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Wastewater Feasibility Report

Matthiasson Family Winery P17-00394-UP and P19-00190-VIEW
Planning Commission Hearing May 15, 2019

madrone
engineering

WASTEWATER FEASIBILITY REPORT

FOR THE

MATTHIASSON FAMILY VINEYARD
USE PERMIT

PROJECT LOCATED AT

3175 DRY CREEK RD
NAPA, CA 94558

COUNTY: NAPA
APN: 035-460-022

NOVEMBER 10, 2017
REVISION 1: MAY 2, 2018

PREPARED FOR REVIEW BY:

NAPA COUNTY DEPARTMENT OF ENVIRONMENTAL HEALTH
1195 THIRD STREET
NAPA, CA 94559

1485 MAIN STREET, SUITE 302 - ST. HELENA, CALIFORNIA 94574
707-302-6280 TELE

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I. INTRODUCTION

Matthiasson Family Vineyard is requesting a Use Permit Major Modification to increase production and visitation for an existing winery on a 5.78 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, new fire and domestic water storage tanks 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.

This report has been prepared to evaluate the feasibility of handling the proposed increase of process and domestic wastewater on the parcel and in a manner following the requirements of the County Environmental Health Division.

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).

The existing use permit allows up to 2 visitors per day, and the proposed marketing plan allows for up to seventeen (17) visitors per day (max) and 15 visitors per day (average) in addition to winery special events. To limit the size of the proposed domestic wastewater system, special events will use portable toilets and outside catering. The following special events are proposed in the marketing plan:

- *Wine Club/Release Events – 4/Year with up to 30 guests each*
- *Special Auction-related Event – 1/Year with 50 guests each*

This report presents a preliminary plan for treating and dispersing the wastewater generated from the additional wine production and visitation.

All plumbing fixtures in the approved winery shall be low flow, water-saving fixtures per the Uniform Plumbing Code as adopted by the Napa County Building Department.

II. WINERY DOMESTIC WASTEWATER FLOW

A. Wastewater Generation

The domestic wastewater (DW) generated at Matthiasson Family Vineyard is dependent on the daily number of employees and visitors present at the winery. The marketing plan, as presented in the Introduction of this report determines the maximum number of guests the winery is permitted to serve in one day, as well as the maximum number of permanent employees that the winery needs to functionally operate. In terms of wastewater generation, this gives the maximum number of people that will be contributing to the daily peak wastewater flow rate.

B. Estimating Wastewater Quantity

To calculate the daily peak DW flow rates generated at Matthiasson Family Vineyard, the maximum number of people present at the site, as well as the amount of wastewater each person will generate, must be estimated. The marketing plan proposes a total of 4 employees and 17 daily visitors (maximum). Napa County estimates the wastewater generated by visitors is 3 gallons per day per person, and 15 gallons per day per employee[1].

The peak effluent generated in a day will occur when the winery requires all part-time and full-time (seven (7)) employees on staff and receives seventeen (17) visitors in a single day. *Based on this combination, the peak daily domestic wastewater flow is 156 gallons per day* (see **Table 1**, below). For design purposes, this shall be taken as the maximum daily flow considered for storage and treatment requirements.

Source	Number	Projected Flow (gpd)	Total Flow No Event Day (gpd)	Total Flow Event Day (gpd)
Full-time employees	4	15	60	60
Part-Time employees (<60 days/year)	3	15	45	45
Visitors (15 weekday, 17 weekend)	17	3	51	51
Private Event*	30	0	0	0
Private Residence (bedrooms)**	3	120	360	360
Grand Total		**Total Peak Flow**	**156**	**156**

*Events shall use portable toilets

*Private Residence flows are included for reserve area sizing only

Table 1: Total Domestic Wastewater Flows

C. Estimating Wastewater Quality

The quality of domestic wastewater generated at a winery is similar to wastewater generated from a residence. The main effluent quality parameters that must be estimated from a winery's wastewater are the 5-day Biochemical Oxygen Demand (BOD5) and the Total Suspended Solids (TSS). The BOD5 concentration is a measurement used to estimate the amount organic matter present in wastewater. The TSS concentration is a measure of solid particles that have not yet settled out of the wastewater. Several additional wastewater constituents must also be estimated, as they have a direct correlation with the treatment processes used to reduce BOD5 and TSS concentrations. Fats, oils, and grease (FOG) will likely be discharged to the sewer system, and can damage the biological processes that take place in wastewater treatment. The total dissolved solids (TDS) present in wastewater can be an indicator for cleaning agents, which can affect the pH balance and destroy the bacteria that reduce organic matter in wastewater. The pH value affects bacteria that consume organic matter in the wastewater. The dissolved oxygen (DO) level can tell wastewater treatment operators that the bacteria need more or less

[1] Napa County Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems, Appendix 1, Table 4, 2006.

oxygen in order to consume and reduce organic matter present in the wastewater. In addition to oxygen, bacteria need nitrogen to fuel their consumption of organic matter. The total nitrogen concentration in wastewater will alert wastewater treatment operators to how much nitrogen they need to add to the wastewater in order for bacteria to most efficiently consume organic matter. If a high level of wastewater treatment is required, it is important to know the type and amount of harmful bacteria and pathogens that are present in the effluent so the most appropriate form of disinfection can be applied. In domestic wastewater, fecal coliform is extremely prevalent, and is detrimental to human health. **Table 2** provides a description of the expected strength of each wastewater constituent.

Constituent	Unit	Domestic
FOG	Mg/L	31-164
BOD5	Mg/L	110-400
TSS	Mg/L	100-350
TDS	Mg/L	280-850
Nitrogen (total as N)	Mg/L	20-85
Total Coliform	MPN/100 mL	10^7-10^8
Fecal Coliform	MPN/100 mL	10^4-10^5

Table 2: Typical Domestic Wastewater Values

III. WINERY PROCESS WASTEWATER FLOW

A. Production Methods

Winery wastewater outflow and strength varies throughout the winemaking year. A typical winemaking year begins with harvest preparation and harvest. These events occur during the months of August, September, and October. The harvest season typically generates both the largest volume and maximum strength of process wastewater. A breakdown of the different winemaking phases are detailed below.

Harvest and Crush – As previously mentioned, a winery will harvest and crush its fruit during the months of August, September, and October. Once the grapes have reached maturity, the fruit will be separated from the stems, and crushed to collect the juice for fermentation. Floor drains typically collect the juice, stems, seeds, and skins that are washed off of the equipment in the crush process. Grate covers on the drains can prevent larger solids from entering the wastewater system, but seeds and skins can often enter the primary wastewater tank.

Fermentation – Juice from crush is collected and stored in tanks for fermentation. Yeast will be added to the juice in order for sugar to be converted to alcohol. The fermentation process can take anywhere from one to three weeks to complete. Once the fermentation process is complete, the wine will be drained from the tank into barrels for aging. Wine drained from the fermentation tanks will carry excess skins and seeds into the barrel. The remaining solids, known as pomace, will remain at the bottom of the tank. If desired by the winemaker, the pomace can be pressed to produce more wine with different characteristics

for the blending process. The remaining solids will be disposed of at a solid waste facility. The empty fermentation tanks and pomace bins will be washed out with a combination of water and sodium hydroxide or potassium hydroxide. These additives can reduce the pH of the wastewater, and contribute to the total dissolved solids (TDS) concentration.

Clarification and Racking – Due to the excess grape skins and seeds carried over from the fermentation tanks, wine can have a high concentration of suspended solids directly after fermentation. These solids are called "lees" and are allowed to settle in the barrel during the aging process. To improve the clarity and quality of the wine, the liquid will be removed from the initial barrel, and placed in a new barrel that is free of settled solids. This process is called "racking" and will often occur several times through the wine aging process, which can last for several years. The first racking will most likely occur between the months of November and January. The lees that are washed out of barrels after the first racking are known as "gross lees." Gross lees represent the largest solid particles collected during the racking process. Responsible wineries will de-water the gross lees, and dispose of the solids off-site. However, lees are often washed out of barrels and allowed to drain to the process wastewater system due to their high water content. Wastewater generated from this process will typically have very high total suspended solids (TSS) content, and a very high biological oxygen demand (BOD). Additionally, tartaric acid can be added to the wine to adjust the acidity. Process wastewater generated by racking after pH treatment can negatively affect the natural biological treatment process in the primary wastewater tanks. As clarification and racking are part of the process used to "age" wine, it is possible for wastewater to be generated by this phase year round.

Filtering and Bottling – Wine that has reached the end of its aging process will be filtered and bottled. This process can occur throughout the year due to wine types aging at different rates and the winery's production schedule. The wine storage barrels will often be washed and reused. Equipment used for bottling will be washed on a daily basis. The wastewater strength at this stage of the wine making process is typically much lower than the previous three stages of winemaking.

B. Estimating Wastewater Quantity

As every individual winery incorporates differing winemaking methods and equipment, the actual annual wastewater produced varies for each winery. The amount of wine produced in one year is the most important part in estimating a specific winery's wastewater generation. Once a winery determines the volume of wine they will produce, various factors can be applied to estimate the wastewater that will be generated from production. Furthermore, it is very important to estimate the peak volume of wastewater that can be generated in one day. Undersized storage tanks and pumps can lead to the costly failure of wastewater treatment systems, and halt the production process. Two methods are currently used by the local wastewater engineering consultants to determine both the annual and daily peak process wastewater flows generated from a winery. The Napa County Method is used to estimate the peak wastewater flow that could occur in one day during harvest. The Industry Method estimates the annual wastewater generation, then distributes a percentage of that flow to each month based on the seasonal behaviors of winemaking. The daily peak flow is then estimated by dividing the volume of wastewater generated during the peak month by the number of days

in the month. The Industry Method generally produces a more realistic estimate of wastewater flows. This report will analyze and compare both methods to determine the volume of process wastewater produced, and will size the system based on the more conservative (higher) flow estimate.

Napa County Method

The Napa County Method focuses on determining the maximum daily flow a wastewater system would be required to treat. This method uses two base assumptions: the amount of process wastewater generated annually is only distributed during harvest period, and a multiplication factor of 1.5 is used for process waste generation. The harvest period, shown in **Table 3** below, is divided into days that grapes are crushed based on annual production in order to obtain a flow rate in gallons per day (GPD).

Table 3: Napa Method: Crush Days

Annual Wine Production (gallons)	# of Crush Days
<20,000	30
20,000-50,000	45
>50,000	60

Based on the projected wine production (18,000 gallons), the multiplication factor (1.5), and the number of crush days (30) that wastewater generation is distributed over, the Napa Method estimates a process wastewater (PW) peak harvest flow of **900 gallons per day** (see Appendix 1).

Industry Method

The Industry Method uses a ratio of 4-12 gallons of PW generated per gallon of finished wine produced to determine the annual PW volume produced. The ratio depends on the water conservation techniques utilized within each individual winery. In rare cases, if the winery is water conscious, the ratio can be as low as 4. For a typical winery, the ratio is higher. For Matthiasson Family Vineyard, a value of 8 gallons of PW per gallon of wine is analyzed. The next step in estimating wastewater quantity is to determine the peak daily flow. The annual estimated PW is broken down into monthly percentage flows. This method attempts to consider the winery operations, which vary by month depending on the winemaking season. For example, with this method, the percentages increase for the harvest months and the percentages decrease for the non-harvest months.

Based on the proposed annual wine production of 18,000 gallons of wine and 8 gallons of PW generated per gallon of wine, the Industry Method estimates 144,000 gallons of PW produced annually. **Table 4** shows the percentage breakdown for monthly and daily flows. This table is located in the 'Wastewater Flow Generation' page of the Water Balance Spreadsheet, found in **Appendix 1**.

PW Generation Table			
Month	% of Annual	Monthly Flow	Average Daily Flow
January	4.0%	5,760	186
February	6.0%	8,640	309
March	6.0%	8,640	279
April	4.5%	6,480	216
May	6.0%	8,640	279
June	7.0%	10,080	336
July	8.5%	12,240	395
August	10.0%	14,400	465
September	16.0%	23,040	**768**
October	14.0%	20,160	650
November	10.5%	15,120	504
December	7.5%	10,800	348
Total	**100.0%**	**144,000**	**395**

Table 4: Monthly Process Wastewater Flows

Based on Table 4 above, the peak daily process waste flow using the industry method is estimated to be **768 gallons per day**. However, the more conservative County Method result of **900 gallons per day** will be used as the basis of septic system design in this report.

C. Estimating Wastewater Quality

The effluent strength parameters for all wineries vary throughout the year as different processes take place in each stage of the winemaking process. Furthermore, the strength of effluent at each individual winery can vary due to differences in the winemaker's technique and philosophy. The main effluent quality parameters that must be estimated from a winery's wastewater are the 5-day Biochemical Oxygen Demand (BOD5) and the Total Suspended Solids (TSS), as the concentrations of these constituents are regulated by both the Bay Area Water Quality Control Board and Napa County. The BOD5 concentration is a measurement used to estimate the amount organic matter present in wastewater. The typical BOD5 concentration of raw winery wastewater is 5,000 mg/L. The TSS concentration is a measure of solid particles that have not yet settled out of the wastewater.

Several additional wastewater constituents must also be estimated, as they have a direct correlation with the treatment processes used to reduce BOD5 and TSS concentrations. The total dissolved solids (TDS) present in wastewater can be an indicator for the amount of additives used to clean winery equipment, which can affect the pH balance and destroy the bacteria that reduce organic matter in wastewater. The pH value affects bacteria that consume organic matter in the wastewater. The dissolved oxygen (DO) level can tell wastewater treatment operators that the bacteria need more or less oxygen in order to consume and reduce organic matter present in the wastewater. In addition to oxygen, bacteria need nitrogen to fuel their consumption of organic matter. The nitrogen concentration in wastewater will alert wastewater treatment operators to how much nitrogen they need to add to the wastewater in order for bacteria to most efficiently consume organic matter. Fortunately, the presence of fecal coliform's and other pathogens are not detectable in process waste, and will not be considered a

constituent of concern. The following table provides a range of the expected strength of each wastewater constituent throughout the winemaking year.

Table 5: Typical Process Wastewater Values

Constituent	Unit	Peak Season[a]	Off Season[b]
PH		3.8-7.8	3.8-7.8
BOD5	Mg/L	5,000	1,000
TSS	Mg/L	57-3,950	12-400
TDS	Mg/L	315-1,240	214-720
Nitrate	Mg/L	0.63-362	0.23-53
Ammonia	Mg/L	2.25	
D.O.	Mg/L	2.3-6.3	2.3-6.3

[a] Peak season is September through March

[b] Off season runs from April to August

IV. SITE EVALUATION

A site evaluation is required to determine available on-site areas for subsurface dispersal of wastewater generated from the winery. Madrone Engineering completed a site evaluation on June 20, 2017 to locate acceptable soils for a proposed wastewater dispersal area on the property. Six (6) test pits were excavated in the vineyard. The site evaluation denoting the test pit locations and soil findings can be found in **Appendix 2** of this report.

Soils on the site are marginal for septic use, as is typical in this area of the Napa Valley, but Test Pits 1 through 6 contained sufficient soil depth to support a subsurface drip system with the use of a 6-inch soil cap. The application (infiltration) rate of the soil in this location for this system type is recommended to be no greater than 0.30 gallons per square foot per day.

V. WASTEWATER TREATMENT SYSTEM – OPTION 1

The proposed Option 1 system design proposes to handle the domestic and process wastewater separately. The system would disperse winery domestic waste into the existing winery septic system (standard system) and would propose a hold and haul system for process wastewater.

A. Domestic Wastewater

The domestic wastewater from the winery is to be treated via a standard septic tank (primary treatment) with final disposal via gravity to leach lines. The primary treatment system shall be equipped with effluent filters and will treat and remove settleable solids to acceptable concentration levels.

The disposal area for the domestic wastewater is proposed to be the existing leach field that currently serves the existing winery. With approved production levels of 5,000 gallons of wine annually, the system has been successfully dispersing peak wastewater flows of up to 250 gallons per day since its installation in 1986. Under this option, winery process waste would be diverted from the existing septic system to a proposed hold and haul system, therefore reducing the load on the existing leach lines from 250 gpd to 156 gpd (proposed domestic waste only).

The existing system was inspected in August 2017 by Sakai General Engineering, and is in good condition. Portions of the leach lines extend into easement and well setbacks. The leach field would be required to be modified to stay outside required setbacks per Napa County Environmental Health Division standards.

Using a conservative application rate of 0.25 gal/sf/day, and a sidewall credit of 3 feet/foot, the required leach line length to serve the proposed domestic uses would be 208 linear feet. After modifications to the leach field to meet current setback requirements, approximately 210 LF of leach field would be available to disperse the domestic wastewater.

Following is a schematic of the proposed domestic wastewater treatment system:

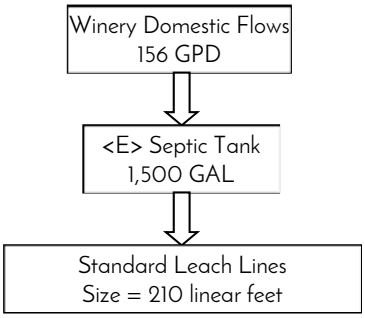

Figure 1: Conventional Domestic Wastewater Treatment System Schematic

B. Process Wastewater – Hold and Haul

For Option 1, process wastewater would be handled through the installation of a new holding tank that can be periodically pumped and hauled offsite by a licensed sewage hauling company. Per Napa County Code 13.52, the holding tank (or tanks) shall be sized to store seven days of peak flow (900 gpd). Total storage of 6,300 gallons shall be provided under this option, and a high-water alarm shall be installed to indicate when the tank is 75% full.

C. Domestic and Process Wastewater Reserve Areas

In the event a reserve area is required, suitable area has been identified in Test Pits 3 & 4. Reserve area shall also be sized to accommodate the existing 3-bedroom residence on the parcel. Due to the limited depth of suitable soil, the recommended wastewater system type for the reserve area is a sub-surface drip engineered wastewater system. The application (infiltration) rate of the soil in this location for this system type is recommended to be 0.20 gallons per square foot per day. Using this application rate, we can calculate the required reserve area for both domestic and process wastewater as follows:

$$square\ feet\ of\ reserve\text{:}\ \frac{1{,}416\ gpd}{0.30\ gal/ft^2} = 4{,}720\ ft^2\ x\ 200\% = 9{,}440\ ft^2$$

Please see Appendix 2 for a map showing the proposed reserve area for Option 1.

VI. WASTEWATER TREATMENT SYSTEM – OPTION 2

The proposed Option 2 system design handles the combined domestic and process wastewater with a pretreatment system, and disperses effluent into sub-surface driplines.

A. Domestic Wastewater – Primary Treatment

The domestic wastewater from the winery is to be treated via a standard septic tank (primary treatment), multiple Orenco AX-20 units (secondary treatment, described in Section VI.C below) with final disposal via subsurface drip lines. The primary treatment system shall be equipped with effluent filters and will treat and remove settleable solids to acceptable concentration levels.

B. Process Wastewater - Primary Treatment

Primary treatment provides partial removal of TSS and BOD through the gravitational settling of solids, as well as a small amount of biological treatment. Raw wastewater will flow via gravity from various sources throughout the site into a septic tank system. All septic tanks are to be equipped with an effluent filter. Within the septic tanks, solids will settle out of solution, and the remaining wastewater will continue to gravity flow to the next step of the treatment process. Detention time in the holding tank plays a large factor in reduction of TSS and BOD. In general, a longer detention time means more reduction of pollutants.

The strength of process wastewater is generally not reduced to the same extent as domestic wastewater. The reduction of BOD5 is typically below 30%, and depends on the detention time.

To aid in BOD and TSS reduction, the semi-treated effluent will enter into a second tank with two areas: an aeration portion and a secondary settling portion. The BOD level shall be reduced by 95% to less than 300 mg/L and the TSS shall be reduced to less than 300 mg/L prior to entering secondary treatment system.

C. Process & Domestic Wastewater - Secondary Treatment

The semi-treated effluent from both domestic and process sources will enter into a secondary treatment system, consisting of a recirculation tank and an Orenco AX-20 treatment unit. The BOD level shall be reduced by to less than 30 mg/L and the TSS shall be reduced to less than 30 mg/L prior to entering the dosing tank.

D. Process & Domestic Wastewater Disposal – Primary Area

The disposal area for the combined process & domestic wastewater is proposed to be located in the existing vineyard as identified in the site evaluation. Based on the soils within the vineyard, an application rate of 0.30 gal/ft^2/day is used for the design of the Option 2 system.

Required Drip Line Length:

$$square\ feet\ of\ dispersal\ area: \frac{1{,}056\,gpd}{0.30\,gal\,/\,ft^2} = 3{,}520\,ft^2$$

The primary disposal area shall consist of 3,520 square feet of subsurface drip line. Following is a schematic of the proposed wastewater treatment system:

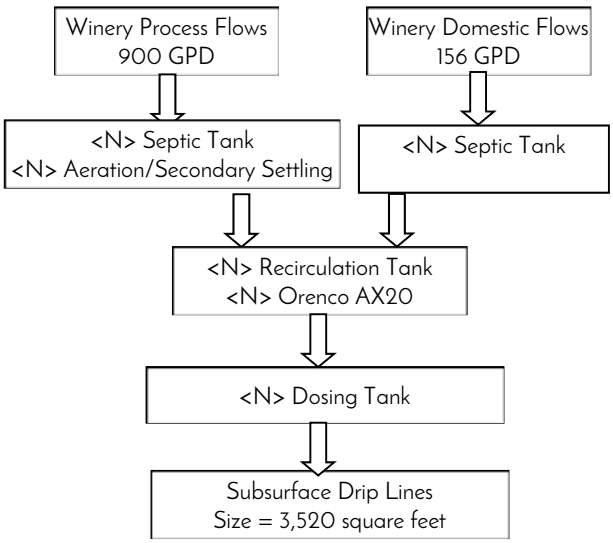

Figure 3: Combined Process & Domestic Wastewater Treatment System Schematic

E. Domestic and Process Wastewater Reserve Area

See Section V.C, above, for a description of the proposed reserve area.

VII. CONCLUSION

Based on the analysis performed in this report, the Matthiasson Family Vineyard project is feasible with regard to wastewater disposal. The parcel contains suitable soils and adequate available dispersal area to support the project from a wastewater treatment perspective. Please see the Use Permit Plans for the proposed sizes and location of the primary and reserve areas for all the options described previously. Detailed calculations and construction plans will be submitted to the Napa County Department of Environmental Management for approval prior to the construction of the wastewater disposal system.

IX. APPENDIX

1. Water Balance Calculations
2. Site Evaluation Report

APPENDIX 1:
WATER BALANCE CALCULATIONS

Project: Matthiasson Family Vineyard
3175 Dry Creek Rd
Napa, CA 94558
APN: 035-460-022

Project Description:
The following calculations are intended to estimate the process and domestic wastewater for Matthiasson Family Wines.

Winery Process Wastewater Generation

	18,000	gallons
Annual Wine Production	2.4	gal/case
	7,500	cases
Wastewater Generation Rate	8	gal water/gal wine
Annual Process Wastewater	**144,000**	gal
Crush Length	30	days (<20k, 20k-50k, 50k+)
Wastewater Generation Rate (during crush)	1.5	gal water/gal wine
Daily Wine Production (during crush)	600	gal wine/day
Peak Daily Process Waste (County Method)	900	gal PW/day
Peak Daily Process Waste (Industry Estimation - see table below)	768	gal PW/day

PW Generation Table

Month	% of Annual	Monthly Flow	Average Daily Flow
January	4.0%	5,760	186
February	6.0%	8,640	309
March	6.0%	8,640	279
April	4.5%	6,480	216
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Total	**100.0%**	**144,000**	**395**

Domestic Wastewater Generation

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Full-time employees	4	15	60	60
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Visitors (30 weekday, 30 weekend)	17	3	51	51
Private Event*	30	0	0	0
Private Residence (bedrooms)**	3	120	360	360
Grand Total		**Total Peak Flow**	**156**	**156**

*Events shall use portable toilets

**Private Residence flows are included for reserve area sizing only

APPENDIX 2:
SITE EVALUATION REPORT

Napa County Division of Environmental Health

SITE EVALUATION REPORT

Please attach an 8.5" x 11" plot map showing the locations of all test pits triangulated from permanent landmarks or known property corners. The map must be drawn to scale and include a North arrow, surrounding geographic and topographic features, direction and % slope, distance to drainages, water bodies, potential areas for flooding, unstable landforms, existing or proposed roads, structures, utilities, domestic water supplies, wells, ponds, existing wastewater treatment systems and facilities.

Permit #: OE17-00093

APN: 035-460-022

(County Use Only)
Reviewed by: Date:

PLEASE PRINT OR TYPE ALL INFORMATION

Property Owner Dave Bader	☐ New Construction ☐ Addition ☐ Remodel ☐ Relocation ☒ Other: Expand Winery Production
Property Owner Mailing Address 3175 Dry Creek Rd	☐ Residential - # of Bedrooms: Design Flow : gpd
City State Zip Napa, CA 94558	☒ Commercial – Type: Sanitary Waste: 120 gpd Process Waste: 560 gpd
Site Address/Location same as mailing address	☐ Other: Sanitary Waste: gpd Process Waste: gpd

Evaluation Conducted By:

Company Name MADRONE ENGINEERING	Evaluator's Name Joel Dickerson, P.E.	Signature (Civil Engineer, R.E.H.S., Geologist, Soil Scientist)
Mailing Address: 1485 Main Street, Suite 302		Telephone Number (707) 302-6280
City State Zip St. Helena, CA 94574		Date Evaluation Conducted 06/20/17

Primary Area	**Expansion Area**
Acceptable Soil Depth: 25 in. Test pit #'s: 4, 5, 6	Acceptable Soil Depth: 24 in. Test pit #'s: 1, 2, 3, 4
Soil Application Rate (gal. /sq. ft. /day): 0.30	Soil Application Rate (gal. /sq. ft. /day): 0.30
System Type(s) Recommended: Sub-Surface Drip	System Type(s) Recommended: Sub-Surface Drip
Slope: 15 %. Distance to nearest water source: >100 ft.	Slope: 15 %. Distance to nearest water source: >100 ft.
Hydrometer test performed? No ☒ Yes ☐ (attach results)	Hydrometer test performed? No ☒ Yes ☐ (attach results)
Bulk Density test performed? No ☒ Yes ☐ (attach results)	Bulk Density test performed? No ☒ Yes ☐ (attach results)
Percolation test performed? No ☒ Yes ☐ (attach results)	Percolation test performed? No ☒ Yes ☐ (attach results)
Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)	Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)

Site constraints/Recommendations:

System will need to be designed to cross vine rows. Existing vine rows may need to be removed during septic system construction, and replanted vine rows in the area of the primary and reserve field will need to be hand farmed (no machines/tractors driving through the area). A 5" minimum soil cap will be needed in the primary dispersal area.

Test Pit # 1

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-24	C	<10	C	S-SB	H	F	VS	F/F	F/F	N/A
24-34			C	HARDPAN						C/C

Test Pit # 2

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-26	C	<10	C	S-SB	H	F	VS	F/F	F/F	N/A
26-36			C	HARDPAN						C/C

Test Pit # 3

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-24	C	<10	C	S-SB	H	F	VS	F/F	F/F	N/A
24-35			C	HARDPAN						C/C

Attach additional sheets as needed

Test Pit # 4

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-27	C	<10	C	S-SB	H	F	VS	F/F	F/F	N/A
27-36			C	HARDPAN						C/C

Test Pit # 5

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-25	C	<10	C	S-SB	H	F	VS	F/F	F/F	N/A
25-36			C	HARDPAN						N/A

Test Pit # 6

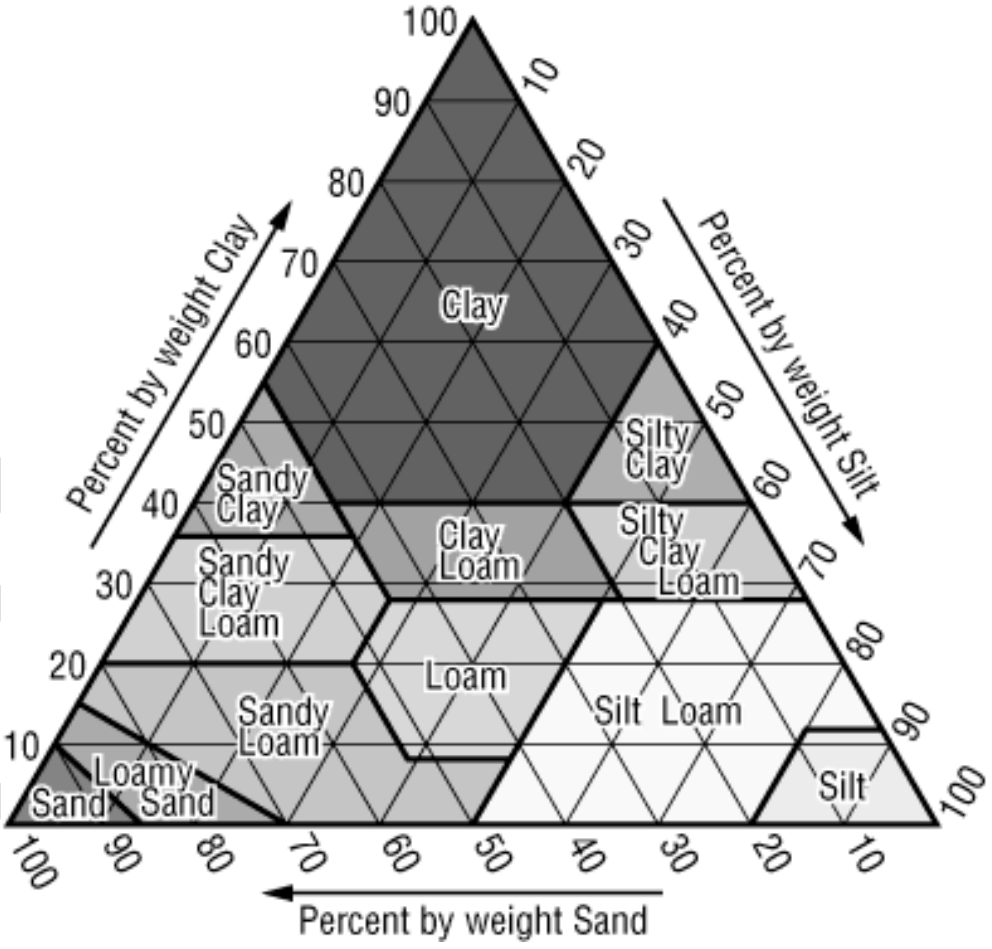
Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-26	C	<10	C	S-SB	H	F	VS	F/F	F/F	N/A
26-34			C	HARDPAN						N/A

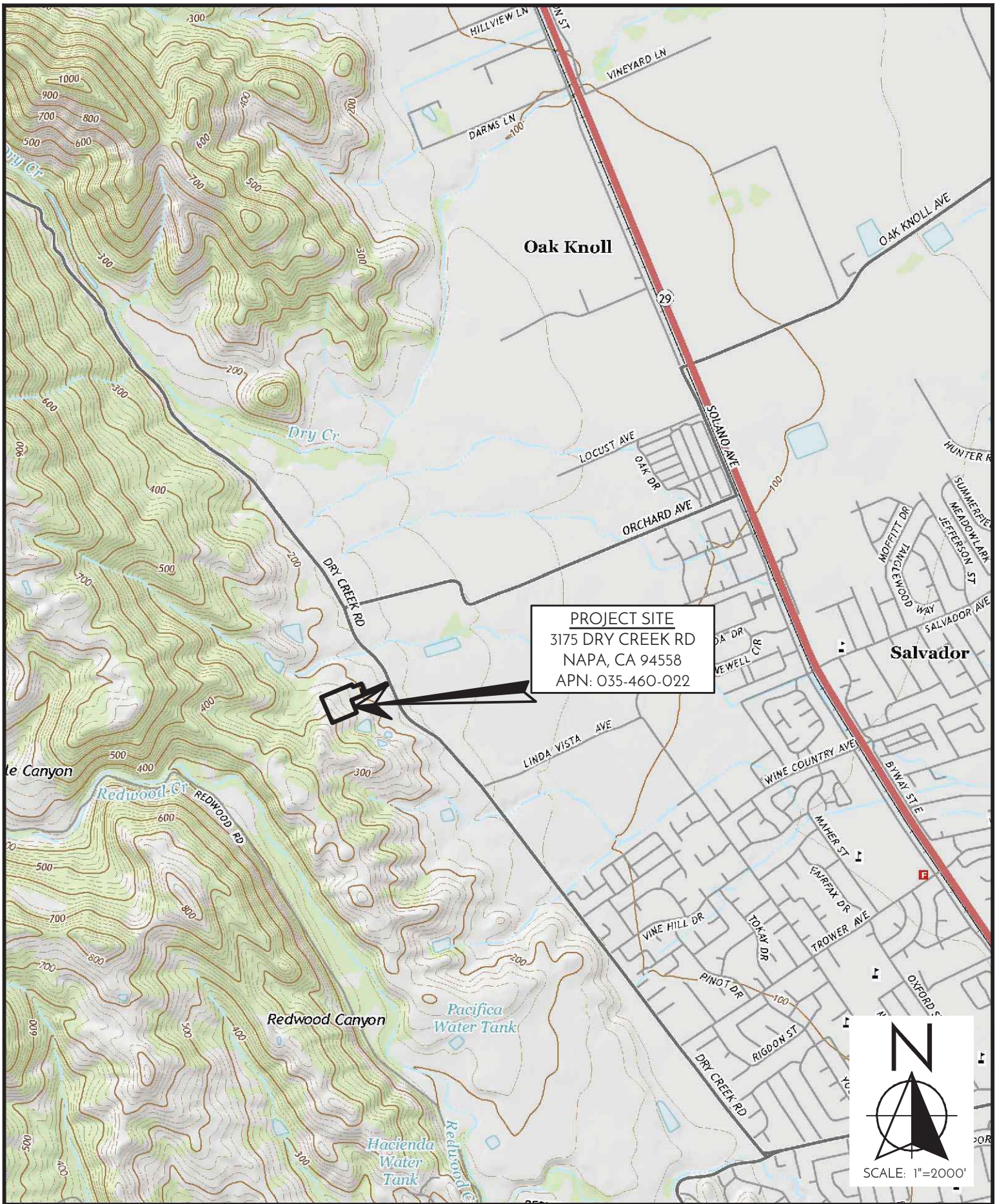
Attach additional sheets as needed

ABBREVIATIONS

Boundary	Texture	Structure	Consistence			Pores	Roots	Mottling
			Side Wall	Ped	Wet			
A=Abrupt <1” **C**=Clear 1”-2.5” **G**=Gradual 2.5”-5” **D**=Difuse >5”	**S**=Sand **LS**=Loamy Sand **SL**=Sandy Loam **SCL**=Sandy Clay Loam **SC**=Sandy Clay **CL**=Clay Loam **L**=Loam **C**=Clay **SiC**=Silty Clay **SiCL**=Silty Clay Loam **SiL**=Silt Loam **Si**=Silt	**W**=Weak **M**=Moderate **S**=Strong **G**=Granular **Pl**=Platy **Pr**=Prismatic **C**=Columnar **AB**=Angular Blocky **SB**=Subangular Blocky **M**=Massive **SG**=Single Grain **C**=Cemented	**L**=Loose **S**=Soft **SH**=Slightly Hard **H**=Hard **VH**=Very Hard **ExH**=Extremely Hard	**L**=Loose **VFRB**=Very Friable **FRB**=Friable **F**=Firm **VF**=Very Firm **ExF**=Extremely Firm	**NS**=NonSticky **SS**=Slightly Sticky **S**=Sticky **VS**=Very Sticky **NP**=NonPlastic **SP**=Slightly Plastic **P**=Plastic **VP**=Very Plastic	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **VF**=Very Fine **F**=Fine **M**=Medium **C**=Coarse **VC**=Very Coarse	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **F**=Fine **M**=Medium **C**=Coarse **VC**=Very Coarse **ExC**=Extremely Coarse	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **F**=Fine **M**=Medium **C**=Coarse **Contrast:** **Ft**=Faint **D**=Distinct **P**=Prominent

U.S.D.A. SOIL CLASSIFICATION TRIANGLE



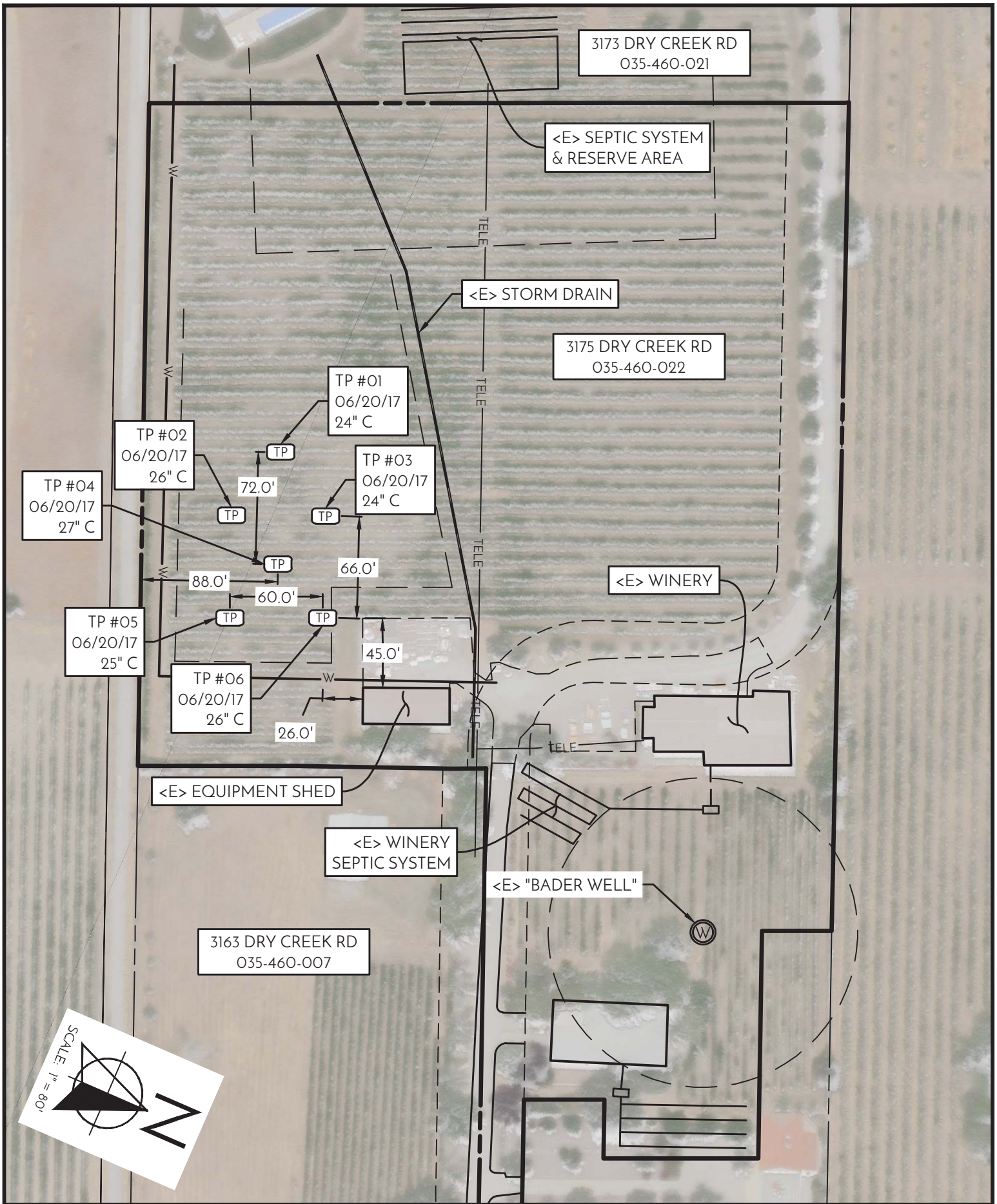


MATTHIASSON FAMILY VINEYARDS
VICINITY MAP

madrone engineering
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



MATTHIASSON FAMILY VINEYARDS
TEST PIT MAP

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

DATE:	06/29/17
SCALE:	1"=80'
JOB #	17.018
APN:	035-460-022

SHEET 1 OF 1