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Wastewater Feasibility Study

Vineyard 29 P20-00062-MOD
Planning Commission Hearing Date November 1, 2023

WINERY WASTEWATER FEASIBILITY REPORT

VINEYARD 29
2929 ST. HELENA HWY.
ST. HELENA, CALIFORNIA 94574

APN 022-200-027

Prepared for:
Vineyard 29, LLC
Po Box 93
St Helena, CA 94574

Project #4115029.0
September 30, 2022

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INTRODUCTION

This report is provided to support the Use Permit Determination. Vineyard 29 (APN 022-200-027) proposes to increase production from 48,500 gallons of wine per year to 75,000 gallons, and requests recognition and authorization of employees, visitors, and marketing events.

The topography on the parcel ranges from steep slopes to relatively level areas. The parcel is used for vineyards and the existing winery. One (1) well exists on the site. Appendix 1 contains a site Location Map, and a USGS Site Map showing the parcel topography, features, and boundary.

This report will evaluate the treatment and disposal of winery process and domestic wastewater.

EXISTING WASTEWATER SYSTEMS

Information from Napa County Environmental Health Department files for the parcel shows an existing septic system for domestic and process wastewater designed by Napa Valley Engineering, Incorporated. The system has been designed for a peak flow of 1,213 gpd of process wastewater and 865 gpd of domestic wastewater for a total peak flow capacity of 2,078 gpd. Both systems discharge into dedicated standard leach fields. The total capacity of the existing system was investigated by McCollum Engineering on April 30, 2020, and was found to actually only have a capacity of 746 gpd. The McCollum report is attached in Appendix 2.

The client proposes to add a separate process wastewater treatment system, and will use treated process wastewater for vineyard irrigation. The existing process and domestic wastewater system will be converted to a domestic only system.

WINERY DOMESTIC WASTEWATER

The existing wastewater generation in shown in Table 1. The proposed wastewater generation is shown in Table 2 below. The number of existing and proposed employees and visitors are based on information provided by the client. The projected flow is based on Napa County Environmental Management guidelines.

Table 1 Existing Conditions

Use	Source		Projected Flow (gpd)	Total Flow No Event Day (gpd)	Total Flow 15 Person Event Day (gpd)	Total Flow 25 Person Event Day (gpd)	Total Flow 50 Person Event Day (gpd)	Total Flow 110 Person Event Day (gpd)	Total Flow 65 Person Event Day (gpd)
WINERY	Full-time employees	13	15	195	195	195	195	195	195
	Part-time employees	2	15	30	30	30	30	30	30
	Harvest employees	3	15	45	45	45	45	0	0
	Visitors	40	3	120	120	120	120	0	0
	Private Event w/ meals	15	15	0	225	0	0	0	0
	Private Event w/ meals	25	15	0	0	375	0	0	0
	Private Event w/ meals	50	15	0	0	0	750	0	0
	Private Event w/ meals	110	15	0	0	0	0	1,650	0
	Private Event w/ offsite catered meals	165	10	0	0	0	0	0	1,650
	Event Staff	6	15	0	90	90	90	90	90
Total Peak Flow				**390**	**705**	**855**	**1,230**	**1,965**	**1,965**

Table 2 Proposed Conditions

Use	Source		Projected Flow (gpd)	Total Flow No Event Day (gpd)	Total Flow 15 Person Event Day (gpd)	Total Flow 25 Person Event Day (gpd)	Total Flow 50 Person Event Day (gpd)	Total Flow 110 Person Event Day (gpd)	Total Flow 165 Person Event Day (gpd)
WINERY	Full-time employees	15	15	225	225	225	225	225	225
	Part-time employees	6	15	90	90	90	90	90	90
	Harvest employees	5	15	75	0	0	0	0	0
	Visitors	Varies	3	(60) 180	(58) 174	(8) 24	(60) 180	0	0
	Private Event w/ meals	15	15	0	225	0	0	0	0
	Private Event w/ meals	25	15	0	0	375	0	0	0
	Private Event w/ meals	50	15	0	0	0	750	0	0
	Private Event w/ meals	110	15	0	0	0	0	1,650	0
	Private Event w/ offsite catered meals	165	10	0	0	0	0	0	1,650
	Event Staff	Varies	15	0	(2) 30	(2) 30	(4) 60	(6) 90	(6) 90
Total Peak Flow				**570**	**744**	**744**	**1,305**	**2,055**	**2,055**

PROPOSED DOMESTIC WASTEWATER TREATMENT SYSTEM

The total capacity of the existing system is 746 gpd from the McCollum Engineering investigation, from April 30, 2020, as attached in Appendix 2. The system can treat and disperse 746 gallons of wastewater per day. This capacity is sufficient for the flows generated on a day with no event, or an event day with 15, or 25 guests.

On event days of 50, 110 and 165 guests, flows will need to be metered into the existing dispersal field to avoid overwhelming the field's capacity. To accomplish this metering the existing 1,200-gallon domestic septic tank, and 1,000-gallon grease interceptor, will be used to treat the wastewater prior to it flowing by gravity into the existing 3,000-gallon tank (currently used for Winery Process Wastewater); from where it will be metered into the dispersal field via duplex pumps. This can be done because the 3,000-gallon tank will no longer be necessary for Winery Process Wastewater. The proposed alterations to the system are to plumb the 1,200 domestic septic tank to flow into the 3,000-gallon tank, and to install duplex pumps in the 3,000-gallon tank.

The 50 person events days will take 4 days to meter into the dispersal field; while the 110-person and 165-person event days will take 8 days to meter into the field. This means that event planning will need to be done in accordance with these metering timelines. The existing system is described in Appendix 2.

No additional domestic wastewater treatment or dispersal system is needed. A report has been provided by McCollum Engineering detailing the condition of the existing system, this report has been included in Appendix 2.

WINERY PROCESS WASTEWATER GENERATION

Wine Production:	75,000 gallons of wine per year 2.38 gallons of wine per case = 75,000 gal/year/2.38 cases/year = 31,513 cases/year
Wastewater Production:	7 gallons of wastewater/gallon of wine = 75,000 gal/year x 7-gal wastewater/gal = 525,000 gal/year wastewater
Peak Daily Wastewater Flow:	Crush Period = 45 days 75,000 gallons x 2 / 45 days = 3,333 gallons/day
Average Daily Flow:	525,000 gal/year = 525,000 gallons/year/365 = 1,438 gallons/day

Monthly Wastewater Flows:

	% By Month	Waste/Month	
Sept	15%	78,750	Gal/Month
Oct	13%	68,250	Gal/Month
Nov	11%	57,750	Gal/Month
Dec	8%	42,000	Gal/Month
Jan	4%	21,000	Gal/Month
Feb	6%	31,500	Gal/Month
Mar	6%	31,500	Gal/Month
Apr	5%	26,250	Gal/Month
May	6%	31,500	Gal/Month
Jun	7%	36,750	Gal/Month
Jul	9%	47,250	Gal/Month
Aug	10%	52,500	Gal/Month
Totals	100%	525,000	Gal/Year

WINERY PROCESS WASTEWATER CHARACTERISTICS

According to Napa County Environmental Management Sewage Treatment System Design Guidelines, winery process wastewater must be treated prior to surface discharge. Based on our experience, winery wastewater characteristics are as follows:

Characteristics	Units	Average
pH		3.5
BOD5	mg/l	6000
TSS	mg/l	500
Nitrogen	mg/l	20
Phosphorus	mg/l	10

The treatment goal is 160 mg/L BOD and 80 mg/L TSS. To meet this treatment goal a treatment train including a sump basin, 8,000-gallon equalization tank, treatment tank with Biofiltro BIDA system, and pump tank are proposed. This treatment train may be modified for a more desirable treatment processes prior to submitting construction plans. The following sections describe the process in more detail. The proposed system is shown in Appendix 3.

WINERY PROCESS WASTEWATER – SURFACE DRIP IRRIGATION

The existing standard system will be used to dispose of only the domestic wastewater generated from the winery. The proposed 525,000 gallons per year production of wastewater will be treated using a worm-based wastewater treatment to the required standards, and will be beneficially reused via surface drip for vineyard irrigation. See the Biofiltro Proposed BIDA System Overview in Appendix 3. An analysis of the process wastewater flow can be found below. There are two options for surface drip irrigation areas, both options are presented here.

Sump Basin
A sump basin for process wastewater will be installed ahead of the existing process wastewater tank to be pumped to the proposed treatment system.

Equalization Tank
The control unit will contain an equalization tank that will serve to buffer peak flows and strengths from overwhelming the system and impairing treatment. This tank will be 5,000 gallons, and also provide pH balance, aeration, and recirculation.

Treatment Tank
The treatment tank will serve to treat wastewater flows using a Biofiltro BIDA system. Three (3) units will be required to treat the peak process wastewater flow of 3,333 gpd. Flow to this tank will be metered to ensure that the units are not overloaded.

Pump Tank
The pump tank will serve to hold treated wastewater prior to pumping to the storage. This tank will house dual pumps. This tank will be 200 gallons.

Holding Tank and Dispersal Field Options
To provide a preliminary estimate of the amount of storage tanks required, we have prepared a monthly water balance, as shown in Appendix 4. Monthly wastewater production is based on a percentage of the total annual wastewater production. The amount of water to be applied is estimated by the typical vine water demand. The irrigation will be applied to areas of vineyards on the winery and neighboring parcel outside well setback requirements. The area available for irrigation is shown in Appendix 4. For this option a total area of 4.57 acres of vineyard and 1.35 acres of cover crop has been used to calculate the storage capacity required. Based on monthly analysis 13,061 gallons of storage is required. However, proposed storage of 40,000 gallons will be provided for treated process wastewater generated during wet weather periods. This is based on providing a minimum of 13 days storage of the average process wastewater flows plus the storage required by the monthly water balance.

During the summer months all of the treated wastewater will be used for irrigation. During the wet winter months, a limited discharge will be consistent with landscape water demand, and no discharge will occur within 48-hours of a forecasted rain event, and also for 48-hours after a rain event. These irrigation scheduling constraints necessitate installing tanks to store excess water that cannot be discharged during the winter months. All stored water will then be used for irrigation during the summer months.

OPERATION AND MAINTENANCE

The winery process wastewater system will be fully automated and will be designed so minimal input from winery staff is required. Per Napa County guidelines, a Registered Civil Engineer, Registered Environmental Health Specialist, or Licensed Contractor will provide semi-annual monitoring and evaluation of the system. The contract with the responsible party will be provided prior to the final inspection for the system installed.

CONCLUSION

This report demonstrates that the proposed flow of process wastewater can be treated and disposed of on the neighboring parcel through the vineyard using drip irrigation. Also, the existing wastewater system can treat and disperse the projected domestic wastewater flows for the increased events, visitors, and employees.

The above methodology results in a design that meets the Napa County Environmental Management Design standards for the treatment of winery and domestic wastewater as well as the State Winery General Order.

Appendix 1

Vicinity Map
USGS Quad Map

VINEYARD 29
VICINITY MAP
NAPA COUNTY CALIFORNIA

VICINITY MAP

SCALE: 1" = 3000'

RSA+
1515 FOURTH STREET
NAPA, CALIF. 94559
OFFICE|707|252.3301
+ www.RSAcivil.com +

RSA+| CONSULTING CIVIL ENGINEERS + SURVEYORS + est. 1980

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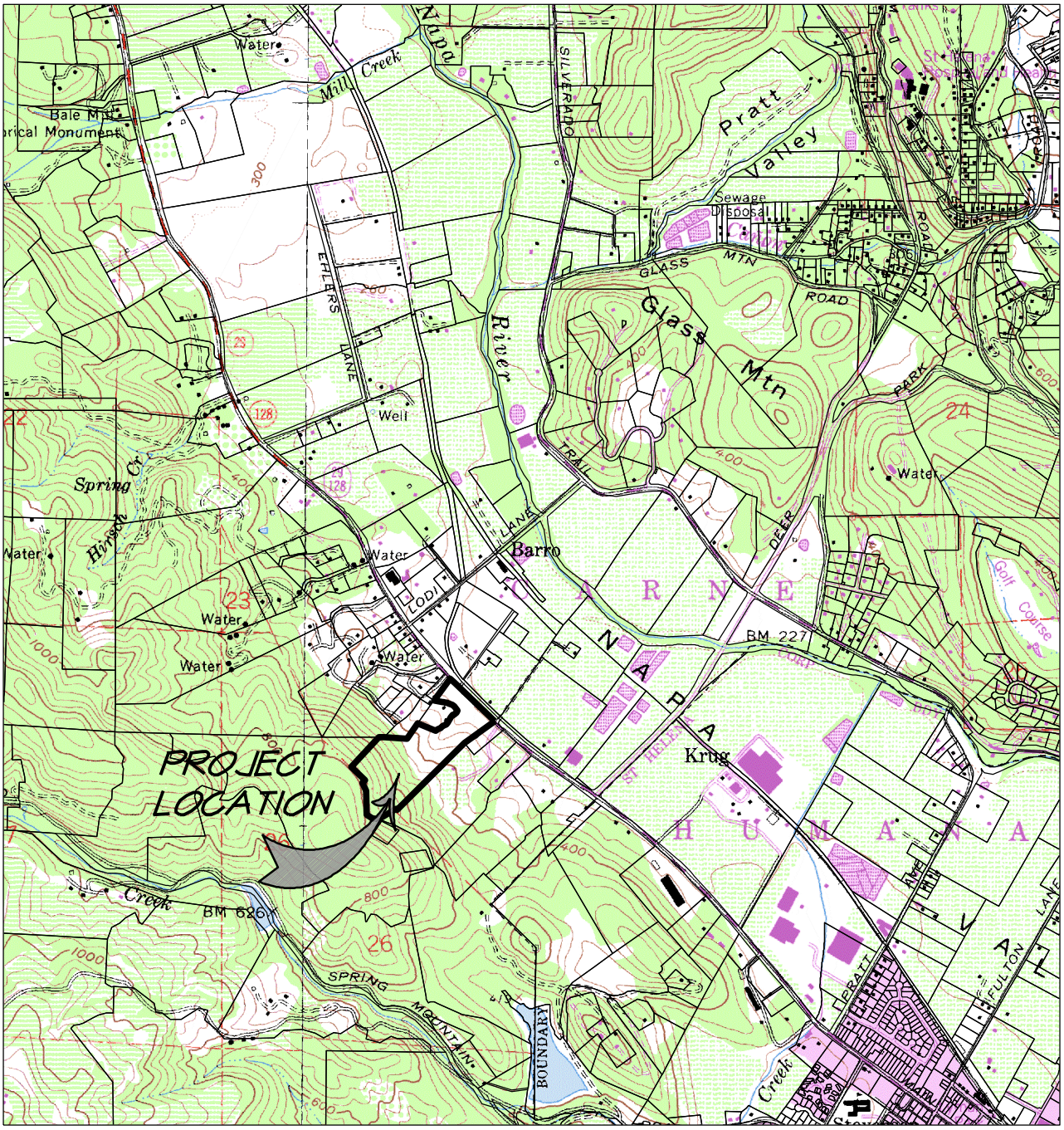
VINEYARD 29
USGS QUAD MAP



SCALE: 1"=2000'

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+ www.RSAcivil.com +

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JUNE 9, 2015 4115029.0 Exh-USGS.dwg

Appendix 2

McCollum Engineering Investigation of the Existing Septic System

McCollum

General Engineering Contractor
P.O. Box 2223
Yountville, CA 94599
Phone: 707.252.6220
Fax: 707.224.1753
MGECONSTRUCTION@YAHOO.COM

Keith Emerson
Vineyard 29

RE: 2929 Highway 29

As instructed by Keith Emerson, McCollum General Engineering (M.G.E.) conducted an investigation of the existing septic system located at 2929 Highway 29, St. Helena CA. The following information was collected during a one day investigation (04/30/2020).

Grease tank

1. The grease tank was located, opened, pumped and visually inspected. Grease tank is a pre fab concrete tank with steel access lids. The inlet T, outlet T are in place. The fluid level was in normal operating range upon arrival. The tank has a 1000 gallon capacity. The tank is fifteen feet away from the foundation.

Sanitary Sewer tank

1. The septic tank was located, opened, pumped and visually inspected. Septic tank is poured in place concrete with steel lids. The inlet T, outlet T are in place. The baffle wall is in place. The water level was in normal operating range upon arrival. The tank has a 1200 gallon capacity. The tank is twenty feet away from the foundation.

Process Waste tank

2. The process waste tank was located, opened, pumped and visually inspected. Process waste tank is poured in place concrete with steel lids. The inlet T, outlet T are in place. The baffle wall is in place. The water level was in normal operating range upon arrival. The tank has a 3000 gallon capacity. The tank is twenty five away from the foundation.

Leach field

3. Leach lines were probed, rodded and potholed for location and depth. The outlet tight line from the septic tank and process waste tank flows directly into a series of seven distribution boxes. The distribution boxes gravity flow to 4” PVC hancore leach lines. The leach lines are random lengths. The leach lines total five hundred and sixty five feet. The leach field is operating as designed. There is no obstructions or debris in the distribution boxes or leach lines.

MGE replaced all access lids at the septic tank and secured. Potholes were backfilled and covered in the leach field area.

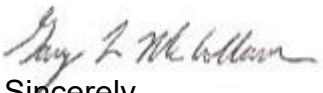
In summary the existing septic system is operating correctly. Water enters the septic tank and process waste tank, settles solids, passes through the baffle wall and exits the tanks through the outlet tight line. Water flows from the tank outlet tight line into a series of distribution boxes. The distribution boxes serve seven gravity flow 4" Hancore PVC leach lines. The leach lines and distribution boxes are free of obstructions and debris. The system is working as designed.

Septic systems will process water differently depending on household water usage, cleaning chemicals, number of residents and daily flows. (Please see attachment for proper septic system operation and maintenance.)

Municode setbacks for septic system construction–

http://library.municode.com/index.aspx?clientId=16513&stateId=5&stateName=California

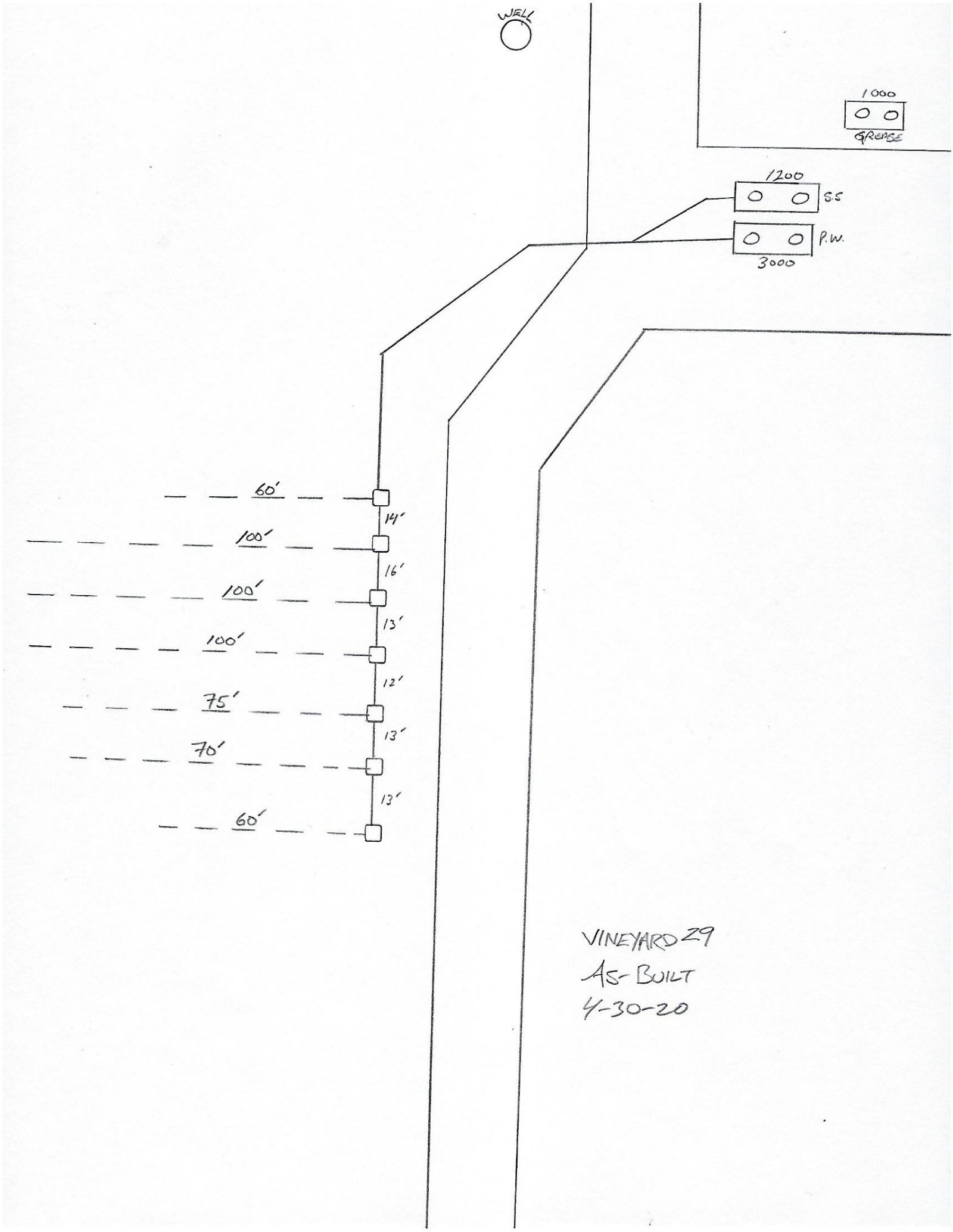
Please call if you have any questions.



Sincerely,
Gary L. McCollum
COWA/NAWT Certified Onsite
Waste Water Inspector/Installer

Company Disclaimer

Based on what we were able to observe and our experience with onsite wastewater technology, we submit this Onsite Wastewater Treatment System Inspection Report based on the present condition of the onsite wastewater treatment system. McCollum General Engineering has not been retained to warrant, guarantee, or certify the proper functioning of the system for any period of time in the future. Because of the numerous factors (usage, soil characteristics, previous failures, etc.) which may effect the proper operation of a wastewater treatment system, this report shall not be construed as a warranty by our company that the system will function properly for any particular owner or buyer. McCollum General Engineering DISCLAIMS ANY WARRANTY, either expressed or implied, arising from the inspection of the wastewater treatment system or this report. We are also not ascertaining the impact the system is having on the environment.


WELL
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GREASE
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S.S
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100'
16'
100'
13'
100'
12'
75'
13'
70'
13'
60'
VINEYARD 29
AS-BUILT
4-30-20

EXISTING INDIVIDUAL SEPTIC SYSTEM INSPECTION REPORT FORM FOR NAPA COUNTY

PROPERTY OWNER *Vineyard 29 Winery* DATE: *04/30/2020*
ADDRESS: *2929 Highway 29,St Helena, CA* A.P.N.

PRIMARY TREATMENT **GREASE** TANK
Distance from closest well:
This parcel *100+'* Adjacent parcel *100+'*
Distance from foundation: *15'*
Distance from property line: *20'*
Material-tank *Concrete* Lid *steel*
Number of compartments: *Two*
Total Capacity: *1000gal.*

Date tank was last pumped: *04/30/2020*
Pumped by: Dependable
Pre-fab tank or poured in place (describe):
Pre fab
Inside Length 8' Width 3' Depth 4'

SECONDARY TREATMENT-DISPOSAL FIELD (if other than leach field, describe below)
Distance from closest well:
this parcel *100+'* Adjacent parcel *100+'*
Distance from foundation: *50'*
Distance to property line: *10'*
Number of lines: *7*

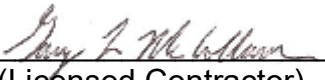
Total length on leach line: *565'*
Total effective sidewall: *1130'*
Amount of filter Material: *21"* Type of pipe*:4"Hancore*
Below pipe: *18"* Type of filter material: *¾ rock*
Above pipe: 3" Depth of cover over pipe: *20"*
Trench Width: 18" Depth: 45"

GENERAL INFORMATION
Is the house/structure presently occupied? *Yes* How many bedrooms? N/A
If commercial use, how many employees (FT / PT) *N/A* How many units served by this system? *2*
Any other septic systems of the property? *Yes*. If yes, how many? 1

CONDITION OF SYSTEM
Make a statement of the condition of the septic tank and interior surfaces, including baffles and fittings. How was this determined? *Septic tank was located, pumped and visually checked. Inlet T and outlet T are in place. The Baffle wall is in place. The tank has steel access lids. The tank is in operating condition.* Note: If tank is over five years old, it must be inspected (pumping is required to allow inspection).

Make a statement on the condition of the sump/pump (if applicable), including size, alarm, structure, etc. *N/A*

Make a statement on the condition of the distribution box, leaching line, etc. How was the length and location of the disposal field determined? *Leach lines were probed, rodded and potholed for location and depth. Leach lines are 4" Hancore PVC. There are seven leach lines in the field. The leach lines are served by seven distribution boxes. There are no obstructions or debris in the leach lines are distribution boxes.* Note: Information on disposal field must be determined by physically locating each line by exposing the ends. All distribution boxes must be uncovered and inspected.



(Licensed Contractor)

EXISTING INDIVIDUAL SEPTIC SYSTEM INSPECTION REPORT FORM FOR NAPA COUNTY

PROPERTY OWNER *Vineyard 29 Winery* DATE: *04/30/2020*
ADDRESS: *2929 Highway 29, St Helena, CA* A.P.N.

PRIMARY TREATMENT **PROCESS WASTE** TANK
Distance from closest well:
This parcel *100+'* Adjacent parcel *100+'*
Distance from foundation: *25'*
Distance from property line: *20'*
Material-tank *Concrete* Lid *Steel*
Number of compartments: *Two*
Total Capacity: *3000gal.*

Date tank was last pumped: *04/30/2020*
Pumped by: Dependable
Pre-fab tank or poured in place (describe):
Poured in place
Inside Length 9' Width 8' Depth 6'

PRIMARY TREATMENT **SANITARY SEWER** TANK
Distance from closest well:
This parcel *100+'* Adjacent parcel *100+'*
Distance from foundation: *20'*
Distance from property line: *20'*
Material-tank *Concrete* Lid *Steel*
Number of compartments: *Two*
Total Capacity: *1200gal.*

Date tank was last pumped: *04/30/2020*
Pumped by: Dependable
Pre-fab tank or poured in place (describe):
Poured in place
Inside Length 9' Width 5' Depth 5'

GENERAL INFORMATION
Is the house/structure presently occupied? *N/A* How many bedrooms? N/A
If commercial use, how many employees (FT / PT) *N/A* How many units served by this system? *2*
Any other septic systems of the property? Yes If yes, how many? 1

CONDITION OF SYSTEM
Make a statement of the condition of the septic tank and interior surfaces, including baffles and fittings.
How was this determined? *Septic tank was located, pumped and visually checked. Inlet T and outlet T are in place. The Baffle wall is in place. The tank has steel access lids. The tank was in normal operating range upon arrival.* Note: If tank is over five years old, it must be inspected (pumping is required to allow inspection).

CONDITION OF SYSTEM
Make a statement of the condition of the septic tank and interior surfaces, including baffles and fittings.
How was this determined? *Process waste tank was located, pumped and visually checked. Inlet T and outlet T are in place. The Baffle wall is in place. The tank has steel access lids. The tank was in normal operating range upon arrival.*
Note: If tank is over five years old, it must be inspected (pumping is required to allow inspection).

(Licensed Contractor)

Appendix 3

Biofiltro Proposed BIDA System Overview

BIOFILTRO
REVITALIZE WATER

BIDA® System Quote

Prepared for:

WAS Proposal for Vineyard 29

Prepared for: Chuck McMinn, 2929 Road 29, St. Helena, CA 94574

Prepared by: John Garn, Sales Manager, BioFiltro

Proposal Valid for Sixty Days

December 20, 2019

1. INTRODUCTION

1.1 Background

Vineyard 29 (V29) is seeking a Use Permit modification to increase their production from their current 48,000 gallons to 75,000 gallons. At the same time, the winery is dealing with odor issues emanating from the location of the domestic and process wastewater sumps being in the parking lot right in front of the winery. With the current production of process water, the winery is concerned that the current septic system with leach field could fail, an issue which could potentially cause overflow to enter the storm drain and ultimately the creek that runs along Hwy. 29.

In an effort to address all of these issues at once, V29 has requested that BioFiltro propose a worm-based wastewater treatment system to handle all of the process wastewater from the winery and remove it totally from the current septic system. At current production capacity, the winery is generating approximately 2,100 gallons per day GPD. With plans to increase wine production, RSA+ Engineering has requested a quote for a 3,333 GPD system.

	GPD	pH	BOD (mg/l)	TSS (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)
Harvest Average	2,300					
Peak Harvest	3,333					
Influent		N/A	4,350	2,638	20	10
Target Effluent		5-8.5	90%	90%	Similar	Similar

2. SYSTEM DESCRIPTION

2.1 Proposed Process Wastewater Solution

BioFiltro has based this proposal and the Wastewater as a Service (WaaS) system design on a maximum daily discharge of 3,333 gallons per day (GPD). The proposed BioFiltro treatment system uses a patented BIDA® System (see Appendix A for more details on the BIDA) and to reduce the biochemical oxygen demand (BOD5) and total suspended solids (TSS) by at least 90%. Total Kjeldahl Nitrogen shall also be positively impacted, though the removal efficacies can only be determined when influent quality data has been provided.

BioFiltro shall include in this WaaS treatment system the transport fee and the full services of design, engineering, construction, installation, inoculation, operation, maintenance and delivery of BIDA® System treated water for use in vineyard and/or landscape irrigation. The WaaS will also include a pH electrode and a flow meter, which shall be installed and the data shall be displayed on a Hanna control panel onsite and transmitted to a cloud-based platform. The platform enables BioFiltro technicians and V29's team to remotely monitor the system and, in the case of BioFiltro, adjust flow, pH, irrigation frequency, etc. Items excluded from this preliminary proposal are permitting and site preparation, as the specific location has not been determined and it is currently not known how the surface area of the selected site may need to be prepared and/or connected. Upon further review and study, BioFiltro can provide these additional services for an extra fee when the site is selected. At this time BioFiltro has not included a solid separation equipment to separate out any process solids from the stream, electing instead to use the existing septic tanks to catch any solids coming to the system.

The site used in this proposal is located on the southern edge of the graded area in front of the caves (Cave Area). This site already has very good soil compaction and should require minimal work to ready it for the installation of three (3) Wiggle2 modules. The Cave Area was also selected as it has the shortest run of untreated process water from the winery. Since the site does have landslide potential, short run lines of untreated water have the lowest risk of a spill.

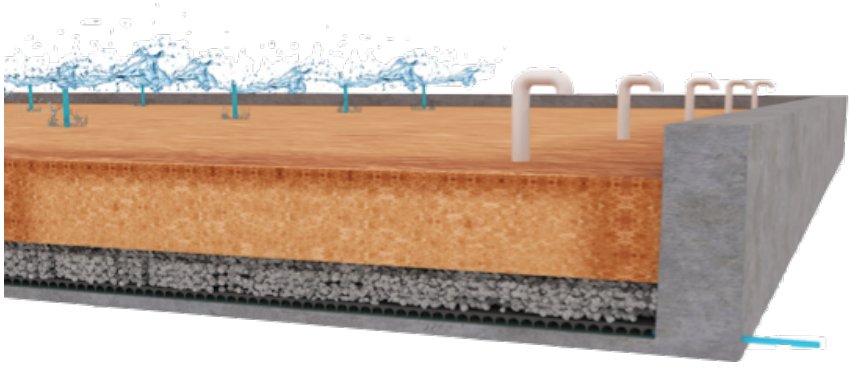
2.2.1 Containerized 2Wiggle2 BIDA Modules

Based on a current average flow of 2,100 GPD of process wastewater and the projected maximum flow of 3,333 GPD at maximum Use Permit production, BioFiltro proposes the installation of three (3) Wiggle2 modules and a control panel unit which shall require approximately 1,000 square feet of surface area.

Using the existing wastewater infrastructure, the process wastewater influent will be pulled from the existing septic tanks and then pumped to a 5,000 gallon poly tank, which is included in BioFiltro's scope of work, to provide buffer capacity and homogenization. The poly tank will also provide the needed storage for maximum wastewater flows during harvest when wastewater flows can can triple or quadruple daily averages. After treatment, the effluent from the three Wiggle2s will go to a 200 gallon storage tank where it will then be pumped to the large cistern (accumulation tank) up the hill for gravity flow into the vineyard, or irrigation of a small redwood groove.

Appendix A

The BIDA® System is a contained open top pretreatment wastewater solution. The system may be contained by concrete walls, steel tanks, housed within a shipping container, and/or placed in a retro-fitted pond. The medias that are placed into the system require approximately 4'1" of height and consist of, from top to bottom, approximately 3'6" worth of Douglas Fir 1" wood shavings; 6" of 1/2" – 1" river cobble; and a single layer of ¾" tall drainage basins which are placed directly on the system floor. The floor is sloped to facilitate water's exit from the system through exit pipes. PVC pipes are placed along the system's edge to provide passive ventilation to the air chamber maintained by the drainage basins at the base of the BIDA® System. An irrigation system, consisting of sprinkler heads and PVC piping, is lined across the surface and used to evenly disperse wastewater which then percolates down throughout the layers.



During system start up, BioFiltro introduces an industry specific mix of aerobic microbes and worms to the wood shavings media following the biological processes described in BioFiltro's Patent US 7540960 B2, "Method and system for inoculating bacteria in contaminated water using earthworm humus." *Eisenia fetida*, commonly referred to as the California red worm, serve two primary purposes: aeration and solid digestion. The worms aerate the system as they burrow throughout the wood shavings media in search of larger solids to consume. As the worms consume larger solids, the bacteria in their intestines and castings (excrement) break down and digest waste into smaller solids and soluble solids which microbes finish off. The organisms work symbiotically and beneficially together to form a biofilm, or robust digestive film formed by billions of microbial colonies, which grows throughout the wood shavings and river cobble. The river cobble maintains an ideal environment for nitrification denitrification microbes to flourish. The biological population is self-regulating; if the Owner expects to have significant low and/or non activity at the Facility, much of the microbial population will go dormant while worms feed on remaining particles and the carbon based wood shavings. The average lifespan of a worm is six to

eight years, during which they lay hundreds of cocoons that only hatch in optimum environments. The latter is relevant as it ensures that the BIDA® System builds a strong reserve of worms during the low activity.

As wastewater is applied across the BIDA® System surface, it slowly percolates down throughout the medias via gravity. Wood shavings act as sponges that absorb and release the water, enabling the biofilm that to capture contaminants. The application is done in an intermittent batch process in which the system is irrigated typically for 5 minutes every 25 minutes. The rest cycle between irrigation sessions enables the wood shavings to release most of the water before the next batch begins.

Within 4 hours of hitting the system surface, filtered water flows out of the BIDA® System along its sloped floor and out an an exit pipe. A sieve box is hung at the end of the exit pipe in order to prevent any media from leaving the system. The amount of material collected in this sieve is less than 0.05 cubic yards per month and can simply be returned to the system or disposed of in routine trash removal.

Appendix 4

Water Balance for Irrigation and Storage
Irrigation Areas Exhibit

Reclaimed Process Wastewater
Water Balance for Irrigation and Storage

Project Description		Annual Process Waste Flow Volume		
Project Number:	4115029.0	Wine Production:	75,000	gal/year
Project Name:	Vineyard 29			
Prepared By:	MSS	Annual Process Waste per Gallon Wine:	7	gal/year
Date:	September 13, 2022	Total Annual Process Waste Generated:	525,000	gal/year

Vineyard Irrigation Parameters		Cover Crop Irrigation Parameters		
Acres of irrigated vineyard:	4.57 acres	Crop type / name:		
Row spacing:	7.0 feet	Total irrigated acres of crop:	1.35 acres	
Vine spacing:	8.0 feet			
Total number of vines:	3,555 vines			
Water use per vine per month (peak):	28 gal			
Total peak monthly irrigation demand:	100,246 gal			

Monthly Process Wastewater Generation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly process wastewater generated as % of annual total:	4%	6%	6%	5%	6%	7%	9%	10%	14%	14%	11%	8%
Monthly process wastewater generated [gallons]:	21,000	31,500	31,500	26,250	31,500	36,750	47,250	52,500	73,500	73,500	57,750	42,000

Monthly Vineyard Irrigation Water Use

(Based on per-vine water use)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Beginning of month reclaimed water in storage [gallons] (This number brought forward from end of previous month)	13,061	0	0	0	0	0	0	0	0	0	0	9,457
Vineyard irrigation as % of peak month irrigation demand:	6%	6%	10%	100%	100%	100%	100%	100%	100%	100%	10%	10%
Irrigation per month per vine (gallons):	2	2	3	28	28	28	28	28	28	28	3	3
Total vineyard irrigation demand [gallons]:	6,015	6,015	10,025	100,246	100,246	100,246	100,246	100,246	100,246	100,246	10,025	10,025
Will vineyard be irrigated with reclaimed water this month?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Process wastewater generated this month, reclaimed for vineyard irrigation [gallons]	6,015	6,015	10,025	26,250	31,500	36,750	47,250	52,500	73,500	73,500	10,025	10,025
Remaining vineyard irrigation demand after using this month's process water [gallons]	0	0	0	73,996	68,746	63,496	52,996	47,746	26,746	26,746	0	0
Drawdown from storage for remaining vineyard irrigation [gallons]	0	0	0	0	0	0	0	0	0	0	0	0
Well water required to satisfy remaining vineyard irrigation demand	0	0	0	73,996	68,746	63,496	52,996	47,746	26,746	26,746	0	0
Net storage after vineyard irrigation drawdown [gallons]	13,061	0	0	0	0	0	0	0	0	0	0	9,457
This month's process wastewater, remaining after vineyard irrigation, available for cover crop irrigation[gallons]	14,985	25,485	21,475	0	0	0	0	0	0	0	47,725	31,975

Total = 1.18 ac-ft
Winery Parcel = 0.93 ac-ft
Neighbor Parcel = 0.25 ac-ft

Water balance continues on next page for cover crop irrigation.

Monthly Cover Crop Irrigation Water Use

(Based on evapotranspiration crop demand and irrigated area)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
This month's process wastewater, remaining after vineyard irrigation, available for cover crop irrigation[gallons] *(From sheet 1)*	14,985	25,485	21,475	0	0	0	0	0	0	0	47,725	31,975
Reference ET (ETo) (in/month) (see note 1)	1.32	1.8	3.32	4.78	6.11	6.84	7.07	6.3	4.9	3.45	1.74	1.29
Crop Coefficient (k_c) (see note 2)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Crop water demand per acre [inches]	0.79	1.08	1.99	2.87	3.67	4.10	4.24	3.78	2.94	2.07	1.04	0.77
Crop water demand per acre [gallons]	21,505	29,325	54,088	77,873	99,541	111,433	115,180	102,636	79,828	56,205	28,347	21,016
Total crop water demand for irrigated area [gallons]	29,031	39,588	73,018	105,129	134,380	150,435	155,494	138,559	107,768	75,877	38,269	28,372
Will landscape be irrigated with reclaimed water this month?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Process wastewater remaining after vineyard irrigation, reclaimed for cover crop irrigation [gallons]	14,985	25,485	21,475	0	0	0	0	0	0	0	38,269	28,372
Cover crop irrigation water required from storage or other source [gallons]	14,046	14,103	51,543	105,129	134,380	150,435	155,494	138,559	107,768	75,877	0	0
Drawdown from storage for cover crop irrigation [gallons]	13,061	0	0	0	0	0	0	0	0	0	0	0
Process wastewater generated this month, unused for irrigation, to be reclaimed and stored [gallons]	0	0	0	0	0	0	0	0	0	0	9,457	3,604
Net end-of-month reclaimed water storage after all irrigation [gallons]	0	0	0	0	0	0	0	0	0	0	9,457	13,061

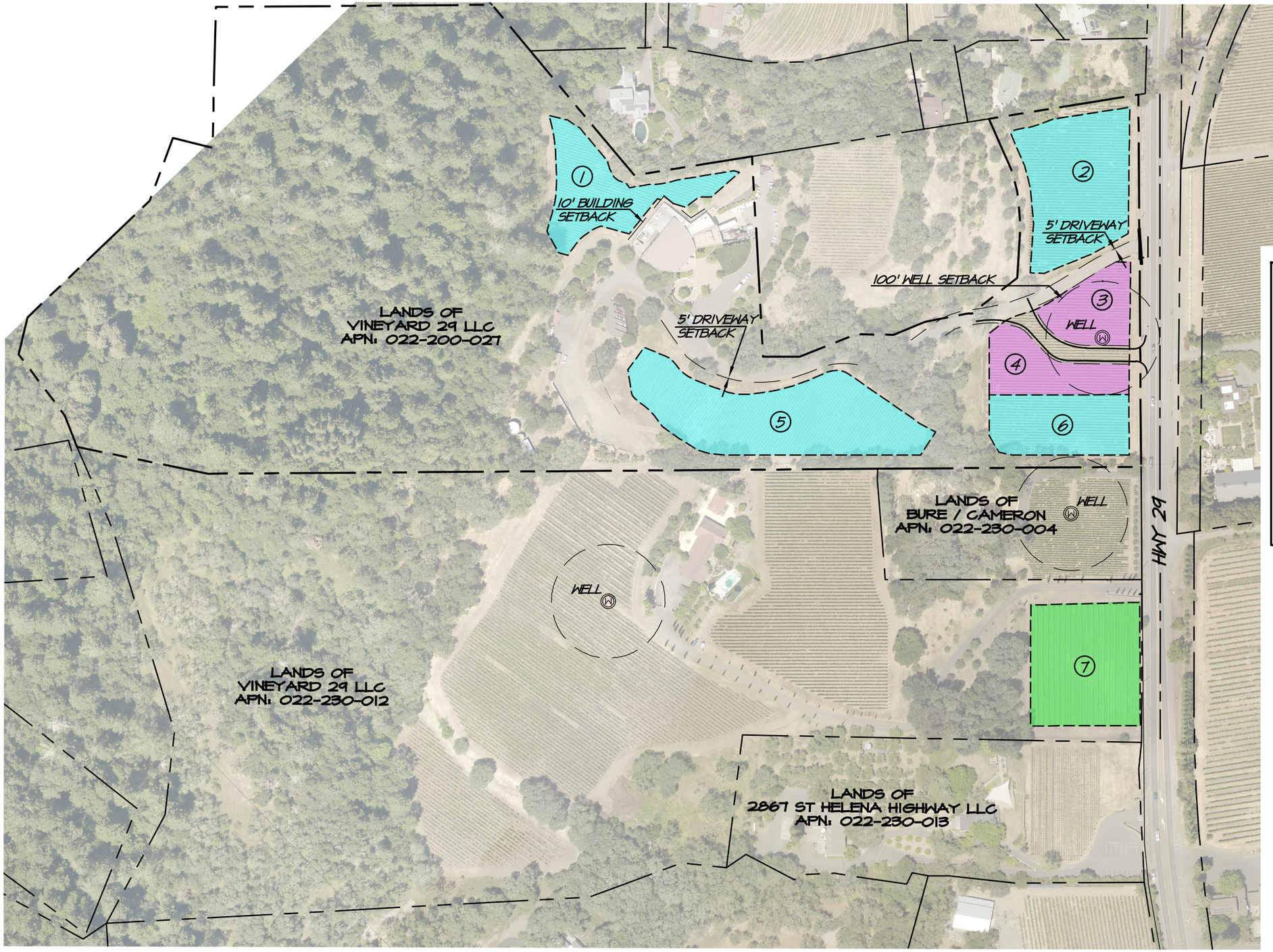
End of Water Balance

Peak Monthly Storage = 13,061 gallons

Notes:

1. Reference ETo from California Irrigation Management Information System
2. Crop Coefficient from Table 1 of "Estimating Irrigation Water Needs of Landscape Plantings in California", University of California Cooperative Extension, August 2000.

VINEYARD 29
VINEYARD IRRIGATION EXHIBIT



VINEYARD BLOCK AREAS

1. 0.66 Acres
2. 1.02 Acres
3. 0.39 Acres
4. 0.44 Acrea
5. 1.35 Acres
6. 0.59 Acres
7. 0.95 Acres

Total 5.40 Acres

\+ TOTAL WINERY PARCEL VINEYARD IRRIGATION = 4.45 ACRES

TOTAL WINERY PARCEL VINEYARD TO BE IRRIGATED WITH PROCESS WASTEWATER = 3.62 ACRES

TOTAL NEIGHBORING PARCEL VINEYARD TO BE IRRIGATED WITH PROCESS WASTEWATER = 0.95 ACRES

\+ TOTAL VINEYARD TO BE IRRIGATED WITH PROCESS WASTEWATER = 4.57 ACRES

COVER CROP TO BE IRRIGATED IN AREA OF BLOCK 5

GRAPHIC SCALE

180' 0 180'

(IN FEET)
1 INCH = 180 FT

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