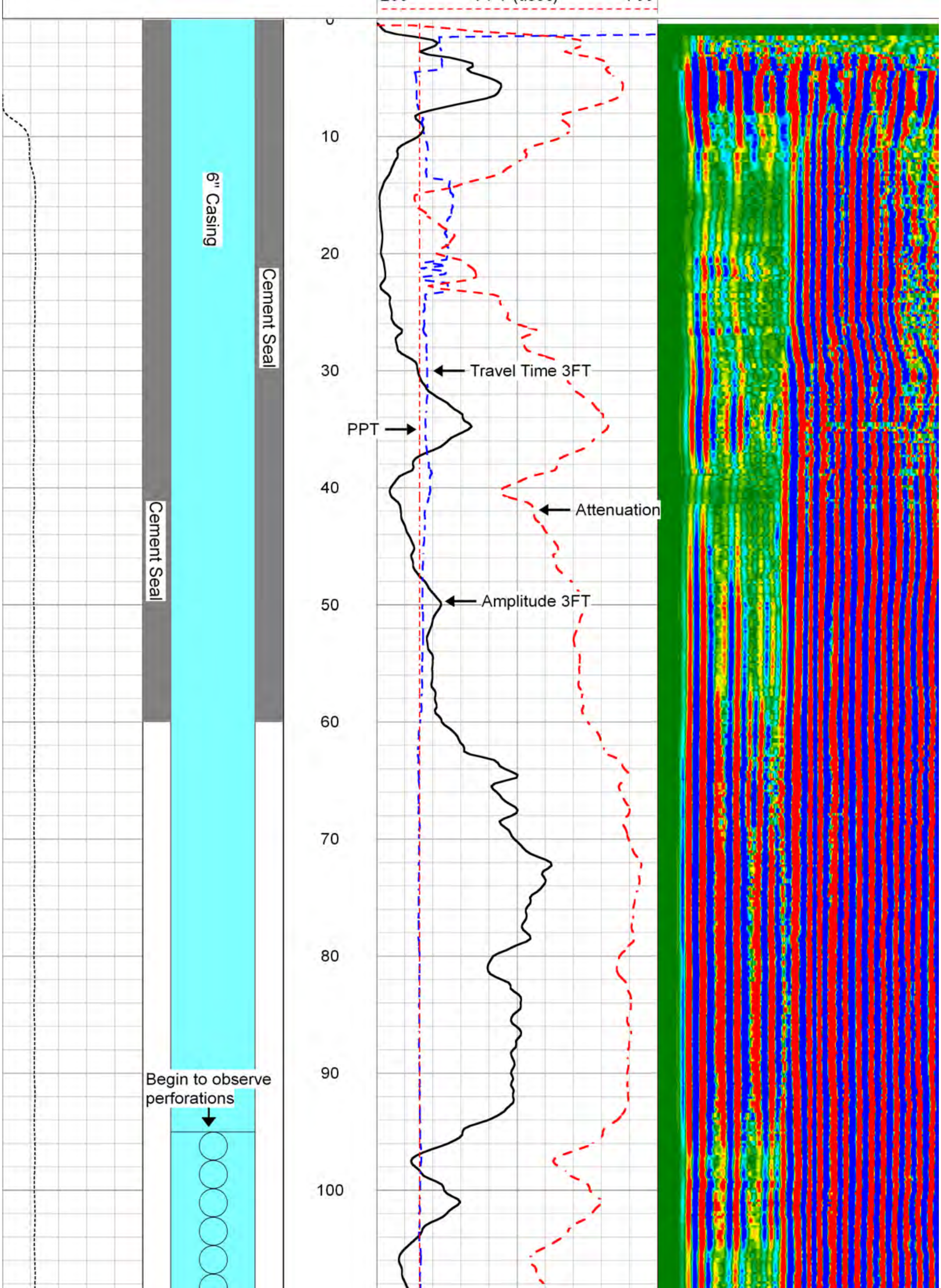
	Raw (v)		Calibrated (v)		Results	
	Zero	Cal	Zero	Cal	Gain	Offset
CAL						

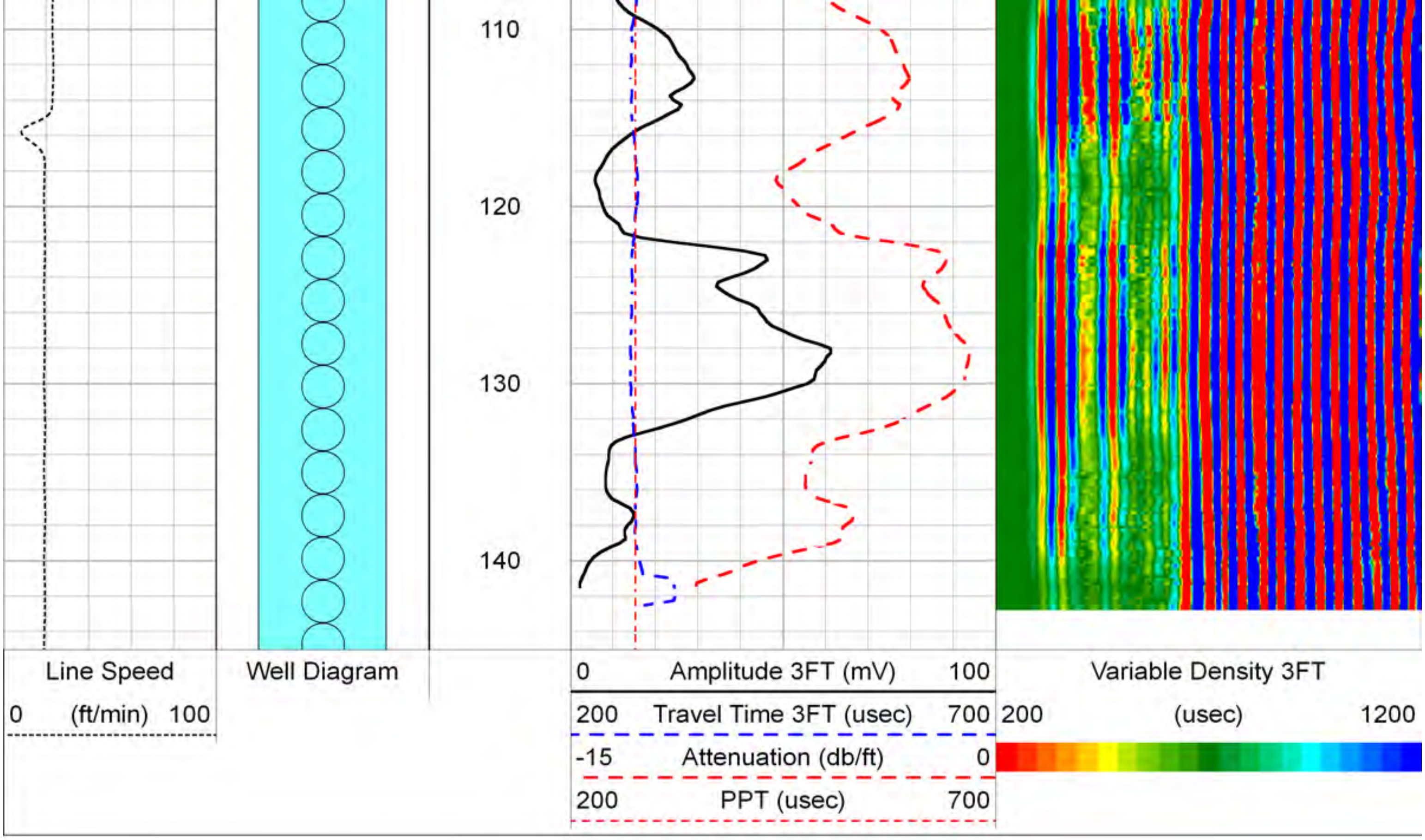
Air Zero Calibration, performed Mon Mar 12 14:36:53 2018:

	Raw (v)	Calibrated (v)	Results
	Zero	Zero	Offset
3'	0.000	0.000	0.000
5'	0.000	0.000	0.000
SUM			
S1			
S2			
S3			
S4			
S5			
S6			
S7			
S8			

Database File	22841.db
Dataset Pathname	cbl3
Presentation Format	cbl_barr
Dataset Creation	Mon Mar 12 15:17:26 2018
Charted by	Depth in Feet scaled 1:120

Line Speed	Well Diagram	Amplitude 3FT (mV)	Variable Density 3FT
0 (ft/min) 100		0 Amplitude 3FT (mV) 100	200 (usec) 1200
		200 Travel Time 3FT (usec) 700	
		-15 Attenuation (db/ft) 0	
		200 PPT (usec) 700	


6" Casing
Cement Seal
Cement Seal
0
10
20
30
40
50
60
70
80
90
100
Travel Time 3FT
PPT
Attenuation
Amplitude 3FT
Begin to observe perforations


110
120
130
140
Line Speed
0 (ft/min) 100
Well Diagram
0 Amplitude 3FT (mV) 100
200 Travel Time 3FT (usec) 700
-15 Attenuation (db/ft) 0
200 PPT (usec) 700
Variable Density 3FT
200 (usec) 1200

APPENDIX
DRILLER'S LOGS/ PERMITS FOR OFFSITE WELLS

FEE $179.00 DATE 11/3/87
RECEIPT NO 20602 BY

Rec# 926 "Well 2"

A.P. NO. 35-460-22
ON-35-460-23

NAPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL HEALTH

APPLICATION & PERMIT TO CONSTRUCT A WATER WELL

NAME [redacted] (Owner) ADDRESS [redacted] Napa (Job Location)
NAME Pulliam Drilling (Well Driller) ADDRESS 2877 Piedmont DATE 10-21-87

TYPE OF WORK NEW WELL ✓ RECONDITIONING ____ DEEPENING ____
TYPE I PERMIT ✓ DESTROY ____ OTHER ____
TYPE II PERMIT ____ TEST HOLE ____

PROPOSED USE DOMESTIC ____ IRRIGATION ✓ INDUSTRIAL ____ MUNICIPAL ____
TEST WELL ____ OTHER ____ HOT WATER ____

Sewage Disposal on site (existing or proposed) Public ____ Individual ✓ Private ____
Distance from well to any part of nearest sewage disposal system 100 feet.
(Sketch of site to accompany application) County road setback 48 feet from centerline

TYPE OF EQUIPMENT TO BE USED: Rotary ✓ Cable ____ Hand Dug ____ Other ____

WORKER'S COMPENSATION COVERAGE: (Check one of the following)

☐ A certificate of current Worker's Compensation Insurance coverage is presently on file with this office.

☐ A certificate of current Worker's Compensation Insurance is being filed with this application.

☒ I certify that in the performance of the work for which this permit is issued I shall not employ any person in any manner so as to become subject to the Worker's Compensation laws in California.

Signature of Applicant ____ Date 10-21-87

CASING

CONSTRUCTION:
Total Depth 440 Ft. Depth of Casing 440
Surface Seal to 25 Ft.
Any Stratas Sealed: Yes ____ No ✓
If yes, depth of stratas:
From ____ Ft. to ____ Ft./From ____ Ft. to ____ Ft.
Perforations:
From 60 Ft. to 440 Ft./From ____ Ft. to ____ Ft.
From ____ Ft. to ____ Ft.

WATER LEVELS
First Water at 390 Ft. Static level at 284 Ft.

WELL TESTS
How performed Air Test
Yield 6 GPM with 150 Ft. Drawdown after 4
Hrs. Annular space depth 25 Ft./Thickness 2
____ in. Diameter of casing 5" Material Plactic
Gravel Pack: Yes ✓ No ____ Conductor Casing:
Yes ____ No ____ Sealed with: Concrete ✓
Grout ____ Neat Cement ____ Pudd. Clay ____
Other ____ Chlorination by: Owner ____
Pump Co. ____ Driller ____

WELL LOG
(Formation; described by color, size of material, structure)

Ft. to Ft.	
00-12'	brown clay, boulders
12-180'	grey shale
180-375'	hard black rock & brown ash
375-390'	gray shale
390-440'	black rock with sand stone

RECEIVED
JAN 15 1988
DIVISION OF ENVIRONMENTAL HEALTH

CONTRACTOR'S STATEMENT: I, ____, contractor for the above work, hereby certify that the above was installed according to all applicable rules and regulations covered by this permit, and that the information is true and correct to the best of my knowledge.

Tom Pulliam
Contractor's Signature

12-30
White-Office Pink-Owner
Return to Office Orange-Contractor

"Well 4"

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0329616

Page 1 of 1

Owner's Well Number

Date Work Began 11/01/2016 Date Work Ended 11/15/2016

Local Permit Agency Napa Planning, Building & Environmental Services

Permit Number E15-00612 Permit Date 10/30/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ○ Vertical ◉ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	4	Top soil.
4	20	Clay.
20	175	Brown clay.
175	180	Medium hard rock grey.
180	200	Sticky clay.
200	220	30% Sticky clay with sand and medium hard grey rock.
220	240	Multi color medium hard rock with 30% clay.
240	260	Multi color rock medium hard with 30% clay.
260	320	50% clay with black and grey medium hard rock.
320	340	Sticky clay.

Total Depth of Boring 340 Feet

Total Depth of Completed Well 340 Feet

Well Owner

Name David Bader

Mailing Address 3175 Dry Creek Road

City Napa State CA Zip 94558

Well Location

Address 3185 Dry Creek Road

City Napa County Napa

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

Datum Dec. Lat. Dec. Long.

APN Book 035 Page 460 Parcel 034-000

Township Range Section

Location Sketch

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

North

South

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

Activity

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

Planned Uses

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

Water Level and Yield of Completed Well

Depth to first water 180 (Feet below surface)

Depth to Static Water Level 223 (Feet) Date Measured 11/15/2016

Estimated Yield * 8 (GPM) Test Type Air Lift

Test Length 6.0 (Hours) Total Drawdown (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	140	12 1/4	Blank	F480 PVC	.316	6.625		
140	160	9	Screen	F480 PVC	.316	6.625	Milled Slots	0.032
160	180	9	Blank	F480 PVC	.316	6.625		
180	340	9	Screen	F480 PVC	.316	6.625	Milled Slots	0.032

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	21	Cement	net
21	51	Bentonite	3/8" chips

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 McLean & Williams, Inc.
Person, Firm or Corporation

878 El Centro Ave. Napa CA 94558
Address City State Zip

Signed [signature] 11-21-2016 396352
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Rig #2
Ed Swager

"Well A"

CONERTY, KIM (MR)

ORIGINAL
File with DWR

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

Do not fill in
No. 103059

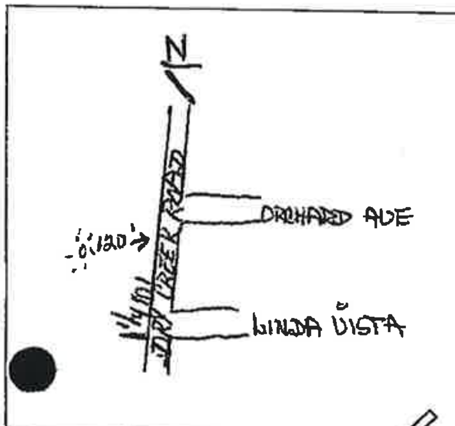
06N/04W-30 LL1 (WM)

State Well No.
Other Well No. 6N/~~4W~~-30

of Intent No.
Permit No. or Date

3181 Dry Creek Rd
035-460-005

(2) LOCATION OF WELL (See instructions): 35-010-38
County Napa Owner's Well Number
Well address if different from above 3181 Dry Creek Rd.
Township Napa Range Section
Distance from cities, roads, railroads, fences, etc. 035-010-038



WELL LOCATION SKETCH

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

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

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

(6) GRAVEL PACK:
Yes ☐ No [X] Size
Diameter of bore
Packed from to ft.

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

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

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	520'	6"	.250	160'	520'	1/8X3"

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No ☐ If yes, to depth 25' ft.
Were strata sealed against pollution? Yes ☐ No [X] Interval ft.
Method of sealing Grout

(10) WATER LEVELS:
Depth of first water, if known 312' ft.
Standing level after well completion 90' ft.

(11) WELL TESTS:
Was well test made? Yes [X] No ☐ If yes, by whom? Drillers
Type of test Pump ☐ 90' Bailer [X] Air lift ☐
Depth to water at start of test ~~[illegible]~~ ft. At end of test 230' ft
Discharge 8 gpm gal/min after hours Water temperature
Chemical analysis made? Yes ☐ No [X] If yes, by whom?
Was electric log made? Yes ☐ No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth 520' ft. Depth of completed well 520' ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	30	Adobe
30	72	Blue shale
72	312	Brown shale
312	341	Granular black rock
341	451	Brown shale
451	516	Hard fractured blue shale
516	520	Brown shale

Work started June 20 19 77 Completed July 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.

SIGNED J. D. Doshier
(Well Driller)

NAME Doshier-Gregson Drilling, Inc.
(Person, firm, or corporation) (Typed or printed)
Address 5365 Napa-Vallejo Highway
City Vallejo, Calif. Zip 94590
License No. 294001 Date of this report July 20, 1977

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

"Well C"

ORIGINAL

File with DWR

of Intent No.

Permit No. or Date

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

035 0- 006

Do not fill in

No. 080084

State Well No.

Other Well No. 06N04W30A

(1)

Address

City

035-460-006??

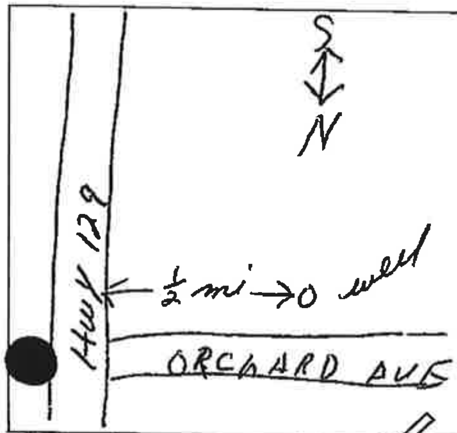
(2) LOCATION OF WELL (See instructions):

County Napa Owner's Well Number

Well address if different from above Same

Township 35 06N Range 842 04W Section 06

Distance from cities, roads, railroads, fences, etc. 3mi. West of Hwy. 129 on Orchard Ave.



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

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

(4) PROPOSED USE:

Domestic

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☐

Other ☐

(5) EQUIPMENT:

Rotary ☐ Reverse ☐

Cable ☒ Air ☐

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☒ Size

Diameter of bore 8

Packed from to ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	104	8	125	84	104	1×3

(9) WELL SEAL:

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

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

Method of sealing CEMENT

(10) WATER LEVELS:

Depth of first water, if known 30 ft.

Standing level after well completion 25 ft.

(11) WELL TESTS:

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

Type of test Pump ☐ Bailer ☒ Air lift ☐

Depth to water at start of test 25 ft. At end of test 70 ft

Discharge 15 gal/min after 1 hours Water temperature

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

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

(12) WELL LOG: Total depth 115 ft. Depth of completed well 115 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	15	brownclay
15	28	boulders, brownash
28	32	brown clay
32	40	sandyclay
40	57	brownclay
57	90	brownclay
90	115	brownash

Work started 12-5- 1980 Completed 12-10- 1980

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 Bill Pullian (Well Driller)

NAME Pullian Well Drilling (Person, firm, or corporation) (Typed or printed)

Address 2877 Piedmont Ave.

City Napa Zip 94558

License No. 548677 Date of this report 12-20-80

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

HEALTH DEPT. USE ONLY
FEE: 12.00
DATE: 5-2-75
RECEIPT NO: 1703
BY: [signature]

"Well D"

NAPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL HEALTH

APPLICATION & PERMIT TO CONSTRUCT
A WATER WELL
(ORDINANCE #)

RECEIVED
MAY 16 1975
DIVISION OF ENVIRONMENTAL HEALTH

35-011-40
35-460-007-

NAME [redacted] (Owner) ADDRESS [redacted] (Job Location) DATE 5-2-75

NAME McLean & Williams (Well Driller) ADDRESS 878 El Centro

TYPE OF WORK			
NEW WELL ✓	RECONDITIONING ___	DEEPENING ___
TEST HOLES ___	DESTROYING ___	OTHER ___
TYPE I PERMIT ✓	TYPE II PERMIT ___	FEE ___

PROPOSED USE: DOMESTIC ✓ IRRIGATION ___ INDUSTRIAL ___ MUNICIPAL ___
TEST WELL ___ OTHER ___

Sewage Disposal On Site (Existing or Proposed) Public___ Individual___ Private___
Distance from well to any part of nearest sewage disposal system ___ feet.
(Sketch of site to accompany application. None

TYPE OF EQUIPMENT TO BE USED: Rotary ✓ Cable ___ Hand Dug ___ Other ___

CONSTRUCTION PROPOSED:
Diameter of casing 6" Material Steel Annular Space: Size 3"
Sealed with: Concrete ✓ Grout ___ Neat Cement ___ Puddled Clay ___ Other ___
Conductor Casing: Yes___ No ✓ Material ___
Chlorination By: Owner ✓ Pump Co ___ Driller ___

J. Williams (SIGNATURE OF APPLICANT) 5-2-75 (DATE)

NOTICE TO DRILLER: COMPLETE THIS PORTION AND PROVIDE OWNER WITH THIS COPY.

CASING

CONSTRUCTION

Total Depth 485 Ft.
Surface Seal to 20 Ft.
Any Stratas sealed: Yes___ No xx
If yes, depth of Stratas
From___Ft. to ___Feet
From___Ft. to ___Feet
Perforations
From___Ft. to ___Feet
From___Ft. to ___Feet
From___Ft. to ___Feet

WATER LEVELS

First water at ___ Feet
Static level at ___ Feet

WELL TESTS

How performed Bailer
Yield 8 GPM with 300 Feet
Drawdown ___ Ft. after 4 Hrs.

WELL LOG

(Formation; describe by color, size of material, structure)

	Ft. to	Ft.
Top Soil	0	4
Brown Clay	4	8
Blue Shale	8	198
Light brown clay	198	212
Light brown sandstone	212	285
Light brown clay	285	295
Light brown sandstone	295	312
Grey sandstone	312	354
Hard grey rock	354	385
Grey clay	385	426
Grey sandstone	426	485

Signed: [signature]
License # 272321

APPENDIX
"WATER AVAILABILITY ANALYSIS"
BY
MADRONE ENGINEERING

madrone
engineering

Water Availability Analysis

Matthiasson Family Vineyards

3175 Dry Creek Rd, Napa, CA 94558

APN: 035-460-022

November 10, 2017

Rev 1: May 2, 2018

REGISTERED PROFESSIONAL ENGINEER
JOEL D. DICKERSON
No. 75989
Exp. 06-30-18
CIVIL
STATE OF CALIFORNIA

prepared by:

Madrone Engineering

1485 Main Street, Suite 302

St. Helena, CA 94574

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C. Proposed Water Usage 6
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E. Groundwater Recharge Analysis 8
III. Tier 2 Analysis 8
IV. Conclusion 8

I. Introduction & General Overview

A. Introduction

Madrone Engineering has prepared this report to assist the Matthiasson Family Vineyards project with compliance with Napa County Water Availability Analysis requirements. As of May 13, 2015, a water availability analysis is required for any discretionary project that may utilize groundwater or will increase the intensity of groundwater use of any parcel through an existing, improved, or new water supply system (Napa County Code 13.15.010).

B. Project Description

Matthiasson Family Vineyard is requesting a Use Permit Major Modification to increase production and visitation for an existing winery on a 5.8 acre parcel located at 3175 Dry Creek Road, Napa, by owners and applicants Steve and Jill Matthiasson. Existing wine production is approved for 5,000 gallons, and is requested to be expanded to 18,000 gallons annually. The property will be improved as follows: the existing winery building will be renovated and upgraded with addition of a small outdoor tasting venue, the existing parking area will be reconstructed and improved, a new fire water storage tank will be constructed, an existing agricultural barn will be converted and improved for winery storage use, and the existing driveway will be improved to meet current Road and Street Standards.

Based on the proposed marketing plan for the winery, the maximum number of winery staff on-site on any given day is estimated to be four (4) full-time employees with up to 3 part-time employees during harvest (a period less than 60 days). In addition to the employees, the proposed marketing plan allows for up to seventeen (17) visitors per day (maximum) and fifteen (15) visitors per day (average) in addition to winery special events. Other water use on the parcel includes an existing 3-bedroom residence with 2 full-time residents, and minimal amounts of vineyard irrigation.

There are three wells available for use on the parcel, and all are shown on the well exhibit (Appendix B). Two of the wells (Wells #01 and #02) are exclusively for use by the parcel, and another well (Well #04) is shared 50%/50% with a neighboring parcel (3173 Dry Creek Rd). Currently, water from Wells #02 and #04 is plumbed to the parcel and available for use. However, after completion of this Use Permit modification, parcel plumbing will be configured such that Well #01 serves the winery only, and all other parcel water uses (vineyard irrigation, existing residence, and residential landscaping) will be served by Wells #02 and #04. For this analysis, only Well #01 will be considered as it will be the water source for all winery water use. Because the parcel is within the AW zoning, and can be considered to be a "hillside" parcel, based on Table 1 below, the project will be subject to Tier 2 analysis requirements.

Table 1: Project Screening Criteria Applicability

Tier	Criteria Type	Napa Valley Floor	MST	All Other Areas
1	Water Use	Yes	Yes	Yes
2	Well and Spring Interference	No[1]	No[1]	Yes
3	Groundwater/Surface Water Interaction	No[1]	No[1]	No[1]

1. Further analysis may be required under CEQA if substantial evidence, in the record, indicates a potentially significant impact may occur from the project.

II. Tier 1 Analysis

Tier 1 of the WAA requests the applicant to estimate the proposed water usage for the project, and then compare the estimated parcel usage for the property to the applicable water use criteria. As noted in Table 2A of the WAA guidelines (see below), the water use criteria is subject to the parcel location.

Table 2A: Water Use Criteria

Project parcel location	Water Use Criteria (acre-feet per acre per year)
Napa Valley Floor	1.0
MST Groundwater Deficient Area	0.3 or no net increase, whichever is less [1]
All Other Areas	Parcel Specific [2]

1. Does not apply to the Ministerial Exemption as outlined in the Groundwater Conservation Ordinance
2. Water use criteria for project shall be considered in relation to the average annual recharge available to project property, as calculated by the applicant or their consultant.

A. Water Use Guidelines

Appendix B of the WAA guidelines includes recommendations for determining the estimated water use for specified land uses. A summary of these guidelines, including the values applied in this report, are identified in the table below:

Table 3: Water Use Guidelines per WAA Appendix B

Use	Recommended Water Use Values	Applied Water Use Values	Unit
Residence	0.5 to 0.75	0.75	AF per Year
Winery			
Process Water	0.0215	0.0215	AF per 1,000 gal Wine Produced per Year
Domestic Water	0.005	0.005	AF per 1,000 gal Wine Produced per Year
Employees	15	15	Gallons Per Shift
Tasting Room Visitation	3	3	Gallons Per Visitor
Events and Marketing	15	15	Gallons Per Visitor
Vineyards			
Irrigation Only	0.2 to 0.5	0.2 (0.05)*	AF per Acre Planted per Year
Heat Protection	0.25	not used	AF per Acre Planted per Year
Frost Protection	0.25	not used	AF per Acre Planted per Year
Landscaping	-	not used	landscaping is included in the residence

*As part of this project, Matthiasson Family Vineyards will move the vineyard to dry farming, and aminimual use of 0.05 AF/acre will be assumed for future vineyard irrigation.

B. Existing Water Usage

The current water uses from all wells on the Matthiasson Family Vineyard property include the following:

Table 4: Existing Property Uses

Use	Value	Unit
Residence(s)	1	Main Residence
Winery		
Wine Produced	5	Thousand Gallons per Year
Employees (Full + Part Time)	2	Employee Shifts per Day
Employees (Full + Part Time)	520	Employee Shifts per Year*
Visitors	2	Visitors per Day
Visitors	620	Visitors per Year**
Event Visitors per Year	0	Visitors per Year
Vineyards		
Acres Planted	3.85	Acres
Heat Protection	N/A	
Frost Protection	N/A	

* 5-day work weeks for Full-Time, 45 total days for Part-Time (harvest)

** Conservatively estimated based on maximum visitation 6 days per week

Based on Table 4, the existing water usage of the parcel is estimated as follows:

Table 5: Existing Water Usage

Residence	0.75	AF per Year
Winery		
Process Water	0.108	AF per Year
Domestic Water + Landscaping	0.025	AF per Year
Employees	0.024	AF per Year
Visitors	0.006	AF per Year
Event Visitors per Year	0.000	AF per Year
Vineyards		
Irrigation Only	0.77	AF per Year
Heat Protection	0	AF per Year
Frost Protection	0	AF per Year
Total Water Usage	1.683	AF per Year

C. Proposed Water Usage

The proposed water uses under this Use Permit Modification for the Matthiasson Family Vineyard property include the following:

Table 6: Proposed Property Uses

Use	Value	Unit
Residence	1	Main Residence
Winery		
Wine Produced	18	Thousand Gallons per Year
Employees (Full + Part Time)	4 Full, 3 Part	Employee Shifts per Day
Employees (Full + Part Time)	1175	Employee Shifts per Year*
Visitors	15 to 17	Visitors Per Day
Visitors	4750	Visitors Per Year*
Event Visitors	170	Visitors Per Year
Vineyards		
Acres Planted	3.67	Acres
Heat Protection	N/A	
Frost Protection	N/A	

* 5-day work weeks for Full-Time, 45 total days for Part-Time (harvest)

** Conservatively estimated based on maximum visitation 6 days per week

The purpose of the Use Permit Modification is to increase wine production from 5,000 gallons to 18,000 gallons per year, and to allow visitors (up to 17 per day + special events).

Based on Table 6, the proposed water usage of the parcel is estimated as follows:

Table 7: Proposed Water Usage

Residence	0.75	AF per Year
Winery		
Process Water	0.387	AF per Year
Domestic Water + Landscaping	0.090	AF per Year
Employees	0.054	AF per Year
Visitors	0.044	AF per Year
Event Visitors per Year	0.008	AF per Year
Vineyards		
Irrigation Only	0.184	AF per Year
Heat Protection	0	AF per Year
Frost Protection	0	AF per Year
Total Water Usage	1.517	**AF per Year**

See Table 8, below, for a summary of the change in water use from the existing condition to the proposed Use Permit condition.

Table 8: Proposed Increase in Water Usage

Existing Water Usage	1.683	AF per Year
Proposed Water Usage	1.517	AF per Year
Water Usage Increase	-0.166	**AF per Year**

The proposed project will reduce groundwater usage relative to the existing conditions, due to a switch from irrigating the vineyards to dry-farming the vineyards. Furthermore, due to the replumbing described above, winery water will come solely from Well #01, and expected total annual water demand for Well #01 is 0.583 acre-feet.

D. Water Supply Capacity

Three wells are available for use by the winery (see Appendix B, Wells #01, #02, and #04). However, well #01 will be assumed to be the primary water supply for the winery. Well #01 was pumped at an average rate of 3 gpm during a well yield test completed by a pumping contractor in March 2018 (see Appendix C).

Based on the results of that March 2018 well yield test, Well #01 appears to be more than capable of pumping at a rate of 1.5 gpm, the rate needed to meet the proposed winery water use of 0.583 acre-feet per year. This 1.5-gpm rate assumes Well #01 would be pumped on a 33% operational basis, or 8 hours per day, every day, throughout the year.

E. Groundwater Recharge Analysis

Please see a separate report for a groundwater recharge analysis completed by Richard Slade & Associates.

III. Tier 2 Analysis

As required by the WAA guidelines, the project must be evaluated for the potential for well and/or spring interference, if the project is outside the Napa Valley Floor. Please see a separate report for a Tier 2 Analysis completed by Richard Slade & Associates.

IV. Conclusion

This report demonstrates that the proposed project is in compliance with current County Code related to groundwater usage per the Napa County Water Availability Analysis guidelines.

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APPENDICES

APPENDIX A: VICINITY MAP
APPENDIX B: WELL EXHIBIT
APPENDIX C: WELL YIELD TEST

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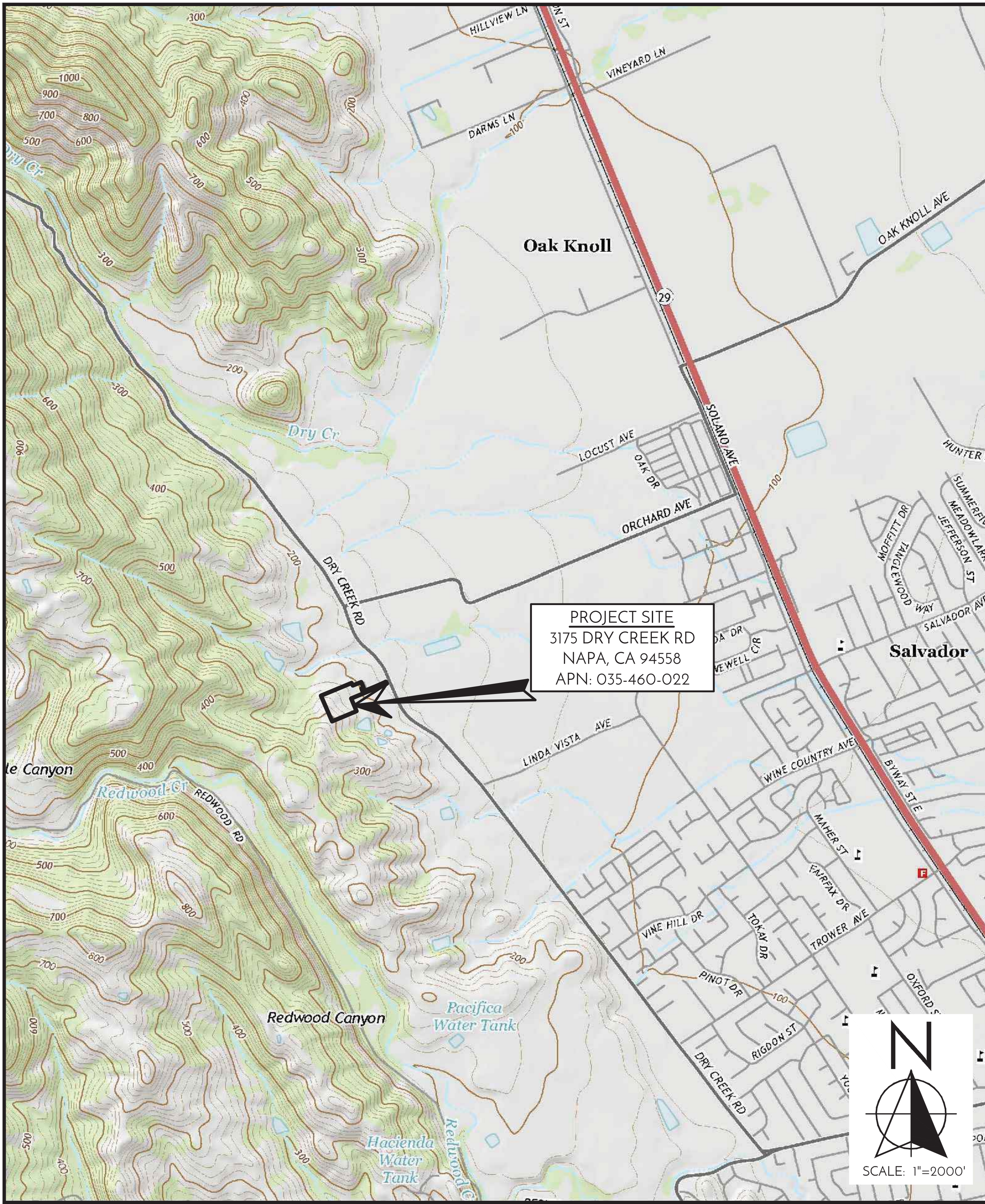
APPENDIX A
VICINITY MAP



MATTHIASSON FAMILY VINEYARDS
VICINITY MAP

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1485 MAIN ST., SUITE 302
ST. HELENA, CA 94574
(707) 302-6280

DATE:	06/29/17
SCALE:	1"=2,000'
JOB #	17.014
APN:	035-460-022

SHEET 1 OF 1

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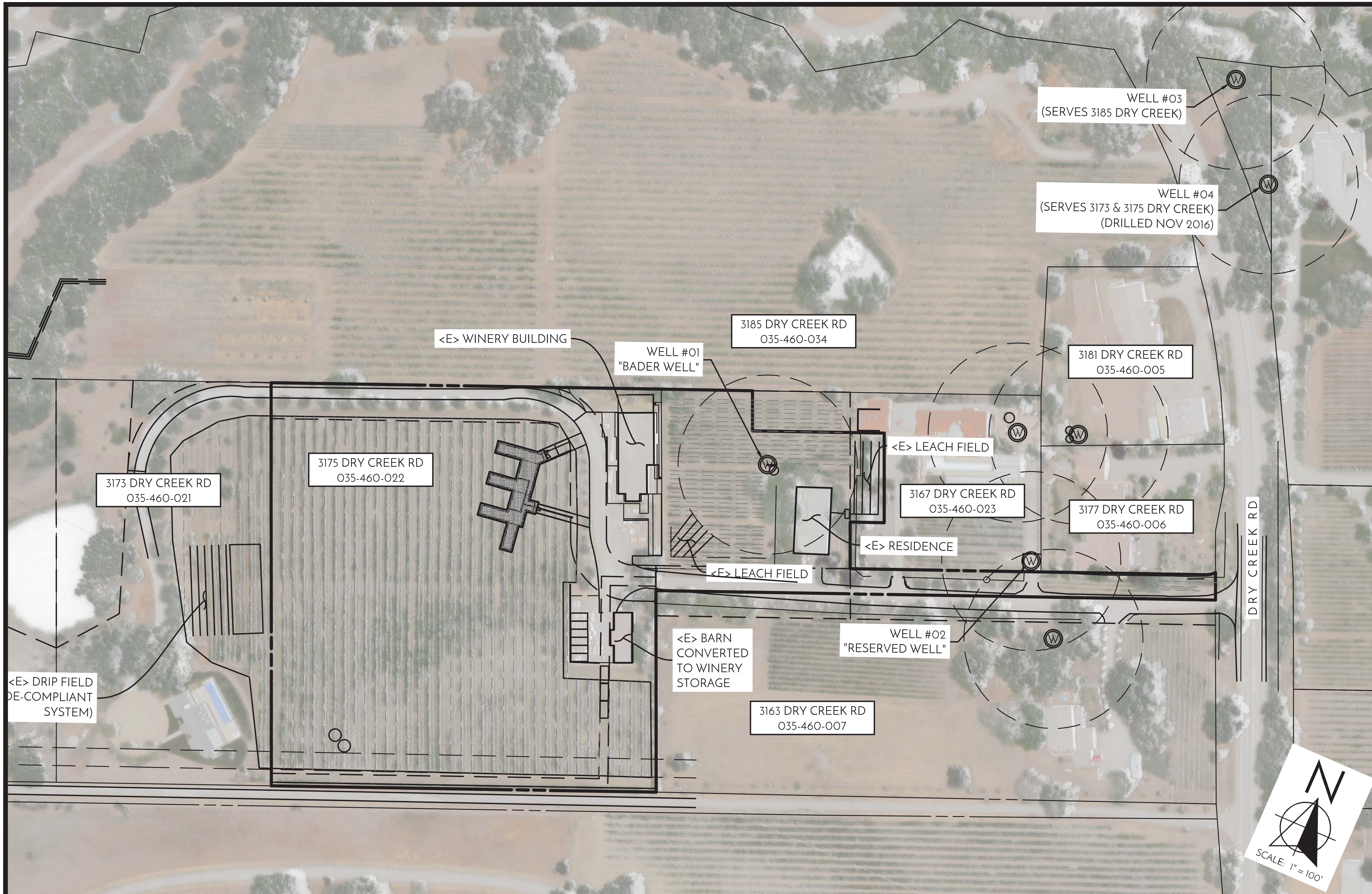
APPENDIX B
WELL EXHIBIT



OVERALL WATER SYSTEM MAP

MATTHIASSON FAMILY VINEYARDS
OVERALL WATER SYSTEM MAP
NAPA CA

1485 Main Street, Suite 302
St. Helena, California 94574
707-302-6280

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DATE:	04/16/18
SCALE:	1"=100'
JOB #:	17.018
APN:	035-460-022

1 OF 1

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APPENDIX C
WELL YIELD TEST

LGS

LGS DRILLING, INC

REPORT OF WATER AVAILABILITY FOR WELLS AND SPRINGS

Property Address: 3175 Dry Creek Rd.

Assessors Parcel # or Minor Subdivision #:

Property Owner: Matthiasson Family Vineyard

Address: 3175 Dry Creek Rd.

Well Driller: LGS Drilling Inc. License #: C57 811727

WATER SOURCE: WELL ☒ SPRING ☐	#1	#2	#3	#4
Date of Test:	3-16-2018			
Time – Start of Test:	8:00			
Finish of Test:	16:00			
Total Hours of Test:	8			
Total Depth of Well:	175'			
Diameter of Well:	6"			
Static Water Level (SWL): (Standing water level prior to pumping)	42.85			
Pumping Level (PL): (Water level at start of sustained yield measurement)	83.65			
Drawdown (DD): (Difference between SWL and PL)	83.65			
Recovery Time: (Time required to return from pumping level to static water level) 90%	8 hr.			
Sustained Yield: (Continuous water production capability of a well measured over a minimum of a 4-hour test period)	3 GPM			
Pressure (PSI)	40 PSI			

Test Pump Specifications (include make, model & HP)

Well #1: 1hp 5 GPM Set at 170' Test Pump New Flow Meter

Well #2:

Well #3:

Well #4:

DATA SHEET FOR STANDARDIZED PUMP TEST

	WELL #1			WELL #2 Observation Well			WELL #3			WELL #4		
	TIME	WATER LEVEL	GPM	TIME	WATER LEVEL	GPM	TIME	WATER LEVEL	GPM	TIME	WATER LEVEL	GPM
3-16	8:00	42.85	3.	7:45	349.6	Ø						
	8:15	60.40	3									
	8:30	67.75	3									
	8:45	74.70	3									
	9:00	84.90	3	9:15								
	9:30	92.10	3									
	10:00	98.50	3									
	10:30	104.15	3									
	11:00	109.0	3	11:15	349.4	Ø						
	12:00	113.5	3									
	13:00	116.85	3									
	14:00	120.0	3									
	15:00	125.0	3									
	16:00	126.5	3									
Recovery	16:05	122.0		15:50	349.2	Ø						
	16:15	116.4										
	16:30	110.7										
	17:00	103.0										
	18:00	90.3										
	19:00	82.4										
	20:00	76.10		8:40	349.10	Ø						
3-17	8:00	46.00		3-17								

I hereby certify under penalty of perjury, that the data recorded above are true and correct and the above pump test was performed in accordance with the requirements of the Solano County Subdivision Ordinance.

M. Scott Smith LGS Drilling Inc.
Signature of Drilling or Pumping Contractor

Date 3-16-2018