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Wastewater Feasibility Study

Grassi Family Winery P15-00339-UP
Planning Commission Hearing Date (February 1, 2017)

DELTA CONSULTING & ENGINEERING
OF ST. HELENA

SEPTIC FEASIBILITY REPORT

FOR THE

GRASSI WINERY
USE PERMIT

PROJECT LOCATED AT

1044 SODA CANYON ROAD
NAPA, CA 94558

COUNTY: NAPA
APN: 039-140-006

SEPTEMBER 23, 2015
REVISION 1: JANUARY 20, 2016

PREPARED FOR REVIEW BY:

NAPA COUNTY PLANNING, BUILDING & ENVIRONMENTAL SERVICES
1195 THIRD STREET
NAPA, CA 94559

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I. INTRODUCTION

The applicant is applying to the County of Napa for a Use Permit for construction and operation of a new winery with visitation. This report has been prepared to evaluate the feasibility of constructing a wastewater dispersal system to serve both domestic and process wastewater for the proposed facility.

The proposed marketing plan and winery operations plan provides the number of employees, the number visitors and the volume of wine to be produced. Based on these numbers, the peak wastewater generation can be estimated.

Grassi Winery is requesting the following uses that contribute to the wastewater flows on-site:

- *Production Capacity:* 25,000 Gallons Wine per Year
- *Employees:* 10 maximum per day (includes permanent and temporary)
- *Daily Visitors (By Appointment):* 12 maximum per day, 70 average per week
- *Marketing Events*: 2 per year with 40 guests, 1 per year with 75 guests
- *Wine Auction Event:* 1 per year with 125 guests

To limit the size of the proposed wastewater system, the following limitations must be placed on the marketing plan:

1. Marketing and Wine Auction events will be catered off-site.
2. Marketing and Wine Auction events with greater than 40 guests will use portable toilets.

This report proposes to combine the process and domestic wastewater and treat the totality of the generated wastewater in a single treatment and dispersal system.

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.

The parcel features an existing residential development which has its own wastewater treatment and dispersal system. The residential development is not a part of the winery and will not be considered in the wastewater feasibility report. A reserve area for the existing system is included with the proposed reserve area for the winery.

II. WINERY DOMESTIC WASTEWATER FLOW

A. Wastewater Generation

The domestic wastewater (DW) generated at the Grassi Winery 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 and temporary 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 the Grassi Winery, the maximum number of people present at the site, as well as the amount of wastewater each person will generate, must be estimated. Napa County estimates the wastewater generated by visitors as 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 ten (10) employees on staff, receives twelve (12) visitors in a single day, and hosts a marketing event with forty (40) guests. *Based on this combination, the peak daily domestic wastewater flow is 306 gallons per day*. For design purposes, this shall be taken as the minimum daily flow considered for storage and treatment requirements.

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 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 coliforms are extremely prevalent, and are detrimental to human health. **Table 1** provides a description of the expected strength of each wastewater constituent.

Table 1: Typical Domestic Wastewater Values

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

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

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" and the "Industry Method." Each method is described in further detail below. This report will analyze and compare both methods to determine the volume of process wastewater produced. The method that generates the peak daily wastewater flow will be used to determine the wastewater system design.

Napa County Method

The Napa County Method is used to estimate the peak wastewater flow that could occur in one day during harvest, which determined the maximum daily flow that 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 2** 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 2: 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 (25,000 gallons), the multiplication factor (1.5), and the number of crush days (45) that wastewater generation is distributed over, the Napa County Method estimates a process wastewater (PW) peak harvest flow of 833 GPD. Please see the 'Wastewater Flow Generation" in **Appendix 1**.

Industry Method

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.

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 the Grassi Winery, 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 projected annual wine production level of 25,000 gallons of wine and 8 gallons of PW generated per gallon of wine, the Industry Method estimates 200,000 gallons of PW produced annually. Please see the 'Wastewater Flow Generation" in **Appendix 1**.

Based on the "Wastewater Flow Generation", the month of September has the greatest wastewater generation. *The peak daily process wastewater flow during September is 1,070 gallons.* As this value is greater than that provided by the Napa County Method, this peak value is used in the feasibility analysis for 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[4]. 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 coliforms 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 4: 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 runs from 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. Delta Consulting & Engineering completed a site evaluation on April 23, 2015 to locate appropriate soils for a proposed wastewater dispersal area on the property. Eight (8) pits were excavated during the site evaluation. The site evaluation denoting the test pit locations and soil findings is on file at Napa County and can be found in **Appendix 2** of this report. Test Pits #2 and #3 will be used for the primary system. Test Pits #2, #4, #5 and #6 will be used for the reserve area.

V. COMBINED PROCESS AND DOMESTIC WASTEWATER TREATMENT SYSTEM

The domestic wastewater and process wastewater generated from the winery will be treated and dispersed via a sub-surface drip system. The peak daily domestic wastewater flow is 306 gallons per day, the peak average daily process wastewater flow is 1,070 gallons per day summed for a peak total flow of 1,376 gallons per day. Please see the Wastewater Field Exhibit located in **Appendix 3** and the Use Permit Plans for the proposed sizes and location of the primary and reserve areas for the system described below.

A. 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 will 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.

For domestic wastewater, the reduction of BOD depends on biological reactions that follow first order kinetics and the amount of detention time provided. The typical reduction of TSS ranges from 50%-

70%[3]. 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. Adequate detention time and the use of solids filtration devices can provide a TSS reduction similar to domestic wastewater.

B. Secondary Treatment

The semi-treated domestic and process waste effluent will combine and enter into secondary treatment. Secondary Treatment shall consist of additional septic tanks, media filtration and aeration. The BOD and TSS levels shall each be reduced to less than 30 mg/L prior to entering the pump tank for sub-surface drip field dispersal. The pump in the dosing tank shall be programmed to dose the field at regular intervals as specified by the Napa County design guidelines.

C. Treated Wastewater Dispersal – Primary Area

The primary dispersal area for the combined wastewater is proposed to be located over Test Pits #2 and #3 per the site evaluation noted above. Based on the soils in these test pits, an application rate of 0.6 gal/ft^2/day is used for the design of the sub-surface drip dispersal field. The required sub-surface dispersal area is 2,294 square feet and the total linear feet of drip line required with 2 foot line spacing is 1,147 feet. Please see the Wastewater Field Exhibit located in **Appendix 3** for the location of the primary area.

D. System Schematic

The following is a schematic of the combined domestic and process wastewater treatment system.

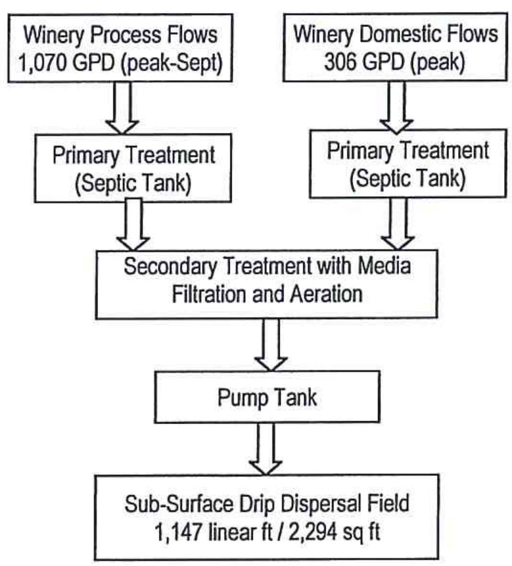

Figure 1: Combined DW + PW Wastewater Treatment System Schematic

E. Treated Wastewater Dispersal – Reserve Area

The Reserve Area for the combined wastewater is proposed to also be a sub-surface drip dispersal field. According to Napa County requirements, a sub-surface drip dispersal field Reserve Area is required to be 200% of the Primary Area.

A reserve area for the existing residential system shall be included with the reserve area for the winery system. The existing Main House and Guest Cottage have a total of three (3) bedrooms. Napa County estimates the wastewater generated by an existing residence as 150 gallons per day per bedroom[2]. *The residential peak daily wastewater flow is 450 gallons per day.* This wastewater flow is added to the 1,376 gallons per day generated from the winery to calculate the total reserve area required.

Due to soil type differences in the test pits used for the reserve area, two (2) 100% reserve areas sized by different application rates are proposed. The first 100% reserve area will be located over Test Pits #2 and #4. An application rate of 0.6 gal/ft^2/day is used for the design and required sub-surface dispersal area is 3,044 square feet. The second 100% reserve area will be located over Test Pits #5 and #6. An application rate of 0.3 gal/ft^2/day is used for the design and required sub-surface dispersal area is 6,087 square feet. Test Pit #1 will not be used as the soil depth was determined to be less than 24 inches per the site evaluation noted above. The total Reserve Area provided is 9,131 square feet. Please see the Wastewater Field Exhibit located in **Appendix** 3 for the location of the reserve areas.

VI. CONCLUSION

Based on the analysis performed in this report, the Grassi Winery project is feasible with regard to wastewater dispersal. The parcel is more than adequate to support the project from a wastewater treatment perspective. See the Use Permit Plans for the proposed sizes and location of the primary and reserve areas for the system described above. Detailed calculations and construction plans will be submitted to the Napa County Environmental Health Division for approval prior to the construction of the final treatment and dispersal system.

VII. APPENDIX

1 Wastewater Flow Generation
2 Site Evaluation Report
3 Wastewater Field Exhibit

[2] Napa County Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems, 2006.

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OF ST. HELENA

APPENDIX 1:
WASTEWATER FLOW GENERATION

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OF ST. HELENA

Wastewater Flow Generation

Process Wastewater

Winery Production (WP) =	10,417	cases/year
	25,000	gallons (2.4 gallons/case)

Harvest Period: Estimated Peak Process Flows (Napa County Method)*

Number of Crush Days=	45	days
Process Wastewater (Harvest Period) =	833	gpd
Estimated theoretical total PEAK PW generated during Harvest period=	37,500	gallons PW generated during harvest

*Napa County Enviromental Management Method for determining peak daily flow

Non-Harvest (Industry Method-Remainder of Wine Making Year outside of Harvest Period)

Estimated Gallons of Process Water Generated per Gallon of Wine Produced=	8	gallons ww/gallon of wine produced
Gallons of Process Waste Generated Per Year=	200,000	gallons/year
MG of Process Watse Generated Per Year=	0.200	MG/year
Process Wastewater (Non-Harvest) =	162,500	gallons/year
Remaining Days of Year Outside Crush Period=	320	days
Estimated Process Daily (non-crush) Flows=	508	gpd

Process Waste Production Summary

Crush Period Flows=	37,500	Gallons/year
Non-Harvest Flows=	162,500	Gallons/year
Total Estimated PW Flows	200,000	**Gallons per year**
Annual Basis, Average Daily PW Flows=	548	**gpd**

Process Flow Design for Peak Flow

Month	Day/mo	Estimated % of PW	Monthly PW Flow (gallons)	Average Daily PW Flow (gallons)	Month
Jan	31	7%	14,000	450	Jan
Feb	28	7%	14,000	500	Feb
Mar	31	8%	16,000	520	Mar
Apr	30	7%	14,000	470	Apr
May	31	6%	12,000	390	May
Jun	30	6%	12,000	400	Jun
Jul	31	6%	12,000	390	Jul
Aug	31	11%	22,000	710	Aug
Sep	30	16%	32,000	1,070	Sep
Oct	31	13%	26,000	840	Oct
Nov	30	7%	14,000	470	Nov
Dec	31	6%	12,000	390	Dec
	TOTAL	100%	200,000		

Peak Average Daily Flow:	1,070	gpd
	Sep	

1104 ADAMS STREET, SUITE 203
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APPENDIX 2:
SITE EVALUATION REPORT

1104 ADAMS STREET, SUITE 203 - ST. HELENA, CALIFORNIA 94574
707-963-8456 TELE + 707-963-8528 FAX

Napa County Department of Environmental Management

SITE EVALUATION REPORT

Permit #: E15-00262	
APN: 039-140-006	
(County Use Only) Reviewed by:	Date:

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.

PLEASE PRINT OR TYPE ALL INFORMATION

Property Owner Mark Grassi	☐ New Construction ☐ Addition ☐ Remodel ☐ Relocation ☒ Other: Site Potential Determination
Property Owner Mailing Address	☐ Residential - # of Bedrooms: Design Flow : gpd
City State Zip	☐ Commercial – Type: Sanitary Waste: gpd Process Waste: gpd
Site Address/Location 1044 Soda Canyon Road Napa, CA	☐ Other: Sanitary Waste: gpd Process Waste: gpd

Evaluation Conducted By:

Company Name	Evaluator's Name	Signature (Civil Engineer, R.E.H.S., Geologist, Soil Scientist)
DELTA CONSULTING & ENGINEERING	Bryan Jackson, P.E.	[signature]
Mailing Address: 1104 ADAMS STREET, SUITE 201		Telephone Number: 707/963-8456
City: ST. HELENA	State: CA Zip: 94574	Date Evaluation Conducted: 04/23/2015

Primary Area	Expansion Area
Acceptable Soil Depth: in. Test pit #'s:	Acceptable Soil Depth: in. Test pit #'s:
Soil Application Rate (gal. /sq. ft. /day):	Soil Application Rate (gal. /sq. ft. /day):
System Type(s) Recommended: To be determined	System Type(s) Recommended: To be determined
Slope: <5 %. Distance to nearest water source: 130 ft.	Slope: <5 %. Distance to nearest water source: 130 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:

The purpose of the site evaluation is to determine the on-site wastewater dispersal capacity of the property.
A blue- line stream is located within the vicinity of the test pits. A 100' setback will be maintained from the stream for any future wastewater system.

Test Pit # 1

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-16		15	SCL	M-SB	SH	FRB	SS	M-C	F-F	N/A
16+	C									YES

Test Pit # 2

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-30		10	SCL	M-SB	SH	FRB	SS	M-F	F-F	N/A
30-66	C	5	SCL	M-SB	S	FRB	SS	M-M	F-F	N/A

Test Pit # 3

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-38		10	SCL	M-SB	SH	FRB	SS	M-F	F-F	N/A
38-66	D	5	SL	M-SB	S	VFRB	NS	C-M	N/A	N/A

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			
0-46		10	SCL	M-SB	SH	FRB	SS	M-F	F-F	N/A
46+	C									YES

Test Pit # 5

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-24		25	SC	M-SB	H	F	S	M-F	F-F	N/A
24+	C									YES

Test Pit # 6

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-24		30	SC	M-SB	H	F	S	M-F	F-F	N/A
24+	C									YES

Attach additional sheets as needed

Test Pit # 7

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-40		10	SCL	M-SB	SH	FRB	SS	M-F	F-F	N/A
40-54	D	5	SL	M-SB	S	VFRB	NS	C-M	N/A	N/A
54+	C									YES

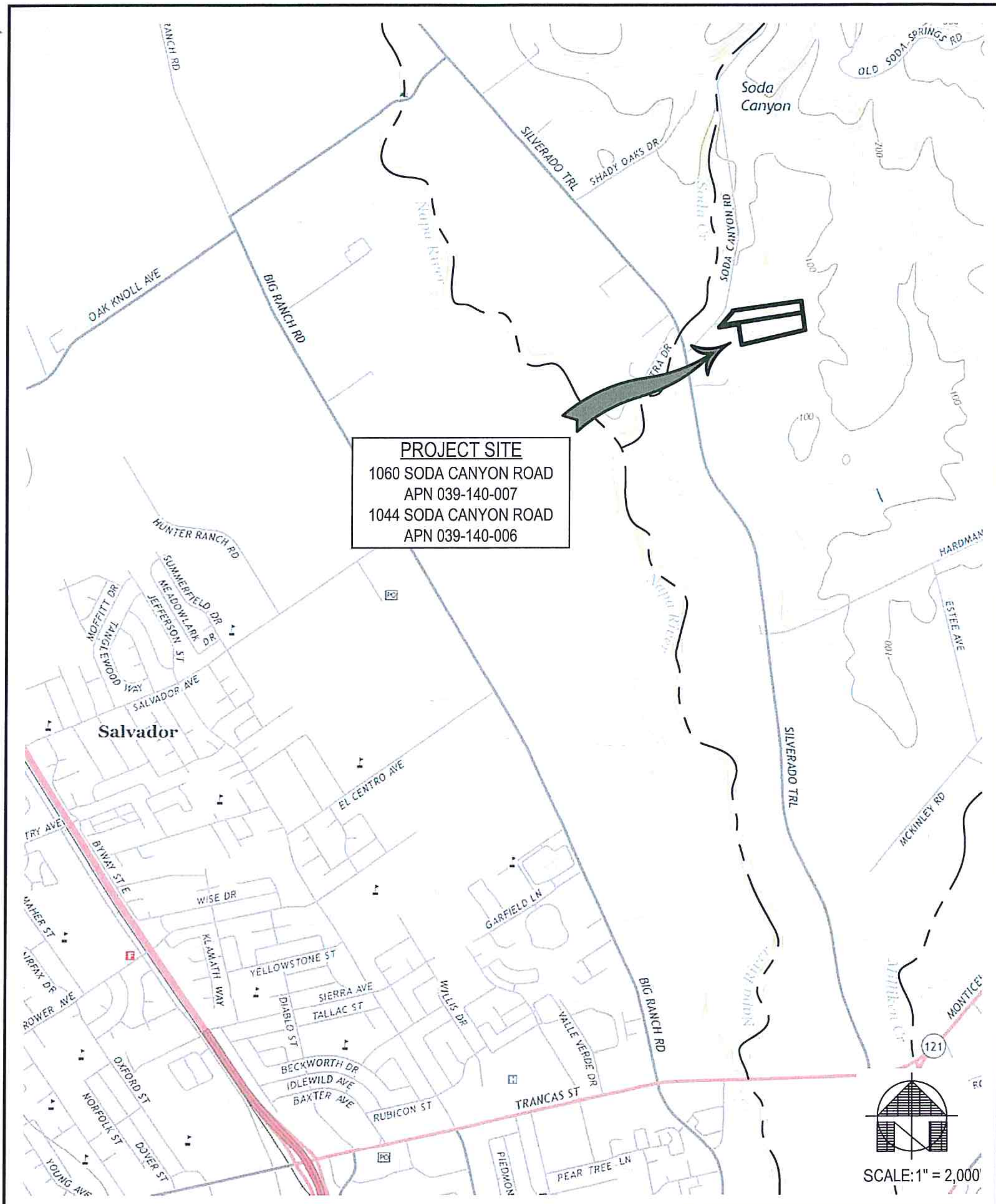
Test Pit # 8

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-45		10	SCL	M-SB	SH	FRB	SS	M-F	F-F	N/A
45-60	D	5	SL	M-SB	S	VFRB	NS	C-M	N/A	N/A
60+	C									YES

Test Pit #

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			

Attach additional sheets as needed



GRASSI WINERY

VICINITY MAP

DELTA CONSULTING & ENGINEERING OF ST. HELENA
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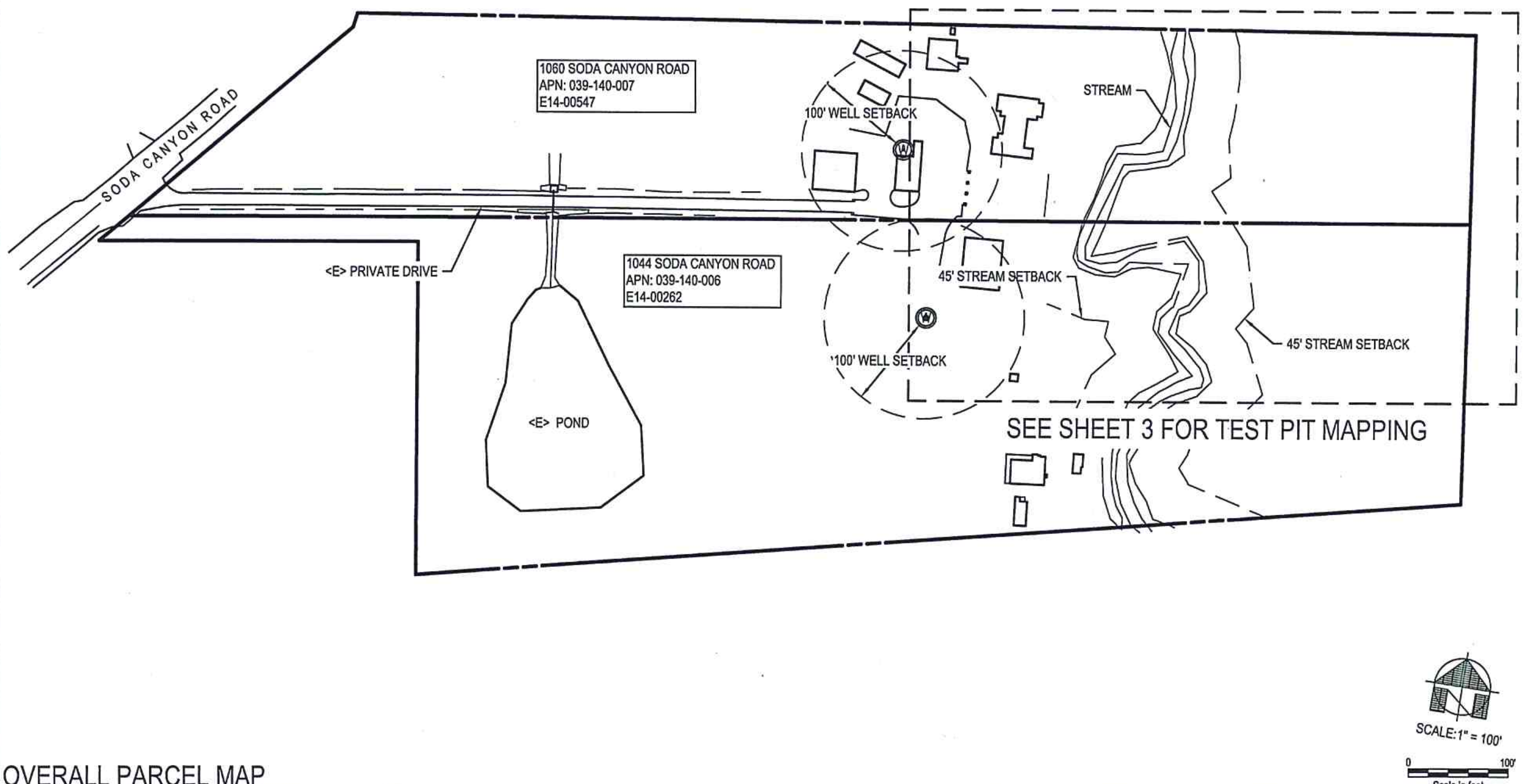
707-963-8456 + 707-963-8528 FAX

DATE:	5/29/15	JOB #	O-123	SHEET 1 OF 3
SCALE:	1" = 2,000'	APN:	039-140-007	



OVERALL PARCEL MAP

DATE: 5/29/15
SCALE: 1" = 100'
JOB #: O-123
APN: 039-140-007

2 OF 3

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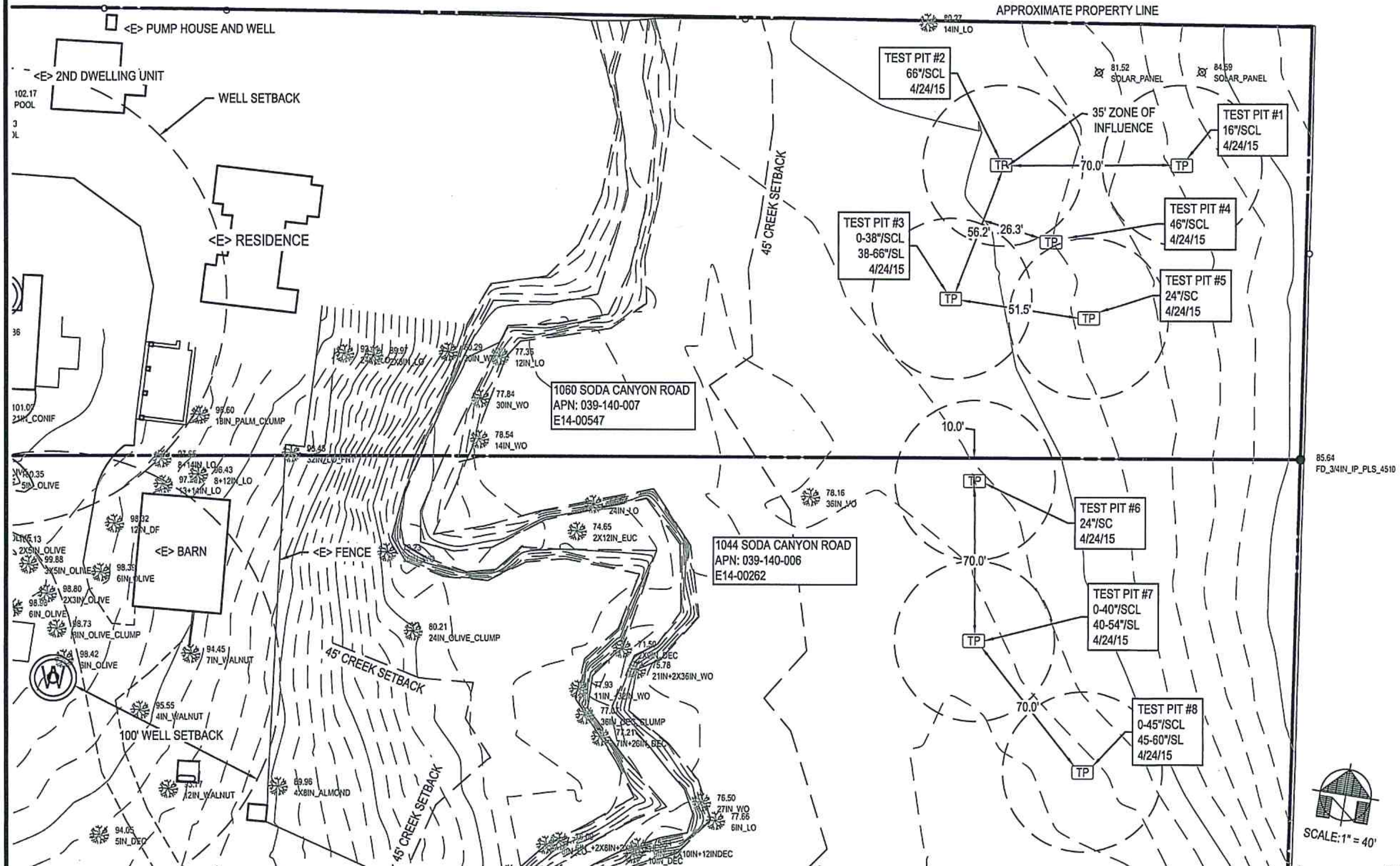
SITE EVALUATION REPORT
OVERALL PARCEL MAP

NAPA CALIFORNIA



TEST PIT LOCATIONS MAP

SITE EVALUATION REPORT
TEST PIT LOCATIONS MAP

NAPA CALIFORNIA

DELTA CONSULTING & ENGINEERING
OF ST. HELENA
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DATE: 5/30/15
SCALE: 1"=40'
JOB #: O-123
APN: 039-140-007

3 OF 3

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OF ST. HELENA

APPENDIX 3:
WASTEWATER FIELD EXHIBIT

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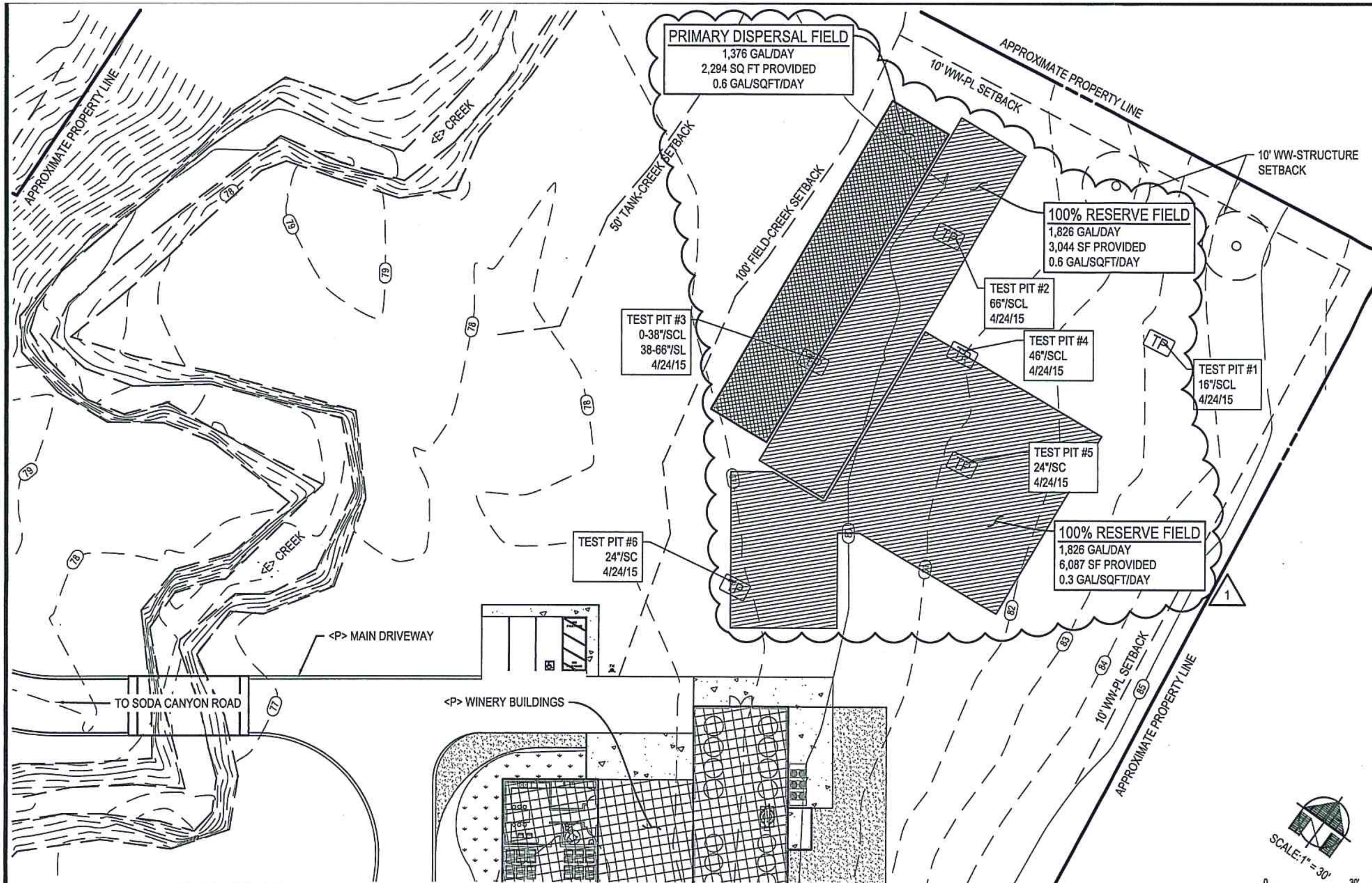

WASTEWATER FIELD PLAN

GRASSI WINERY
WASTEWATER FIELD EXHIBIT
NAPA CALIFORNIA

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DATE:	01/20/2016 REV 1
SCALE:	1" = 30'
JOB #:	O-123
APN:	039-140-006

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