MEMORANDUM

June 24, 2021

To: Mr. Jay Heckenlively
Real Thorevilos LLC
Sent via email (jheckenlively@mcclellanpark.com)

cc: Mr. Jack Bittner
Bittner and Company
Sent via email (jack@bittnerandcompany.com)

Mr. Mike Muelrath
Applied Civil Engineering, Inc.
Sent via email (mike@appliedcivil.com)

Job No. 677-NPA02

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

Re: Results of Napa County Tier 1 Water Availability Analysis
Real Thorevilos/Mund Road Vineyards Property
320 Mund Road
Deer Park Area, Napa County, California

Introduction

This Memorandum presents the key findings and conclusions, along with the preliminary recommendations, regarding the Water Availability Analysis (WAA) prepared by RCS for the proposed new vineyard development at the Real Thorevilos/Mund Road Vineyards property in the vicinity of St. Helena, Napa County (County), California. This document was prepared for the property owner (Real Thorevilos LLC) to provide hydrogeologic analyses in conformance with Napa County Tier 1 requirements, as described in the Napa County WAA Guidelines (WAA, 2015).

The Real Thorevilos/Mund Road Vineyard property (referred to herein as "subject property") is comprised by five contiguous parcels having a total area of 389.6 acres and is located on Mund Road in the Deer Park area of Napa County. Figure 1, "Location Map", shows the boundaries of the subject property superimposed on the USGS topographic map for the St. Helena quadrangle. Property boundaries shown on Figure 1 were adapted from the County Assessor's parcel data; County parcel data are freely available on the Napa County GIS website. Also shown on Figure 1 are the locations of the existing onsite water wells (known herein as the "Vineyard Well", the "Domestic Well", and "Well 1-2020") and the locations of some nearby offsite wells owned by others. Figure 2, "Aerial Photograph Map", shows the same property

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boundaries and well locations that are illustrated on Figure 1, but the basemap for Figure 2 is an aerial photograph of the area, which was obtained via the ArcGIS Pro software package.

As reported by the project engineer, Mr. Mike Muelrath of Applied Civil Engineering, Inc (ACE), the 389.6-acre subject property was developed with 21.9 acres of vineyards, a primary residence, a secondary residence (guest house) and a barn. However, the guest house and the barn were reportedly destroyed during the 2020 Glass Fire. Water demands for the onsite vineyards and residences were historically met via groundwater pumped by the onsite Vineyard Well (used for irrigation) and the Domestic Well (used for the residences). RCS understands the proposed project is to develop approximately 19.0 acres of new vines. For this project, the future water demands for the new vines are proposed to be met using groundwater pumped from the new onsite well, known as Well 1-2020.

The basic purpose of this Memorandum is to comply with Napa County's WAA guidelines for a "Tier 1" WAA (i.e., a Groundwater Recharge Estimate); those guidelines were promulgated by the County in May 2015. Because there are no known offsite wells located within 500 ft of the project well (new Well 1-2020), County requirements for a "Tier 2" WAA analysis (i.e., a Well Interference Evaluation) have been "presumptively met" per the WAA Guidelines (WAA 2015).

Site Conditions

From review of existing data, and from a field reconnaissance visit by an RCS geologist to the subject property on June 2, 2020, the following key items were noted and/or observed (refer to Figures 1 and 2):

a. The Real Thorevilos/Mund Road Vineyards property is comprised of five (5) contiguous parcels having Napa County Assessor's Parcel Numbers (APNs) of: 021-320-022; 021-320-024; 021-320-026; 021-320-027; and 021-320-028. The total assessed area of the subject property is 389.6 acres.

b. Topographically, the subject property, which is situated in the Deer Park area of Napa County, is located in the hills to the northeast of St. Helena, California. Based on the topographic contours illustrated in Figure 1, the property lies southwest of a prominent ridgeline, and the property itself contains ridge areas bordered by small valleys. Ground surface on the subject property generally slopes from southeast to northwest towards Deer Park Road, in the direction of decreasing elevation for the valley areas. An ephemeral drainage is shown on the USGS topographic map within the boundaries of the subject property, as denoted by the dashed blue line on Figure 1. This marked drainage begins in the southeast portion of the property and traverses toward the northwest. Because this drainage is ephemeral, it would contain surface water runoff only during or immediately following a rainfall event. This drainage was observed to by dry during the RCS site visit on June 2, 2020.

c. The subject property is developed with 21.9 acres of vineyards, which are located in the central portion of the property. Prior to the 2020 Glass Fire, the primary residence, the former guest house and former barn were located in the southeastern portion of the property. All other portions of the property were essentially undeveloped. Access to the property is via a private driveway from Mund Road to the west.

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d. Prior to the 2020 Glass fire, offsite areas surrounding the subject property consisted primarily of small vineyard areas and residences to the south. Areas north of the subject property were primarily naturally vegetated or wooded hillsides (i.e., undeveloped areas).

e. As shown on Figures 1 and 2, there are three existing water-supply wells on the subject property. The "Vineyard Well" and "Well 1-2020" are located in the central portion of the property, where the existing vineyards are situated (on APN 021-320-026); these wells lie within approximately 50 ft of one another. The "Domestic Well" is located near the existing primary residence in the southeastern portion of the property (on APN 021-320-028). Each well is currently equipped with a permanent pump. Only the Vineyard Well and Well 1-2020 were observed to be equipped with a totalizer flowmeter device during the June 2020 RCS site visit.

f. During the RCS June 2020 site visit, the geologist also traveled along Mund Road in attempt to identify possible locations and/or the existence of nearby offsite wells owned by others. RCS refers to such work as "windshield surveys." For these surveys, the RCS geologist tried to identify possible well locations by observing typical well-house enclosures, pressure tanks, storage tanks, power lines, or direct observation of a wellhead.

   RCS geologists also contacted Napa County Planning, Building, and Environmental Services (PBES) in another attempt to acquire "Well Completion Reports" (also known as "driller's logs") that might exist for wells located on those neighboring offsite properties. In addition, RCS geologists also accessed the California Department of Water Resources (DWR) online Well Completion Report website to download possible driller's logs for wells within the immediate vicinity of the subject property. As a result of these efforts, 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. It is noteworthy that none of these offsite wells are shown to be located with 500 ft the onsite wells.

<u>Key Construction and Testing Data for Existing Onsite Wells</u>

Napa County PBES provided RCS geologists with two driller's logs that corresponded to the subject property address (320 Mund Road), and both logs were recovered from the County's files for APN 021-320-026; copies of these two driller's logs (Log Nos. 39614 and 39616) are appended to this Memorandum. It should be noted that the well designations for Log Nos. 39614 and 39616 were not listed on the logs, and therefore, it is unknown which driller's log represents the "Vineyard Well" or the "Domestic Well." Both driller's logs detail PVC well casings with nominal diameters of six inches, the same casing diameters of the two onsite wells observed during the RCS site visit. For Well 1-2020, the driller's log (Log No. WCR2020-005208) was provided to RCS by Huckfeldt Well Drilling, Inc (Huckfeldt) of Napa, California. Table 1, "Summary of Well Construction and Testing Data", provides a tabulation of key well construction and testing data available for these two onsite wells.

Well Construction Data

Key data for the three onsite wells listed on the available driller's logs and/or identified during our site visit includes:

a. The Vineyard and Domestic wells were both constructed in November 1977 by Williams Well Drilling (Williams) of Suisan, California. Note that this drilling company no longer appears to be in business. Both wells were drilled using the direct mud rotary drilling method. Well 1-2020 was constructed in March 2020 by Huckfeldt using the direct mud rotary method.

b. Pilot hole depths (the borehole drilled before the well casing is placed downhole) were reported to be 260 ft below ground surface (bgs) for Log No. 39614 and 300 ft bgs in Log No. 39616; the pilot hole depth for Well 1-2020 was reported to be 700 ft bgs on the log.

c. Each of the three onsite wells is cased with PVC well casing. Both the Vineyard and the Domestic wells have a nominal casing diameter of 6 inches, while Well 1-2020 has a nominal casing diameter of 8 inches; total casing depths were reported to be 260 ft for Well Log No. 39614, 300 ft bgs for Well Log No. 39616, and 699 ft bgs for Well 1-2020.

d. Casing perforations for the Vineyard and Domestic wells are machine-cut slots and have slot opening widths of 1/16-inch (0.0625 inches). Casing perforations for Well 1-2020 are reported to also be milled slots, and these have a slot opening of 0.032 inches. It should be noted that the top of the casing perforations in Well 1-2020 occur at a depth deeper than the lowermost casing perforations in the Vineyard Well and the Domestic well.

e. Gravel pack materials shown on the driller's logs for the Vineyard and Domestic wells were listed as "pea gravel," whereas the gravel pack for Well 1-2020 is listed as #6 sand.

f. Each well was constructed with a sanitary seal consisting of cement. These sanitary seals were set to a depth of 20 ft bgs in both the Vineyard and Domestic wells, and a depth of 55 ft for Well 1-2020.

Summary of Original "Testing" Data

The driller's logs for the three onsite wells provided the depth to the original post-construction static water levels (SWL) for these wells, along with the original "test" data (as shown on Table 1). These data include:

- Initial SWL depths following completion of well construction were reported to be 110 ft bgs (Log No. 39614) and 120 ft bgs (Log No. 39616) in November 1977, and 267 ft bgs for Well 1-2020 in April 2020.

- There were no airlifting or pumping data listed on the driller's logs for the Vineyard or the Domestic wells. However, bailer testing was performed in each of these two onsite wells following their construction in November 1977. Bailing rates were not provided on either of the driller's logs for these two wells. At the end of each bailer test, it was reported by the driller that no water level drawdown had occurred in either well.

- A 4-hour airlifting "test" was performed on Well 1-2020 after its construction in April 2020. An estimated flow rate as reported on the driller's log was 120 gallons per minute (gpm) for this well.

Pumping Test Data by Others for Well 1-2020

On August 14, 2020, an 8-hour constant rate pumping test of Well 1-2020 was performed by Oakville Pump Service, Inc. (OPS), of Oakville, California. Testing of the well was performed using the existing permanent pump at the time of testing; the permanent pump was reported by OPS to be a 20-horsepower pump and to have a pumping capacity of 75 gpm; it had been installed to a depth of approximately 672 ft bgs. Water levels and pumping rates were measured and recorded by the OPS pumper during the pumping test. Figure 3, "Water Levels During Constant Rate Pumping Test", illustrates the water level changes in Well 1-2020 during the 8-hour pumping test period. Key data available for this August 2020 pumping test by OPS include:

- A SWL of 504.3 ft below the wellhead reference point (brp) was recorded by the OPS pumper prior to testing. This may not have been a true SWL, however. The OPS pumper reported that Well 1-2020 was pumping for an extended duration prior to the start of the constant rate pumping test. Therefore, the water level in the well likely did not have time to recover to the actual non-pumping water level (SWL) before the testing began.
- A maximum pumping water level (PWL) of 635.9 ft brp was measured at the end of the 8-hour pumping period; this represents a water level drawdown of 131.6 ft at the end of the test. The data show that water levels were continuing to decline slightly by the end of the pumping test. Specifically, PWLs were still declining at a rate of approximately 3 ft in the last 3 hours of the pumping test. This represents a water level decline of about 1 ft/hour. Additionally, PWLs were reported to be about 36 ft above the pump intake depth.
- During the pumping test period, pumping rates began at a rate of approximately 79 gpm, but the rate gradually dropped to 73 gpm by the end of the test. Based on the totalizer flow meter readings provided by OPS, an average pumping rate of 75 gpm was calculated for the 8-hour test. Based on this average pumping rate, and the total water drawdown of 131.6 ft, the specific capacity of Well 1-2020 is calculated to be 0.57 gallons per minute per foot of water level drawdown (gpm/ft ddn) at the time of this OPS test in August 2020. Because the SWL measured before testing began was not a true SWL, the specific capacity calculated here is not representative of the actual specific capacity of the well.
- Following the end of the pumping test, water levels recovered to a depth of 505.2 ft after a period of approximately 165 minutes of non-pumping.

Well Data from Site Visit

As discussed above, a site visit to the subject property was performed by an RCS geologist on June 2, 2020. The following information for the three onsite wells was collected from that site visit:

- The Vineyard Well was observed to be equipped with a permanent pump and was pumping during the site visit at a rate of approximately 25.5 gpm, based on the totalizer flowmeter readings. A PWL of 238.7 ft brp was measured by the RCS geologist.

- The Domestic Well was observed to be equipped with a permanent pump, but it was not pumping during the RCS site visit. A SWL of 166.2 ft brp was measured by the RCS geologist. This SWL is roughly 46 to 56 ft deeper than the original SWL reported on the driller's log (in November 1977) for the Vineyard Well and the Domestic Well.
- Totalizer flow dial devices (to measure flow rates and volumes) were observed to exist at the Vineyard Well and at Well 1-2020. However, a totalizer flowmeter device was not observed to exist at the Domestic Well.
- Well 1-2020 was observed to equipped with a permanent pump and was not pumping at the time of our visit. A SWL of 233.2 ft brp was measured by the RCS geologist. This SWL is roughly 34 ft shallower than the SWLs reported on the driller's logs in April 2020.

Local Geologic Conditions

Figure 4, "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 4 has been adapted from the results of regional geologic field mapping of the Eastern Sonoma and Western Napa Counties, as published by the USGS in 2007. As shown on Figure 4, the key earth materials mapped at ground surface in the area, from geologically youngest to oldest, include the following:

a. Alluvial-type deposits. These deposits consist of undifferentiated and/or undivided alluvium, alluvial fan deposits, stream channel deposits, and terrace deposits (map symbols Qhc, Qhf, Qha, and Qpa on Figure 4, respectively). These deposits are generally unconsolidated, and consist of layers and lenses of sand, gravel, silt, and clay. These geologic materials are generally exposed further to the southwest along the main floor of Napa Valley, but small portions of alluvium (map symbol Qpa) were mapped at ground surface in the northern and western portions of the property.

b. Landslide deposits. Landslide deposits[1] (map symbol Qls on Figure 4) have been mapped in the region by others. These landslides are also exposed at ground surface in the central portion of the subject property, as shown on Figure 4. The landslides that are mapped within the boundaries of the subject property are completely surrounded by Sonoma Volcanic, and are therefore likely consist entirely of volcanic rock material.

c. Sonoma Volcanics. The Sonoma Volcanics are comprised by a highly variable sequence of chemically and lithologically diverse volcanic rocks. These rock types include the following: rhyolite flows (map symbol Tsr); andesitic to basaltic lava flows (map symbol Tsa); pumiceous ash-flow tuff (map symbol Tst); and volcanic sand and gravel (map symbol Tss). As shown on Figure 4, pumiceous ash-flow tuffs are the

[1] 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.

primary volcanic rock material exposed at ground surface across on the subject property.

d. Great Valley Sequence. The geologically older Great Valley Sequence rocks are exposed offsite at ground surface to the northeast of the subject property (map symbol KJgv on Figure 4). These geologically older rocks consist mainly of well-consolidated to cemented, sandstone, shale, and conglomerate, and are considered to be the bedrock of the area. Serpentinite (map symbol sp), is exposed at ground surface to the east of the subject property.

RCS interpretation of the driller's descriptions of the drill cuttings listed on the available driller's logs for the three onsite wells, reveals that typical rocks of the Sonoma Volcanics were likely encountered when drilling the total depths of these three wells. Typical driller-terminology for the drill cuttings on those logs included: "fractured rock;" "red clay;" "hard rock," "tan volcanic tuff," "sandy ash," "fractured volcanics," and "coarse volcanic sands." Therefore, based on the generalized terminology used by the drillers for these wells, the Sonoma Volcanics are interpreted by RCS to extend to depths of perhaps 585 ft bgs, depending on the location of the well. In our opinion, it is not possible to determine from the driller's log for Well 1-2020 whether or not the earth materials below ±585 ft are Sonoma Volcanics or rocks of the Great Valley Sequence.

Local Hydrogeologic Conditions

The earth materials described above can generally be separated into two basic categories, based on their relative ability to store and transmit groundwater to wells. These two basic categories include:

Potentially Water-Bearing Materials

The principal water-bearing materials beneath the subject property and its environs are represented by the hard, fractured volcanic flow rocks and volcanic tuffs of the Sonoma Volcanics. The occurrence and movement of groundwater in these rocks tend to be controlled primarily by the secondary porosity within the rock mass, that is, by the fractures and joints that have been created in these harder volcanic flow-type rocks over time by various volcanic and tectonic processes. Specifically, these fractures and joints have been created as a result of the cooling of these originally molten flow rocks and volcanic ash deposits following their deposition, and also from mountain building or tectonic processes (faulting and folding) that have occurred over time in the region after the rocks were erupted and hardened. Some groundwater can also occur in zones of deep weathering between the periods of volcanic events that yielded the various flow rocks, and also with the pore spaces created by the grain-to-grain interaction in the volcanic tuff and ash.

The amount of groundwater available at a particular drill site for a well constructed into the Sonoma Volcanics beneath the subject property would depend on such factors as:

- the number, frequency, size and degree of openness of the fractures/joints in the subsurface.
- the degree of interconnection of the various fracture/joint systems in the subsurface and to ground surface.

- the extent to which the open fractures may have been possibly in-filled over time by chemical precipitates/deposits and/or weathering products (clay, etc.).
- the amount of recharge from local rainfall that becomes available for deep percolation to the fracture systems.
- to a lesser extent, the size of the pore-spaces formed by the grain-to-grain interactions of volcanic ash particles.

As stated above, the principal rock type expected in the subsurface beneath the property are a combination of fine-grained volcanic ash and tuffs and hard, volcanic flow rocks; the latter may be fractured to varying degrees. Descriptions of drill cuttings by the well driller that are recorded on the available driller's logs for the three onsite wells are consistent with the typical descriptions of the various rocks known in the Sonoma Volcanics. From our long-term experience with the fractured flow rocks within the Sonoma Volcanics, based on numerous other water well construction projects in Napa County, pumping capacities in individual wells have ranged widely, from rates as low as 5 to 10 gpm, to rates as high as 200 gpm, or more. Wells constructed into deeply weathered volcanic materials and ash/tuff layers tend to have lower flow rates because these materials are fine-grained and of low permeability.

Potentially Nonwater-Bearing Rocks

This category includes the geologically older and fine-grained sedimentary rocks of the Great Valley Sequence, including serpentinite. These potentially nonwater-bearing rocks are interpreted to underlie the volcanic rocks that exist beneath the subject property at depths greater than ±585 ft bgs, depending on the well location.

In essence, these diverse rocks are well-cemented and well-lithified, and have an overall low permeability. Occasionally, localized conditions can allow for small quantities of groundwater to exist in these rocks wherever they may be sufficiently fractured and/or are relatively more coarse-grained. However, even in areas with potentially favorable conditions, well yields are often only a few gpm in these rocks, and the water quality can be marginal to poor in terms of total dissolved solids concentrations, and other dissolved constituents.

Geologic Structure

There were no faults[2] as mapped by others on the subject property or in the immediate vicinity of the property, as shown on Figure 4. There is a single northwest-southeast trending fault mapped by others to exist further to the northeast of the subject property. There are various possible impacts of these faults on groundwater availability in the region. Faults can serve to increase the number and frequency of fracturing in the Sonoma Volcanics 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. The nature of the offsite fault discussed above is unknown.

[2] 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.

Project Groundwater Demands

For the purposes of this WAA, Well 1-2020 is considered to be the "project well", as it will replace the existing Vineyard Well and be used to meet the water demands for the existing vineyards and the proposed vineyard development project. Prior to the 2020 Glass Fire, onsite water demands for the residence and guest house were supplied by groundwater pumped from the Domestic Well, and the existing vineyards were supplied by groundwater pumped from the Vineyard Well. As part of the proposed project, Well 1-2020 will be used in the future to meet the onsite water demands of the existing and the proposed new vineyards, whereas the Vineyard Well will be used in the future as redundant and/or emergency backup well only. The Domestic Well will once again be used to meet the water demands for the residence and the guest house, once rebuilt.

Water use estimates for existing and proposed onsite water demands for the subject property have been estimated by RCS geologists and are based solely on water use guidelines provided in the WAA Guidance Document (WAA 2015). Table 2, "Groundwater Use Estimates", is intended to categorize the specific water demands of the proposed project and of the other onsite uses. Estimates shown on Table 2 are discussed below.

Existing (Pre-Fire) Groundwater Demands

Herein, references to "existing" demands represent groundwater demands that existed onsite prior to the 2020 Glass Fire. Groundwater demands for the existing onsite uses have historically been met by pumping groundwater from the Vineyard and Domestic wells. Existing groundwater demands for the subject property are estimated[3] as follows:

a. Residential groundwater demand = 1.25 acre-feet per year (AF/yr)
   - Based on one primary residence (0.75 AF/yr) and one secondary residence (0.50 AF/yr).
b. Permitted vineyard irrigation groundwater demand = 11.0 AF/yr
   - Based on the permitted vineyard acreage of 21.9 acres and an estimated unit water use of approximately 0.50 AF per acre vine per year (AF/ac/yr).
c. Total estimated existing annual groundwater demand = a + b = 12.3 AF/yr

Proposed Groundwater Demands

Groundwater demands for the permitted vineyards and the proposed new vineyards will be met by pumping groundwater from the project well (Well 1-2020), whereas groundwater for residential uses will continue to be pumped from the Domestic Well. Water demand estimates for the proposed project have been estimated by RCS geologists as follows:

a. Existing residential groundwater demand = 1.25 AF/yr
b. Proposed vineyard irrigation groundwater demand = 20.5 AF/yr

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[3] These water demand estimates were 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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- Based on the total proposed vineyard acreage of 40.9 acres (21.9 acres existing permitted, plus 19.0 acres proposed) and an estimated unit water use of approximately 0.50 AF per acre vine per year (AF/ac/yr).

c. Total estimated proposed annual groundwater demand = a + b = 21.8 AF/yr

Based on these water use estimates, future groundwater demand at the subject property will increase by approximately 9.5 AF/yr due to the proposed vineyard expansion.

Proposed Pumping Rates

To determine an appropriate pumping rate necessary from the project well (Well 1-2020) to meet the future proposed vineyard irrigation groundwater demands of 20.5 AF/yr, it was estimated that groundwater from the project well will be pumped during a 20-week irrigation season each year to meet the demand; this does not include the residential domestic demands, which will continue to be met using the Domestic Well. . Based on these assumptions, in order for the project well to meet the groundwater demands for the proposed project, the project well would need to pump at a rate of about 67 gpm. This pumping rate assumes that the project well would be pumped on a 50% operational basis (12 hours/day, 7 days/week) during the 20-week irrigation season.

Based on the constant rate pumping test performed on the project well by OPS in August 2020 (at an average rate of 75 gpm), it appears that the project well (Well 1-2020) is likely capable of meeting the instantaneous groundwater pumping rate demands (67 gpm) required during the vineyard irrigation season each year. Because of the relatively deep pumping water levels reported during the pumping test, it is possible that, near the end of each irrigation season, some makeup water from the existing Vineyard well may be necessary to meet onsite irrigation demands reduced pump capacity associated with the deep pumping water levels observed in the project well.

Rainfall

Long-term rainfall data are essential for estimating the average annual recharge that may occur at subject property. Average annual rainfall totals that occur specifically at the subject property are not directly known, because no onsite rain gage exists. The nearest rain gage to the subject property known to RCS with a significantly long data record is located approximately 1½ miles southwest in St. Helena, California. The data for this “St. Helena” rain gage are available from the Western Regional Climate Center (WRCC) website. For this rain gage, the period of available record is November 1907 through May 2021; data for this gage are listed by calendar year. Note that there are several months and/or years of rainfall data missing in 1907, between 1915 and 1922, between 1979 and 1980, between 1985 and 1988, in 1992, and between 2011 and 2012. For the available period of record, the average annual rainfall at this St. Helena gage has 32.2 inches (2.68 ft), as reported by the WRCC. This rainfall gage is located at a lower elevation (±225 ft above mean sea level, amsl) than that of the subject property, and therefore the average annual rainfall at the subject property could be higher than that experienced at this known gage location.

Another nearby WRCC rain gage, Angwin Pacific Union College (PUC) with a relatively long rainfall record is located in Angwin, roughly 3½ miles north of the subject property. Data for this rain gage are available from 1940 through May 2021. Note there are missing data in the following years: 1940 to 1943; 1946 to 1947; 1975; 1987; and 2011. The average annual rainfall for this rain gage is the period of record listed was reported to be 38.4 (3.20 ft). However, this rain gage is located at a higher elevation (±1,7150 ft amsl) than that of the subject property.

To help corroborate the average annual rainfall data derived from the two WRCC 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 (800-meter) 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 Napa County, including the region of the subject property. Using this data set, RCS determined that the average rainfall for the subject property for the stated date range may be approximately 38.2 inches (3.18 ft).

An additional, though older, 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 County GIS database), 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 is situated within the boundaries of the 35-inch average annual rainfall contour on this County map. Based on our interpretation of the actual isohyetal contour map (not provided herein), the long-term average annual rainfall at the subject property may be on the order of 35 inches (2.92 ft), using this data source.

Table 3, "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 38.2 inches (3.18 ft), as derived from the PRISM data set. The 38.2-inch per year estimate is based on the data source with a relatively long period of record (30 years) and is more site-specific, when compared to the other rainfall data sources listed in Table 3 that exist at different elevations, and/or are located at a significant distance from the subject property.

Estimate of Groundwater Recharge

Groundwater recharge on a long-term average annual basis at the subject property can be estimated as a percentage of average rainfall that falls directly on the subject property and becomes available to deep percolate into the local aquifer system(s) 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 surface; 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 Sonoma Volcanics, as relied upon by other consultants and government agencies for projects in the 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 (by calendar year or water year) 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 were 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. Herein, Figure 5, "Watersheds Map", was prepared for this project using those same watershed boundaries provided by MBK Engineers (MBK), for which watershed water balance data are available in the LSCE&MBK 2013 report. As shown on Figure 5, the vast majority of the subject property is located within the watershed referred to by MBK as the "Napa River Watershed at St. Helena." As shown on Table 8-9 on page 97 of the referenced report (LSCE&MBK, 2013), 14% of the average annual rainfall that occurs within this watershed was estimated to be able to deep percolate as groundwater recharge. Note that, as shown on Table 8-8 of LSCE&MBK (2013), this sub-watershed and several other sub-watershed areas are tributary to the "Napa River Watershed near Napa."

As stated above, the total surface area of the subject property is 389.6 acres. Assuming a conservative amount of 38.2 inches (3.18 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 would be approximately 1,239 AF/yr (389.6 acres x 3.18 ft). Assuming 14% of that average annual rainfall volume would be able to deep percolate to the groundwater beneath the subject property over the long term, then the average annual groundwater recharge at the subject property would be approximately 173.5 AF/yr. This estimated annual recharge volume is much greater than the total estimated future (proposed) average annual groundwater demand of 21.8 AF/yr needed from the project well.

Effect of Ground Slope Angle on Recharge Potential

Any estimate of the percentage of rainfall that becomes available for deep percolation that relies on estimates of rainfall, evapotranspiration, and surface water outflow for an entire watershed, such as those estimates provided by LSCE&MBK 2013, inherently includes the effects of ground surface slope angle in the estimate. However, to provide a more thorough consideration of the potential effects of ground slope angle on groundwater recharge specifically at the subject property, analysis of those effects is provided below.

Many basic geologic references assume that recharge potential is reduced on steeper slopes, as steeper slopes can increase surface water runoff rates, and therefore less time is available for rainfall to deep percolate. Page 56 of LSCE&MBK (2013), asserts that deep percolation recharge from rainfall is "significantly reduced" for land areas with slopes angles greater than 30 degrees. On page 11 of LSCE&MBK (2013), an assessment of slope angles (inclinations) greater than 30 degrees is also mentioned, and this was attributed to a prior LSCE report, namely "LSCE 2011" therein; that document is likely to be the reference listed as "2011a" on page 134 of LSCE&MBK 2013. In that referenced document (LSCE, 2011), the statement is made on page 29 that "areas in which the slope of the land surface exceeds 30 degrees, beyond which recharge potential is significantly reduced." No other references or data are presented in any of the above-referenced documents to quantify the qualitative description of "significantly reduced". Because the various factors that affect groundwater recharge are likely interrelated (Yeh 2009), assigning a value to define the amount that recharge is diminished is extremely difficult. No references were reviewed by RCS that quantify the possible reduction of deep percolation that might occur as a function of slope angle/percentage.

Estimates of the deep percolation of rainfall for the entire "Napa River Watershed at St. Helena" were based on water balance calculations by others that included rainfall throughout the entire watershed. As discussed above, those watershed-scale calculations inherently include all slopes within the watershed, including slopes greater than 30 degrees. Therefore, to evaluate the site-specific recharge potential of the property and to also include assumptions about the varying recharge potential based on slope, then the deep percolation percentage used for slopes less than 30 degrees within the entire watershed would have to be increased to offset the decrease in the percentage for slopes greater than 30 degrees.

Table 4, "Estimated Recharge Based on Deep Percolation Assumptions for Slope Angle", shows a range of values for different assumptions for the amount of deep percolation that might occur on slopes greater than 30 degrees in the Sonoma Volcanics at the subject property. To create Table 4, deep percolation values were first calculated for the entire subject watershed (i.e., "Napa River Watershed at St. Helena"). That is, the deep percolation percentage for the slopes within the watershed that are less than 30 degrees were increased to offset the diminished deep percolation percentage for the slopes greater than 30 degrees. A range of values were calculated assuming a range of "diminishment factors" of 25%, 50%, 75%, and 100%. Once the deep percolation percentages for slopes less than and greater than 30 degrees were calculated for the entire watershed, then those same resultant percentages shown on Table 4 were applied to the subject property; recall that the entire property is underlain by rocks of the Sonoma Volcanics.

As shown above, a recharge estimate of 173.5 AF/yr is calculated for the subject property assuming a conservative value of 14% for the deep percolation of rainfall that would occur on all 389.6 acres of the subject property that are underlain by rocks of the Sonoma Volcanics. Approximately 1.5 acres of the subject property consist of slopes greater than 30 degrees. Hence, if the assumption is made that the deep percolation that occurs on the 1.5 acres of the subject property with slopes greater than 30 degrees is diminished by a factor of 100%, and the revised percolation percentage shown on Table 4 is applied, then the average annual recharge that is estimated to occur at the subject property would be 197.1 AF/yr; see Table 4 herein. This calculated recharge volume is much greater than the estimated total proposed onsite groundwater demand of 21.8 AF/yr from the project well.

Estimate of Groundwater in Storage

To help evaluate possible impacts to the local aquifer system(s) that might occur as a result of pumping for the proposed project, the volume of groundwater extracted for the project can be compared to an estimate of the current volume of groundwater in storage strictly beneath the subject property. To estimate the amount of groundwater currently in storage beneath the subject property, the following parameters are needed:

a) Approximate surface area of property = 389.6 acres

b) Depth of the shallowest onsite well (Driller's Log 39614)= 240 ft bgs. To provide a conservative estimate, we will assume that base of the saturated zone beneath the property is 240 ft bgs. In reality, rocks of the Sonoma Volcanics are known to extend

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to a much greater depth than that for this shallow well, and thus, the saturated zone beneath the property could extend deeper than is estimated using these data.

c) To present a conservative calculation of groundwater in storage, RCS geologists have assumed that the current saturated thickness of the aquifer(s) beneath the subject property is approximately 74 vertical feet. This value is calculated by subtracting the SWL measured by the RCS geologist in the Domestic Well (which was measured at a depth of approximately 166.2 ft brp in June 2020) from the depth of the assumed base of the saturated zone beneath the property (at a depth of 240 ft bgs). Note that the existing Vineyard while was pumping at the time of the site visit in June 2020, therefore a manual SWL measurement was not collected from this well. These values are used for this calculation to provide a conservative analysis of the minimum volume of groundwater in storage beneath the property. Further, as discussed in subpart (b) above, the saturated volcanic rock beneath the subject property, based on the available subsurface geologic data, is thicker; this would tend to create an even greater volume of groundwater in storage in that area.

d) Approximate average specific yield of the Sonoma Volcanics = 2%. The specific yield is essentially the ratio of the volume of water that drains from the saturated portion of the geologic materials (due to gravity) to the total volume of rocks. Specific yield of the Sonoma Volcanics can vary greatly depending on a number of factors, including the degree and interconnection of the pore spaces and/or fracture zones within the rocks. A conservative estimate by Kunkel and Upson for the specific yield of the Sonoma Volcanics ranges from 3% to 5% (USGS 1960). For other Napa County properties for which RCS has performed similar analyses, an even more conservative estimate for specific yield of 2% has been used. Hence, to present a conservative analysis, we will assume a specific yield of 2% for the Sonoma Volcanics rocks that underlie the subject property, but the actual value, in reality, could be higher.

e) Thus, a very conservative estimate of the groundwater in storage (S) beneath the subject property (based on the June 2020 SWL measured in the Domestic Well) is calculated as:

   S = property area (“a”) times saturated thickness (“c”) times average specific yield (“d”) = (389.6 ac)(74 ft)(2%) = 577 AF

In contrast, the proposed average annual groundwater use for the entire property is estimated to be 21.8 AF/yr in the future (all domestic and irrigation demands). Hence, the estimated groundwater demand for the entire property represents only about 4% of the groundwater conservatively estimated to currently be in storage in the volcanic rocks beneath the subject property based on conservative, site specific water level data for the Domestic Well. Furthermore, this percentage does not include annual groundwater recharge that will occur from rainfall into the onsite aquifer(s). Based on the foregoing, the estimated groundwater demands of the proposed project and the entire subject property should not cause a net deficit in the volume of groundwater within the aquifer system(s) beneath the site so as to adversely impact water levels in nearby wells to a point that they would not support existing or permitted land uses.

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 to occur in the region, assuming the project were to operate in the future as described herein. Recharge volumes estimated in this document are based on the long-term average rainfall value 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 period over which the average was calculated. Therefore, it is our opinion that the preceding calculations do inherently include consideration of drought year conditions.

However, to help understand what potential conditions might exist in the local volcanic 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
- WY 2011-12 through WY 2015-16[4] – five years

As of June 10, 2021, the area of Napa County in which the subject property lies, is currently mapped as "Exceptional Drought" on the NDMC website (NDMC, 2021).

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 two rain gages discussed above and shown on Table 5; 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 depends on the period of record for the specific rain gage. The WY 1975-76 to WY 1976-77 drought period recorded by the Angwin PUC rain gage (that had a similar rainfall average to the PRISM rainfall average for the property) and reported by the WRCC showed total rainfall at 32% (drought period average was 12.3 inches), compared to the long-term average (38.4 inches), and that specific drought lasted two years.

Hence, for the purposes of this analysis, a "prolonged" drought period rainfall is conservatively considered to be 32% of the average annual rainfall that occurred in the region (using the

[4] The DWR 2015 drought document was published in February 2015, and lists the drought that began in water year 2011-12 through the 2013-14 water year only; the drought continued throughout the State into WY 2015-16. Due to the rains in WY 2016-17, various sources, including the National Drought Mitigation Center website (NDMC 2018), declared an end to the drought in Northern California in 2017, which included Napa County.

rainfall data from the WRCC Angwin PUC rain gage). Further, to again be conservative, a "prolonged drought period" is estimated to last 6 years, which is the longest drought period on record according to DWR (DWR 2015); see Table 5. This six-year period is a conservative estimate, because the 32%-average figure corresponds with a two-year drought period, not a six-year drought period.

To meet six consecutive years of groundwater demand for the proposed groundwater usage at the subject property, a total onsite groundwater extraction of 130.8 AF is estimated to be required (21.8 AF/yr of groundwater demand for the entire property multiplied by 6 years = 130.8 AF). Assuming groundwater recharge is reduced to 32% of the average annual recharge during each year of such a theoretical "prolonged drought period", then the resulting total of groundwater recharge that might occur during the six-year drought period for the subject property is calculated as follows:

- As shown herein, the estimate of the average annual groundwater recharge on the subject property is 197.1 AF/yr. Taking 32% of this annual volume yields a drought period recharge volume of 63.3 AF/yr.
- Assuming a drought period duration of 6 continuous years, then a total of 379.8 AF (63.3 AF/yr times 6 years) of water would be available to recharge the volcanic rocks beneath the 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 during which only 32% of the average annual rainfall might occur, a conservative estimate of the total drought-period recharge at the subject property (379.8 AF) would be more than the estimate of the total onsite groundwater demand (130.8 AF) that may occur over the same six-year period.

Key Conclusions and Recommendations

1. The Real Thorevilos/Mund Road Vineyards property is currently occupied by a primary residence, and 21.9 acres of vineyards. A secondary residence (guest house) and a barn were destroyed during the 2020 Glass Fire. The majority of the property is undeveloped.
2. The proposed project consists of developing 19.0 acres of new vines on the property.
3. There are three existing water wells on the subject property. The "Vineyard Well" and Well 1-2020 are located in the central portion of the property where the existing vineyard development is located. The "Domestic Well" is located in the southeastern portion of the property near the location of the residences.
4. Prior to the fire, onsite vineyard irrigation demands were met by pumping groundwater from the Vineyard Well; whereas domestic demands for the residences were met by groundwater pumped by the Domestic Well. As part of the proposed project, Well 1-2020 will be used to meet all future vineyard irrigation demands, and the existing "Vineyard Well" will be kept as a redundant and/or backup irrigation-water supply well in the future. The Domestic well will continue to be used to meet the residential domestic demands.
5. The proposed average annual groundwater use for the entire property is estimated to be 21.8 AF/yr (to meet all domestic and irrigation demands), using standard

assumptions for water use published in the County's WAA guidance document (WAA, 2015). Total groundwater demands for the subject property are proposed to increase by 9.5 AF/yr (from 12.3 AF/yr existing to 21.8 AF/yr proposed) as part of the proposed project.

6. To meet the estimated groundwater demands for the proposed and existing vineyards at the subject property (20.5 AF/yr), Well 1-2020 would need to pump at a rate of about 67 gpm during the estimated 20-week irrigation season each year. This pumping rate assumes the well would be pumped on a 50% operational basis (12 hours/day, 7 days/week) throughout the irrigation season (20 weeks) each year. During the non-irrigation portions of the year, pumping from Well 1-2020 will not be necessary, and groundwater demands for the onsite residences will continue to be met by the Domestic Well.
7. Based on the results of the constant rate pumping test conducted in Well 1-2020 in August 2020 (Well 1-2020 was pumped at reported average rate of 75 gpm for a period of 8 hours), the well appears to be capable of pumping at rates needed to meet the future groundwater demands needed for the existing and proposed onsite vineyards. Based on the results of the pumping test and the relatively deep pumping water levels observed by the pumper, it is feasible that, near the end of each irrigation season, makeup water from the backup Vineyard well may be necessary as pumping rates decrease caused by deep pumping water levels .
8. Groundwater recharge at the subject property on an average annual basis is estimated to be 197.1 AF; this value is based on conservative estimates of the long-term average annual rainfall at the property (38.2 inches per year) and conservative estimates of rainfall (14%) that could be available to deep percolate into the pore spaces and/or fractures and joints in the Sonoma Volcanics that underlie the subject property. Also included in our conservative estimates of recharge is the assumption that deep percolation of rainfall occurs on the subject property with slopes greater than 30 degrees (approximately 1.5 acres of the property) is diminished by a factor of 100%. This estimated groundwater recharge of 197.1 AF/yr is greater than the 21.8 AF/yr estimated to be required on an average annual basis in the future from the subject property.
9. Conservative estimates of recharge that may occur during a "prolonged drought" (as defined herein) show that, over a theoretical six-year period of continuous drought in which only 32% of the average annual rainfall might occur, a total of 379.8 AF of rainfall recharge is estimated to occur strictly within the boundaries of the subject property. This theoretical drought period recharge estimate of 379.8 AF is more than the estimated groundwater demand of the proposed project of 130.8 AF for the same continuous six-year period.
10. RCS recommends the immediate implementation of a groundwater monitoring program at the subject property. This would include the monitoring of static and pumping water levels in the onsite well(s), and the monitoring of instantaneous flow rates and cumulative pumped volumes from the onsite well(s) via the installation and use of dual-reading flow meters (that records both flow rate and totalizing values, respectively) on each well. Currently, the "Vineyard Well" and Well 1-2020 were observed to be equipped with a flow meter, installed at each well head, therefore, the

"Domestic Well" would benefit from the installation of a totalizer flow meter. RCS also recommends that water level transducers be purchased and installed in your well(s) to permit the automatic, frequent, and accurate recording of water levels in those well(s). By continuing to observe the trends in groundwater levels and future well production rates/volumes over time by qualified professionals, potential declines in water levels and well production in the onsite well(s), along with possible changes in operational pumping scenarios, can be addressed in a timely manner.

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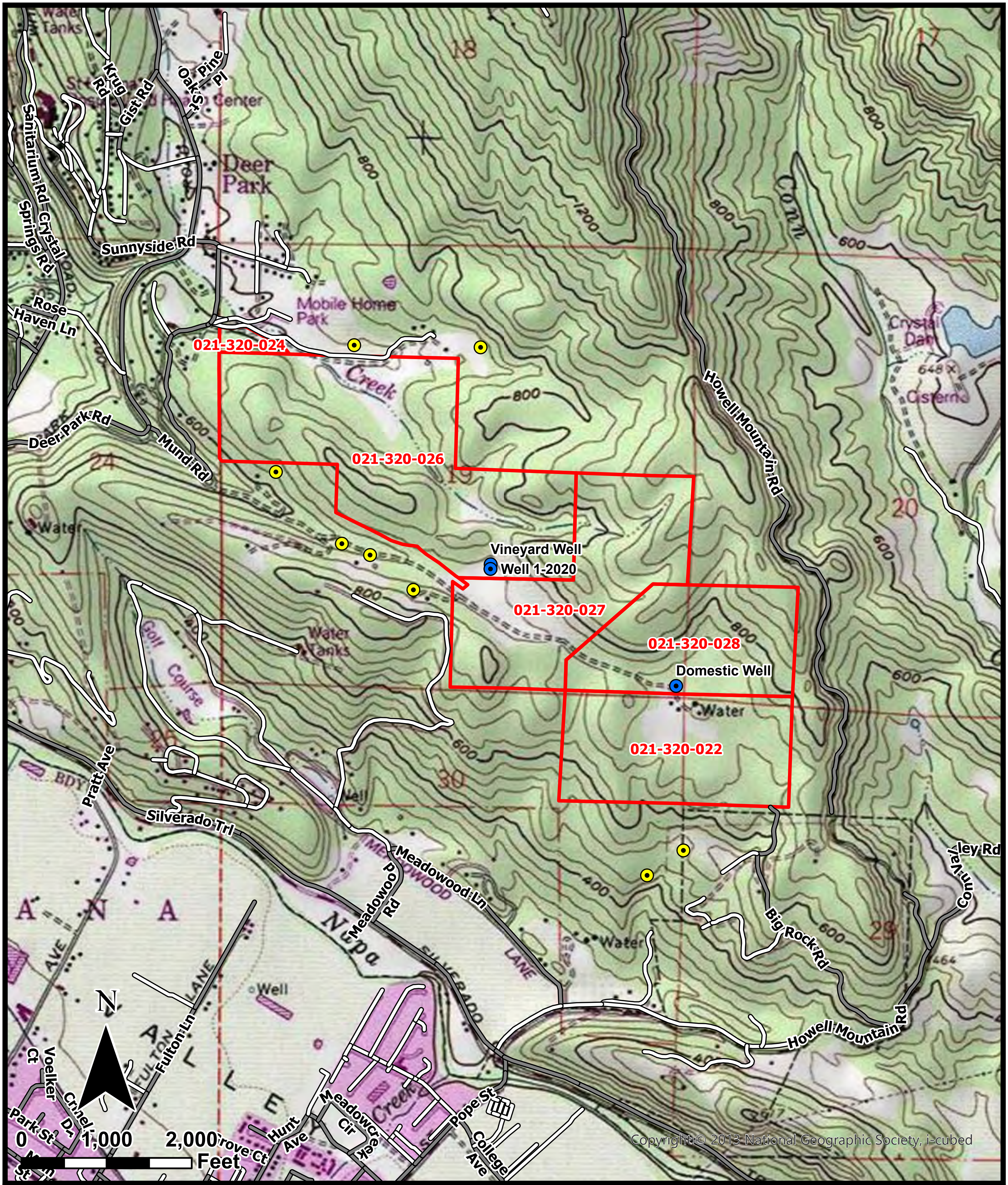

LEGEND

- Subject Property Parcel Boundaries
- Onsite Well Location
- Offsite Well Location (approximate)

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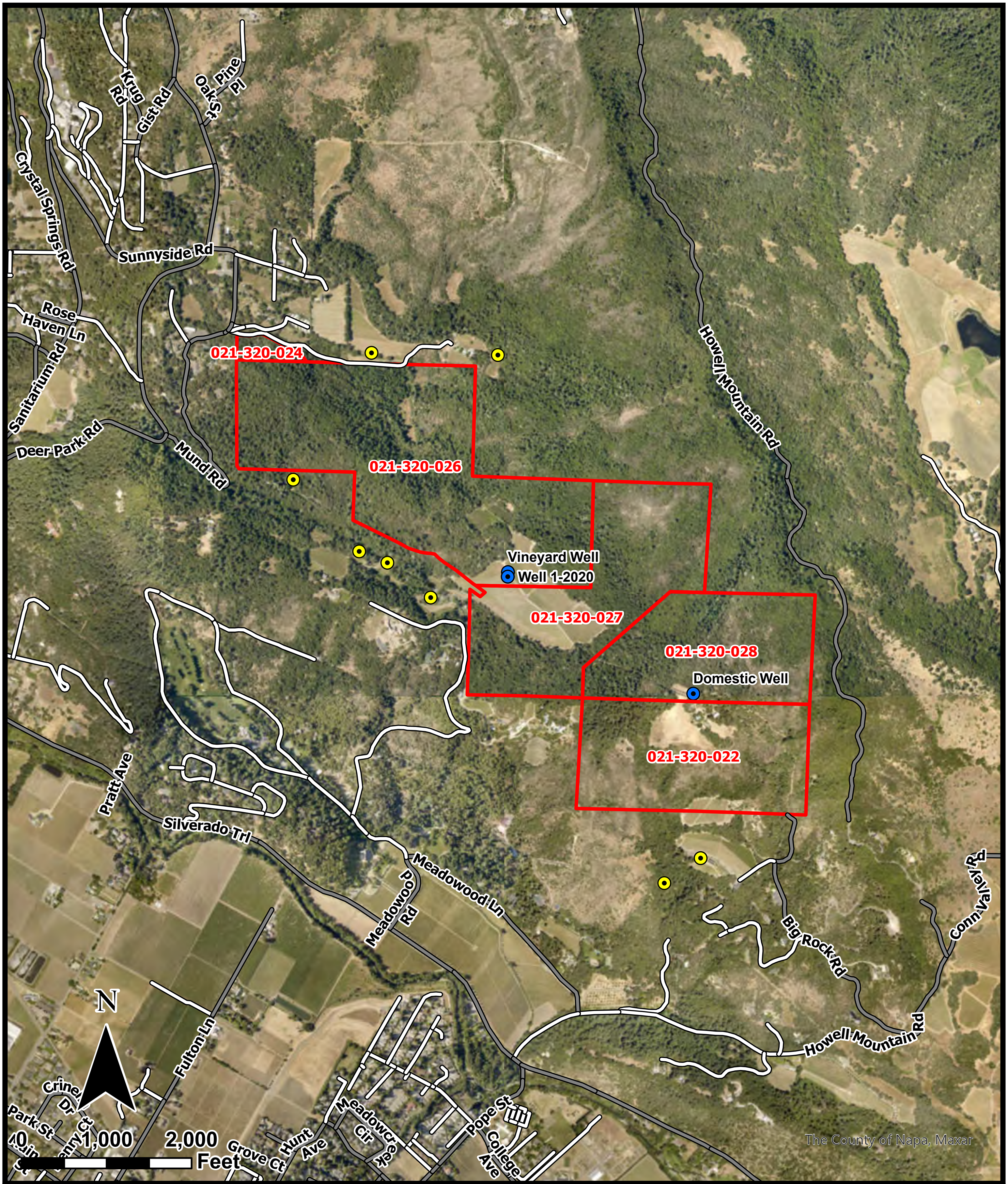
FIGURE 1
LOCATION MAP
REAL THOREVILOS/MUND ROAD VINEYARDS

Job No. 677-NPA02

June 2021



LEGEND

- Subject Property Parcel Boundaries
- Location of Onsite Well
- Offsite Well Location (approximate)

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FIGURE 2
AERIAL PHOTOGRAPH MAP
REAL THOREVILOS/MUND ROAD VINEYARDS

Job No. 677-NPA02

June 2021

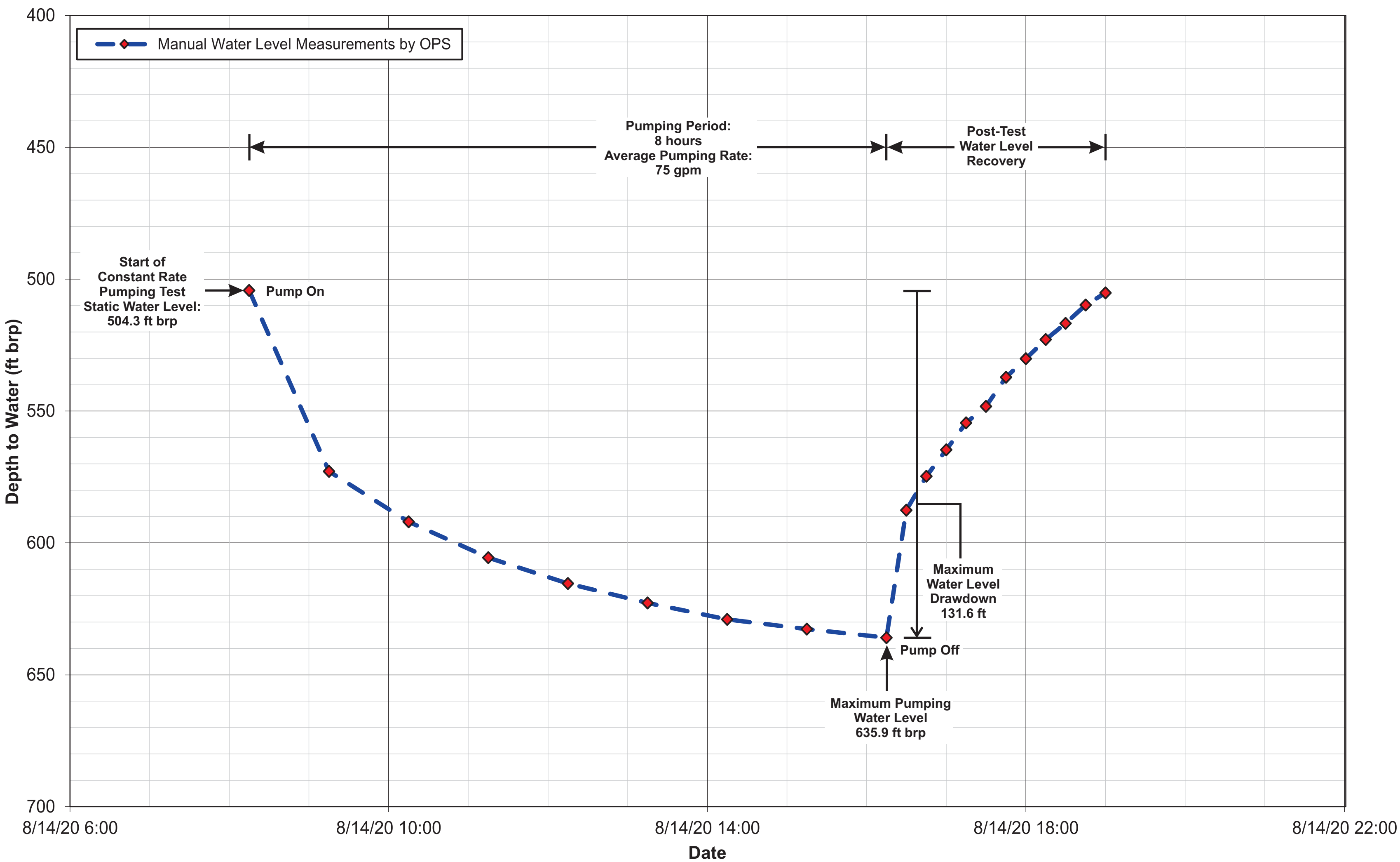

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FIGURE 3
WATER LEVEL DATA DURING CONSTANT RATE PUMPING TEST
WELL 1-2020
REAL THOREVILOS/MUND ROAD VINEYARDS

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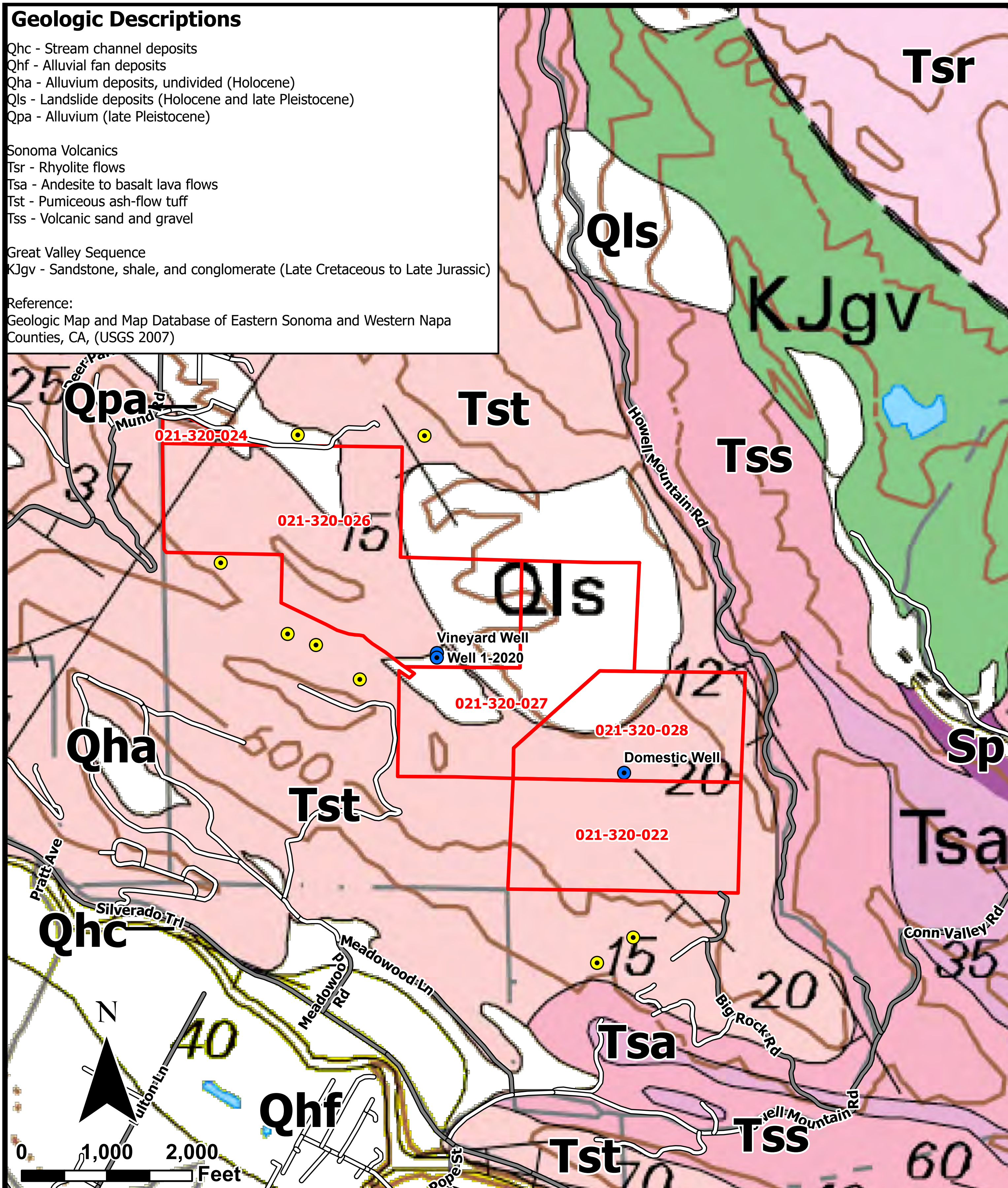
Geologic Descriptions

Qhc - Stream channel deposits
Qhf - Alluvial fan deposits
Qha - Alluvium deposits, undivided (Holocene)
Qls - Landslide deposits (Holocene and late Pleistocene)
Qpa - Alluvium (late Pleistocene)

Sonoma Volcanics
Tsr - Rhyolite flows
Tsa - Andesite to basalt lava flows
Tst - Pumiceous ash-flow tuff
Tss - Volcanic sand and gravel

Great Valley Sequence
KJgv - Sandstone, shale, and conglomerate (Late Cretaceous to Late Jurassic)

Reference:
Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, CA, (USGS 2007)



LEGEND

Subject Property Parcel Boundaries
Onsite Well Location
Offsite Well Location (approximate)

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FIGURE 4
GEOLOGIC MAP
REAL THOREVILOS/MUND ROAD VINEYARDS

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LEGEND

- ★ Subject Property
- Napa County Watershed Boundary

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FIGURE 5
WATERSHEDS MAP
REAL THOREVILOS/MUND ROAD
VINEYARDS

Job No. 677-NPA02

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Table 1
Summary of Well Construction and Testing Data
Real Thorevilos/Mund Road Vineyards

WELL CONSTRUCTION DETAILS

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
ND	39614	November 1977	Mud Rotary	260	260	PVC	6	10	0-20 (cement)	100-120; 160-180; 220-240	Machine-cut 1/16"	20-260; Pea Gravel	Active
ND	39616	November 1977	Mud Rotary	300	300	PVC	6	10	0-20 (cement)	160-180; 200-220; 260-280	Machine-cut 1/16"	20-300; Pea Gravel	Active
1-2020	WCR2020-005208	March 2020	Mud Rotary	700	699	PVC	8	15	0-55 (cement)	279-379; 399-499; 519-559; 659-689	Milled Slots 0.032	55-699; #6 Sand	Active

POST-CONSTRUCITON YIELD DATA

Reported Well Designation	DWR Well Log No.	Date & Type of Yield Data	Duration of "Test" (hrs)	Estimated Flow Rate (gpm)	Static Water Level (ft)	Pumping Water Level (ft)	Estimated Specific Capaity (gpm/ft ddn)
ND	39614	ND Bailer	ND	ND	110	ND	ND
ND	39616	ND Bailer	ND	ND	120	ND	ND
1-2020	WCR2020-005208	4/14/2020 Airlift	4	ND	267	ND	ND
		8/14/2020 Pump	8	75	504*	636	0.57

Notes: ND = No data available
ft bgs = feet below ground surface
in = inches
hrs = hours
gpm = gallons per minute
gpm/ft ddn = gallons per minute per foot of water level drawdown

It is not possible to determine which well is which from the two well logs dated November 1977; one is for the Domestic Well, and the other is for the Vineyard Well, but they were not delineated on the logs.

* - According to Oakville Pump Services, Inc, Well 1-2020 was pumping prior to the constant rate pumping test, and therefore, static water levels in the well did not have sufficient time to recover prior to the pumping test.

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Table 2
Groundwater Use Estimates
Real Thorevilos/Mund Road Vineyards

Groundwater Use	Estimated Groundwater Use (acre-feet/year)	
	Existing (before 2020 Glass Fire)	Future
Residential Groundwater Use		
Existing Primary Residence[1]	0.75	0.75
Secondary Residence (Guest House)[1]	0.50	0.50
Total Residential Groundwater Use	**1.25**	**1.25**
Irrigation Groundwater Use		
Vineyard - Existing 21.9 acres	11.0	11.0
Vineyard - Proposed 19 acres	---	9.5
Total Irrigation Groundwater Use	**11.0**	**20.5**
Total Combined Groundwater Use (Residential + Irrigation)	**12.3**	**21.8**

Notes:
[1]This residential water demand estimate is based on values presented for specified land uses provided in Appendix B of the County's WAA Guidance Document (WAA 2015).
1 acre-foot = 325,851 gallons

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Table 3
Comparison of Rainfall Data Sources
Real Thorevilos/Mund Road Vineyards

Rain Gage and/or Data Source	Years of Available Rainfall Record	Average Annual Rainfall in Inches (ft)	Elevation of Rain Gage (ft amsl)	Distance of Rain Gage from Subject Property	Rain Gage Elevation Relative to Subject Property[(1)]
WRCC St Helena	1907 through May 2021[(2)]	32.2 (2.68)	225	1.5	Lower
WRCC Angwin PUC	1940 through May 2021[(3)]	38.4 (3.20)	1,715	3.5	Higher
PRISM	1981 to 2010	38.2 (3.18)	---	---	---
Napa County Isohyetal Map	1900 to 1960	35 (2.92)	---	---	---

Notes:

ft = feet

amsl = above mean sea level

1. The subject property is located at elevations between ±560 and ±960 ft asl
2. Missing rainfall data in: 1907; 1915 to 1922; 1979 to 1980; 1985 to 1988; 1992; and 2011 to 2012.
3. Missing rainfall data in: 1940-1943; 1946 to 1947; 1975; 1987; and 2011.

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Table 4
Estimated Recharge Based on Deep Percolation Assumptions for Slope Angle
Real Thorevilos/Mund Road Vineyards

Region	Area	Average Rainfall [1]	Rainfall Volume	Reduced Recharge Assumption based on Slope Angle									
				Deep Percolation/Not Slope Dependent		Deep Percolation on >30° Slope Diminished by 25%		Deep Percolation on >30° Slope Diminished by 50%		Deep Percolation on >30° Slope Diminished by 75%		Deep Percolation on >30° Slope Diminished by 100%	
				Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume
	(acres)	(in)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)
Entire Napa River Watershed at St. Helena													
<30° Slope	44,692	41.7	155,305	14.00%	21,742.66	14.49%	22,507.80	14.99%	23,272.94	15.48%	24,038.09	15.97%	24,803.23
>30° Slope	6,291	41.7	21,861	14.00%	3,060.57	10.50%	2,295.43	7.00%	1,530.29	3.50%	765.14	0.00%	-
TOTAL =	50,983			TOTAL =	24,803.23	TOTAL =	24,803.23	TOTAL =	24,803.23	TOTAL =	24,803.23	TOTAL =	24,803.23
Mund Road Vineyards Property													
<30° Slope	388.1	38.2	1,234	14.00%	172.78	14.49%	178.86	14.99%	184.94	15.48%	191.02	15.97%	197.10
>30° Slope	1.5	38.2	5	14.00%	0.67	10.50%	0.50	7.00%	0.33	3.50%	0.17	0.00%	-
TOTAL =	389.6			TOTAL =	173.4	TOTAL =	179.4	TOTAL =	185.3	TOTAL =	191.2	TOTAL =	197.1

Note: The "Napa River Watershed at St. Helena" values are used to calculate the change in deep percolation percentage of <30° slopes based on the deep percolation volume of 155,305 AF calculated using the assumptions shown. Deep percolation percentage values determined for the entire watershed are then used for site specific calculations.

[1] Average Rainfall for "Napa River Watershed at St. Helena" and "Mund Road Vineyards Property" per PRISM Dataset (1980-2010)

Table 5
Drought Period Rainfall as Percentage of Average
Real Thorevilos/Mund Road Vineyards

Statewide Drought Period as Defined by DWR/NDMC	Drought Duration (years)	Average Rainfall by Raingage					
		St. Helena WRCC Period of Record - 1907 through May 2021			Angwin Pacific Union College WRCC Period of Record - 1940 through May 2021		
		[A] Total Gage Average (in)	[B] Drought Period Average (in)	[B/A] Drought Period Rainfall as % of Average	[E] Total Gage Average (in)	[F] Drought Period Average (in)	[F/E] Drought Period Rainfall as % of Average
WY 1928-29 to WY 1933-34	6	32.2	23.9	74%	ND	ND	ND
WY 1975-76 to WY 1976-77	2	32.2	13.4	42%	38.4	12.3	32%
WY 1986-87 to WY 1991-92	6	32.2	18.3	57%	38.4	23.7	62%
WY 2006-07 to WY 2008-09	3	32.2	24.8	77%	38.4	27.6	72%
WY 2011-12 to WY 2015-16	5	32.2	21.7	67%	38.4	33.2	86%
WY 2019-2020	1	32.2	5.6	17%	38.4	22.6	59%

Notes:

ND = No rainfall data and/or missing rainfall data for corresponding drought period.

DRAFT

APPENDIX
CALIFORNIA
DEPARTMENT OF WATER RESOURCES
WELL COMPLETION REPORT (DRILLER'S LOG)
&
OAKVILLE PUMP SERVICE, INC.
PUMPING TEST RECORD
FOR
REAL THOREVILOS/MUND ROAD VINEYARD WELLS

Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 39614

Notice of Intent No. ______

Local Permit No. or Date ______

State Well No. ______

Other Well No. ______

(1) OWNER:
Name ______
Address 320 MUND RD.
City ST. HELENA, CA Zip ______

(2) LOCATION OF WELL (See instructions):
County NAPA Owner's Well Number ______
Well address if different from above ST. HELENA
Township ______ Range ______ Section ______
Distance from cities, roads, railroads, fences, etc.
3 MILES EAST OF ST. HELENA

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 PEA
Diameter of bore 10"
Packed from 20 to 260 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
				240	220	6 x 1/16
				180	160	
				120	100	

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

(10) WATER LEVELS:
Depth of first water, if known ______ ft.
Standing level after well completion 110 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 110 ft. At end of test ______ ft
Discharge ______ gal/min after ______ 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 260 ft. Depth of completed well 260 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	10	TOP SOIL
10	51	FRACTURED ROCK
51	120	RED CLAY
120	180	HARD ROCK
180	260	FRACTURED ROCK

CONFIDENTIAL - NOT FOR PUBLIC USE - WATER CODE SEC. 13752

Work started 11-20 19 77 Completed 11-24 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 ______ (Well Driller)

NAME WILLIAMS WELL DRILLING (Person, firm, or corporation) (Typed or printed)
Address P. O. BOX 571
City SUISUN, CA. Zip 94585
License No. 333201 Date of this report 1-30-78

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

Received 2/10/78

QUADRUPLICATE
Use to comply with local requirements

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

Do not fill in
No. 39616

Notice of Intent No. ______
Local Permit No. or Date 4844

State Well No. ______
Other Well No. ______

(1) OWNER: Name NOBLE
Address 320 MUND RD.
City ST. HELENA, Zip ______

(2) LOCATION OF WELL (See instructions):
County NAPA Owner's Well Number ______
Well address if different from above ______
Township ST. HELENA Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. 3 MILES EAST OF ST. HELENA

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 ☐ Reverse ☐
Cable ☐ X Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☐ X No ☐ Size PEA
Diameter of bore 10"
Packed from 20 to 300 ft.

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

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

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
				280	260	6 x 1/16
				220	200	
				180	160	

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

(10) WATER LEVELS:
Depth of first water, if known ______ ft.
Standing level after well completion 120 ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No ☐ If yes, by whom? DRILLER
Type of test Pump ☐ X Bailer ☐ X
Depth to water at start of test 120 ft. At end of test 120 ft
Discharge ______ gal/min after ______ hours Water temperature ______
Chemical analysis made? Yes ☐ No ☐ If yes, by whom? ______
Was electric log made? Yes ☐ No ☐ X If yes, attach copy to this report

(12) WELL LOG: Total depth 300 ft. Depth of completed well 300 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	30	TOP SOIL
30	70	FRACTURED ROCK
70	160	RED CLAY
160	220	HARD ROCK
220	300	FRACTURED ROCK

Work started 11-25 1977 Completed 11-28 1977

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 ______
(Well Driller)

NAME WILLIAMS WELL DRILLING
(Person, firm, or corporation) (Typed or printed)
Address P. O. BOX 571
City SUISUN, CA Zip 94585
License No. 322301 Date of this report 1-30-78

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 43816-950 7-76 50M QUAD OSP

Received 2/10/78

State of California
Well Completion Report
Form DWR 188 Submitted 4/22/2020
WCR2020-005208

Owner's Well Number: 1-2020 | Date Work Began: 03/13/2020 | Date Work Ended: 04/14/2020

Local Permit Agency: Napa County Planning Building and Environmental Services

Secondary Permit Agency: | Permit Number: E20-00049 | Permit Date: 02/25/2020

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

Name: REAL THOREVILOS, LLC,

Mailing Address: 2054 Fort John Court

City: Gold River | State: Ca | Zip: 95670

Planned Use and Activity

Activity: New Well

Planned Use: Water Supply Irrigation - Landscape

Well Location

Address: 320 Mund RD

City: St. Helena | Zip: 94574 | County: Napa

Latitude: 33 Deg. 31 Min. 40 Sec. N | Longitude: -122 Deg. 27 Min. 24 Sec. W

Dec. Lat.: 33.5277778 | Dec. Long.: -122.4566667

Vertical Datum: | Horizontal Datum: WGS84

Location Accuracy: | Location Determination Method:

APN: 021-320-026

Township:

Range:

Section:

Baseline Meridian:

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

Borehole Information

Orientation: Vertical | Specify:

Drilling Method: Direct Rotary | Drilling Fluid: Bentonite

Total Depth of Boring: 700 Feet

Total Depth of Completed Well: 699 Feet

Water Level and Yield of Completed Well

Depth to first water: 290 (Feet below surface)

Depth to Static Water Level: 267 (Feet) | Date Measured: 04/14/2020

Estimated Yield*: 120 (GPM) | Test Type: Air Lift

Test Length: 4 (Hours) | Total Drawdown: (feet)

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

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	10	tan volcanic tuff
10	25	reddish, brown tuff
25	85	tan sandy ash
85	90	fractured gray volcanics
90	95	yellow sandy ash
95	130	hard, tan volcanics
130	150	dark yellow ash
150	180	fractured gray, brown volcanics
180	210	fractured brown volcanics
210	275	tan sandy ash
275	280	dark gray sandy ash
280	375	fractured mix volcanics
375	400	dark gray sandy ash
400	410	mixed volcanic sands
410	445	tan sandy ash with embedded rock

445	455	course volcanic sands
455	515	blue, gray sandy ash with embedded rock
515	535	tan volcanic tuff
535	550	fractured brown, gray rock
550	558	yellow sandy ash
558	585	blue, gray clay with embedded rock
585	665	blue sticky clay
665	685	medium sandy & gravel
685	700	gray sticky clay

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	279	Blank	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625			
1	279	379	Screen	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625	Milled Slots	0.032	
1	379	399	Blank	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625			
1	399	499	Screen	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625	Milled Slots	0.032	
1	499	519	Blank	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625			
1	519	559	Screen	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625	Milled Slots	0.032	
1	559	659	Blank	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625			
1	659	689	Screen	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625	Milled Slots	0.032	
1	689	699	Blank	PVC	OD: 8.625 in. | SDR: 21 | Thickness: 0.410 in.	0.41	8.625			

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	55	Cement	10.3 Sack Mix		
55	699	Other Fill	See description.		#6 sand

Other Observations:

OAKVILLE PUMP SERVICE, INC.

#1 Walnut Drive / P.O. Box 435
Oakville, CA 94562
Phone (707) 944-2471 Fax (707) 944-5636
License # 744958 / oakvillepump.com

Report Date: 8/14/2020	Report By: Rob Lutz	Tested By: Rob Lutz	Job#: 20H-7848

Property Information

Property Location:	Real Thorevilos - Vyd at South End of Mund Road	St. Helena	CA	94574	AP#: 021-320-026
Buyers Name:		Phone:	email		
Buyers Agent or Rep:		Phone:	email		
Property Owner Name:	Bettinelli Vyds	Phone:	email:		
Listing Agent or Owner Rep:	Paul Goldberg	Phone: 707-815-5249	email: paul@bettinellivineyards.com		

Well & Pump System Information:

Well ID & Location on Property	***Well Depth:***	***Pump Setting:***	***Casing Type & Size:***	***Sanitary Well Seal:***
8" PVC Cased Well next to Power Pole/Meter Panel	699'ft	672'ft	8" PVC Casing	Yes
Submersible Pump / HP / GPM:	***Motor HP,Voltage,Phase:***	***Pipe Size & Type:***	***Check Valve Type:***	***Annular Seal / Pad:***
Franklin FPS 70SR20 70gpm/20hp Pump End	Franklin 20hp/460vac/3ph	2-1/2" Galv Drop Pipe (3" on surface)	Flomatic 80DI-VFD	unknown - suspect 50'ft
Submersible Pump Control Panel:	***Low Water Protection:***	***Flow Control Valve:***	***Press Tank(s) & Qty:***	***Press. Relief Valve:***
Phase Tech 2XD220 240-1ph X 480-3ph VFD Panel	VFD Drive	No	none	Yes - 1-1/2" Brass
Submersible Pump Filtration:	**Sub Pump Misc Equipment Notes:**			
Automatic Screen Filter	Well Fills (2) 10k storage tanks above the vineyard. Requires 110-115psi to get 50-gpm to the tanks via 2" PVC Pipe			

Booster Pump Information:	***Pump Controls:***	***Flow Control Valve:***	***Check Valve Type:***	***Press. Relief Valve:***
None				
Filtration Equipment:	***Storage Tank Size/Type:***	***Booster Pump/Filtration/Tank Equipment Notes:***		
PVC Spears Filter at the tank	(2) 10k concrete tanks on hill	not applicable		

Water Analysis Testing:

Sample Type:	***Date Sampled:***	***Completion Date:***	***Lab Vender:***	***Notes:***
None at this time				

Well Yield Test (Log on second page)

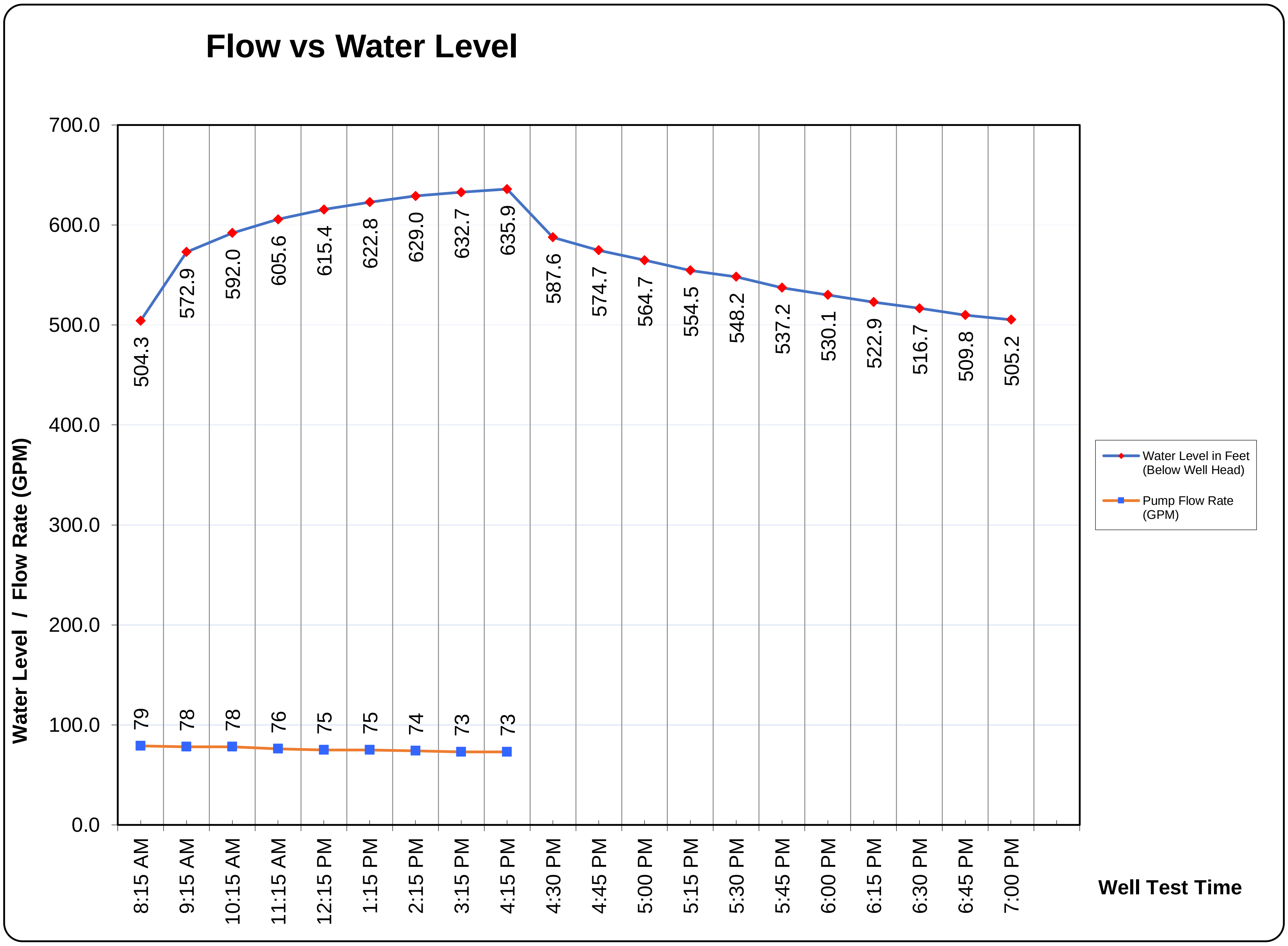
Date of Test:	***Well Type:***	***Static Water Lvl:***	***Pumping Water Lvl:***	***Specific Capacity:***	***Well/Pump Yield:***
8/14/2020	Ag	504.3	635.9	5.6 (gpm/ft drawdown)	**73 gpm after 8-hrs**
Start Time:	***Test Duration:***	***Water Level Recovery:***		***Recovery Time:***	***Total Gallons Pumped:***
8:15 AM	8-hours plus recovery	23.8'ft	feet below well head	2.75-hours	36069

*The well yield test is based upon duration and conditions existing at time of testing. The well production may and will change based upon time of year. The well output may be limited to the size of the pump and the well yield test may not properly represent the true capacity of the well.

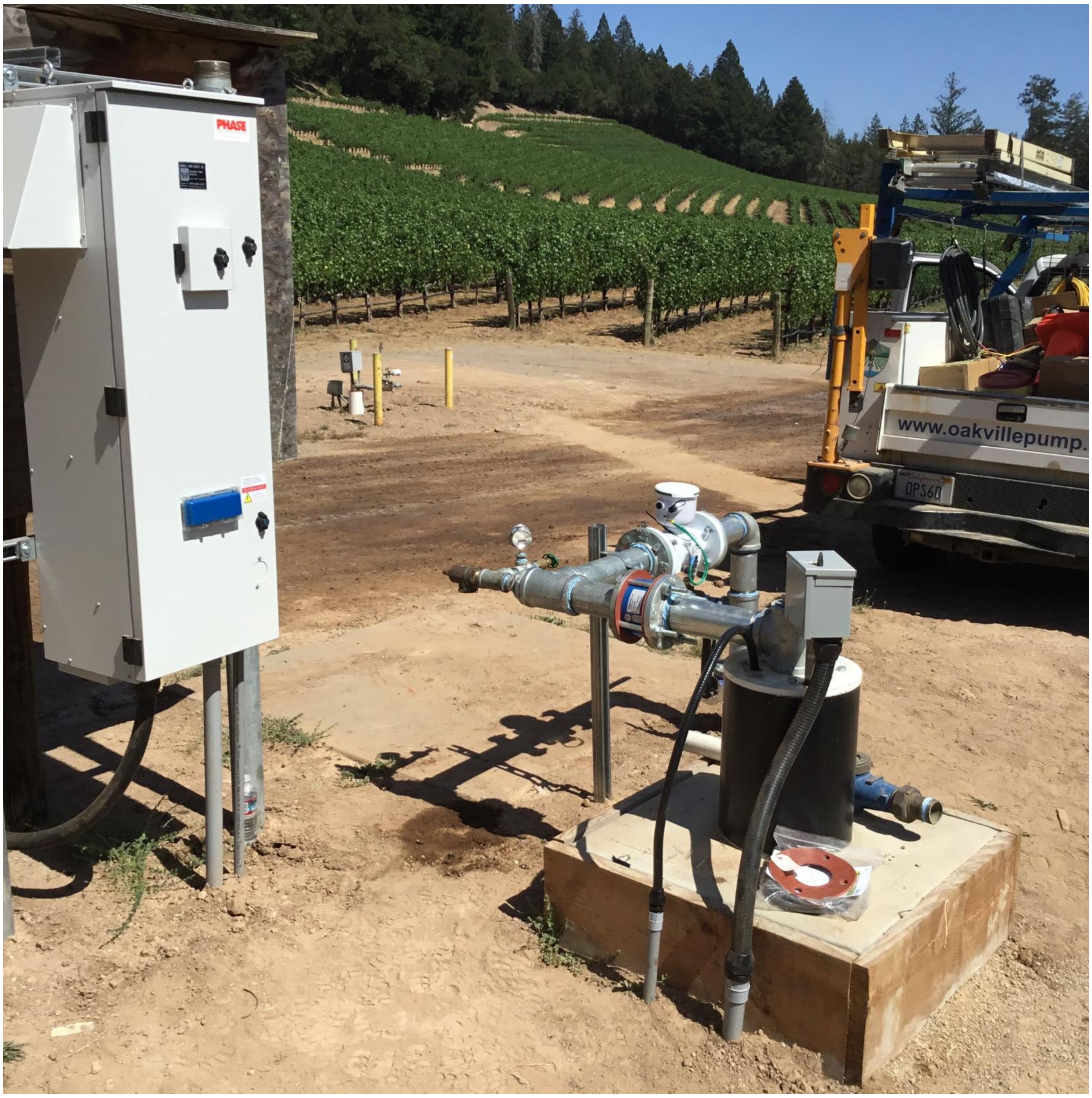
Hour	Time	Water Level in Feet (Below Well Head)	Drawdown in Feet (Differential between start/stop)	Recovery Percentage (Need to meet 95% or better)	Pump Flow Rate (GPM)	Water Meter Reading	
0	8:15 AM	504.3		-	79	1179516	
1	9:15 AM	572.9	68.6	-	78	1184141	
2	10:15 AM	592.0	87.7	-	78	1188733	
3	11:15 AM	605.6	101.3	-	76	1193405	
4	12:15 PM	615.4	111.1	-	75	1197932	
5	1:15 PM	622.8	118.5	-	75	1202371	
6	2:15 PM	629.0	124.7	-	74	1206916	
7	3:15 PM	632.7	128.4	-	73	1211322	
8	4:15 PM	635.9	131.6	0.00%	73	1215585	
8.25	4:30 PM	587.6	83.3	36.70%	-	-	
8.5	4:45 PM	574.7	70.4	46.50%	-	-	
8.75	5:00 PM	564.7	60.4	54.10%	-	-	
9	5:15 PM	554.5	50.2	61.85%	-	-	
9.25	5:30 PM	548.2	43.9	66.64%	-	-	
9.5	5:45 PM	537.2	32.9	75.00%	-	-	
9.75	6:00 PM	530.1	25.8	80.40%	-	-	
10	6:15 PM	522.9	18.6	85.87%	-	-	
10.25	6:30 PM	516.7	12.4	90.58%	-	-	
10.5	6:45 PM	509.8	5.5	95.82%	-	-	
10.75	7:00 PM	505.2	0.9	99.32%	-	-	
					-	-	

Summary:

1. Static Water level at beginning of test:		504.3	feet
2. Max Drawdown Below well head at end of Pumping test:		635.9	feet
3. Water Level at end of recovery time at end of recovery:		505.2	feet
4. Recovery to:	0.9 feet of original water level afte	2.75	Hours
5. Draw-down differential:		131.6	feet
6. Recovery Percentage:		99.32%	percentage
7. Well capacity (gpm) at end of pump test:		73	gpm
8. Well Yield GPM/ft of drawdown:		5.6	gpm/ft



Pictures:



Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	700	15

Certification Statement

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

Name HUCKFELDT WELL DRILLING INC
Person, Firm or Corporation

994 KAISER ROAD	NAPA	CA	94558
Address	City	State	Zip

Signed *electronic signature received* 04/22/2020 439746
C-57 Licensed Water Well Contractor — Date Signed — C-57 License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

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

TRS:

APN: