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Onsite Wastewater Dispersal Feasibility Analysis
Duckhorn Vineyards Winery Major Modification
P19-00097-MOD

Duckhorn Vineyards Winery Use Permit Major Modification
P19-00097-MOD
Planning Commission Hearing – May 3, 2023

August 2022 - Revised
Job No. 13-14

BARTELT ENGINEERING

ONSITE WASTEWATER DISPERSAL FEASIBILITY STUDY FOR DUCKHORN VINEYARDS WINERY 1000 & 1098 LODI LANE, ST. HELENA, CA 94574 APN 022-130-010 (SFAP) & APN 022-100-033 (SFAP)

As required by Napa County Planning, Building and Environmental Services (PBES), this report outlines the design of an onsite wastewater treatment system (OWTS) for an existing winery with proposed improvements located at 1000 and 1098 Lodi Lane, St. Helena, CA 94574.

PROJECT DESCRIPTION

The 30.34± acre parcel is currently developed with an existing winery (fermentation buildings, barrel buildings, a hospitality building, and covered outdoor work areas), vineyards, access roads, parking lots, wells, agricultural buildings, and a residence. The existing winery is located on APN 022-130-010 (SFAP)[1], is 10.67± acres, and is planted with 4.06± acres of vineyard; the existing residence is on APN 022-100-033 (SFAP)[1], is 19.67± acres, and is planted with 10.15± acres of vineyard. The project proposes the demolition of four (4) winery buildings and the residence, the construction of a new production facility and an addition to the existing hospitality building, in addition to an increase in annual wine production. While the existing winery on APN 022-130-010 (SFAP) will remain and continue producing wine, the construction of a new production facility on APN 022-100-033 (SFAP) is proposed because it is the intent of this project to increase the total production capability from 160,000 to 300,000 gallons of wine per year. A reduction in vineyard area is anticipated as a result of the project. Refer to the Use Permit Drawings prepared by Bartelt Engineering for the details of the existing and proposed development conditions.

The approved number of 56 employees, which includes 45 full-time employees, five (5) part-time employees, and six (6) harvest/seasonal employees is proposed to remain constant; however, along with the proposed physical improvements and production increase described previously, the project proposes a modification to the winery's current visitation plan. The project proposes to increase both private tour and tasting without food and private tour and tasting with food appointments to a maximum number of 110 and 109 guests per day, respectively, with an average of 770 guests per week. The project also proposes to adjust the current marketing plan to offer 40 small private wine and food pairings each year for parties up to 25 guests with two (2) additional event staff and 200 small private tastings per year for groups of up to 20 guests. In addition, the marketing plan will be adjusted to accommodate 40 medium events per year for groups of up to 60 guests, one (1) auction event per year for groups of up to 250 guests, and three (3) large events per year for groups of up to 400 guests with additional staff for each event type of up to two (2), five (5), and eight (8), respectively.

[1] Separated for Assessment Purposes (SFAP).

Table 1 summarizes the approved and proposed staffing plan:

TABLE 1: STAFFING PLAN SUMMARY

Description	Number of Employees	Frequency
Full-time Employees	45	Daily
Part-time Employees	5	Daily
Seasonal Employees	6	Daily

Table 2 summarizes the proposed visitation and marketing plans:

TABLE 2: VISITATION AND MARKETING PLAN SUMMARY

Description	Number of Guests	Event Staff	Frequency
Private Tours & Tastings w/o Food	110 per day	n/a	Daily
Private Tours & Tastings w/ Food	109 per day	n/a	Daily
Private Wine & Food Pairings - Small Event	25 per event	2 per event	40 per year
Small Private Tasting	20 per event	0 per event	200 per year
Medium Event	60 per event	2 per event	40 per year
Auction Event	250 per event	5 per event	1 per year
Large Event	400 per event	8 per event	3 per year

As part of our services, representatives from Bartelt Engineering have reviewed the planned operational methods for the proposed winery expansion, reviewed the parcel files available by Napa County PBES, held conversations with Napa County PBES staff, and performed a reconnaissance of the site to view existing conditions. A site evaluation was conducted on APN 022-100-033 (SFAP) in November 2019 by Bartelt Engineering to evaluate the feasibility of providing a new onsite wastewater dispersal system to serve the proposed winery production and marketing modifications and is the basis of our preliminary wastewater design presented herein.

This study and the Use Permit Drawings are provided to demonstrate that the proposed production and marketing plan increases can feasibly be developed and that all wastewater can be adequately treated and dispersed onsite.

WASTEWATER ANALYSIS

The proposed OWTS will be sized based on the proposed wine production level, the employees, staff, and marketing plan of the winery. All plumbing fixtures in the proposed production facility and hospitality addition will be water saving fixtures per the California Plumbing Code (CPC) as adopted by the Napa County Building Division. Furthermore, any fixtures in the existing hospitality or winery buildings will be replaced with those that also incorporate water saving features.

Process Wastewater Flow

The winery production process wastewater (PW) flow rates for harvest and non-harvest seasons can be calculated as follows:

Harvest Peak Winery PW Flow =

$$\frac{300{,}000 \text{ gallons of wine}}{\text{year}} \times \frac{1.5 \text{ gallons of water}}{1 \text{ gallon of wine}} \times \frac{1 \text{ year}}{60 \text{ days of harvest}} = 7{,}500$$

Harvest Peak PW Flow = 7,500 gallons per day (gpd)

Non-Harvest Peak PW Flow =

$$\frac{300{,}000 \text{ gallons of wine}}{\text{year}} \times \frac{4.5 \text{ gallons of water}}{1 \text{ gallon of wine}} \times \frac{1 \text{ year}}{305 \text{ days of non-harvest}} = 4{,}427$$

Non-Harvest Peak PW Flow = 4,427 gpd

Sanitary Wastewater Flow

The sanitary wastewater (SW) generated from winery production and hospitality full-time employees, part-time employees, seasonal/harvest employees, guests, additional event staff, and food preparation can be itemized as follows:

Employees[2]:

- 45 Full-Time Employees x 15 gpd per employee = 675 gpd
- 5 Part-Time Employees x 15 gpd per employee = 75 gpd
- 6 Seasonal/Harvest Employees x 15 gpd per employee = 90 gpd

Guests:

- Private Tours and Tasting without Food:
  - (110 guests per day) x (3 gpd per guest) [3] = 330 gpd
- Private Tours and Tasting with Food:
  - (109 guests per day) x (3 gpd per guest) [3] = 327 gpd
  - (109 guests per day) x (2 gpd per guest) [4] = 218 gpd

[2] For the purpose of calculating SW, it is estimated that 24 of the winery employees will be working at the new production facility on APN 022-100-033 on & off throughout the year.

[3] Wastewater generation rate per Napa County PBES regulations

[4] Kitchen wastewater generation rate is 2 gpd per guest for all events except for the Medium Event and Auction Event which is 5 and 8 gpd per guest, respectively.

- Private Wine & Food Pairings - Small Event:
  - (25 guests per event) x (3 gpd per guest) [3] = 75 gpd
  - (25 guests per event) x (2 gpd per guest) [4] = 50 gpd
  - (2 event staff) x (15 gpd per event staff) = 30 gpd
- Small Private Tasting:
  - (20 guests per event) x (3 gpd per guest) [3] = 60 gpd
  - (20 guests per event) x (2 gpd per guest) [4] = 40 gpd
- Medium Event:
  - (60 guests per event) x (3 gpd per guest) [3] = 180 gpd
  - (60 guests per event) x (5 gpd per guest) [4] = 300 gpd
  - (2 event staff) x (15 gpd per event staff) = 30 gpd
- Auction Event:
  - (250 guests per event) x (3 gpd per guest) x (75%) [3,5] = 563 gpd
  - (250 guests per event) x (8 gpd per guest) [4] = 2,000 gpd
  - (5 event staff) x (15 gpd per event staff) = 75 gpd
- Large Event:
  - (400 guests per event) x (3 gpd per guest) x (50%) [3,5] = 600 gpd
  - (8 event staff) x (15 gpd per event staff) = 120 gpd

> ***Note:*** *This feasibility study assumes that Estate House restrooms are used by 75% and 50% of guests during an auction event and large event, respectively. It also assumes that offsite meal preparation and catering services are utilized during all large events. Finally, it is assumed that all event staff utilize the Estate House restrooms during an event.*

Total Harvest Season and Non-Harvest Season Peak Sanitary Wastewater Flow

The total proposed harvest season peak SW flow is the combination of both production facilities and hospitality SW flows, during the months of August through November (harvest). The total proposed non-harvest season peak SW flow is the combination of both of the production facilities and hospitality SW flows, during the months of December through July (non-harvest).

Table 3 uses the marketing schedule to calculate the SW flows generated by employees and guests during daily event sequences in harvest and non-harvest seasons. Wastewater flows in the same column indicate which appointments and events may occur on the same day.

[5] Percentage of restroom utilization by guests

TABLE 3: HARVEST AND NON-HARVEST SEASONS' DAILY SANITARY WASTEWATER FLOWS									
	Daily Occurrence								
	Harvest			Non-Harvest					
Employees	840	840	840	750	750	750	750	750	750
Tours & Tastings w/out Food	330	330	330	330	330	330	330	0	0
Tours and Tastings w/ Food	545	545	545	545	545	545	545	0	0
Private Wine & Food Pairings - Small Event	155	155	155	155	155	155	0	0	0
Medium Event	0	510	510	0	510	510	510	0	0
Large Event	0	0	0	0	0	0	0	720	0
Small Private Tasting	0	0	100	0	0	100	100	0	0
Auction Event	0	0	0	0	0	0	0	0	2,638
Total Flow (gpd)	1,870	2,380	2,480	1,780	2,290	2,390	2,235	1,470	3,388

Table 3 shows that the greatest SW flow in the harvest season is generated during a typical staffing day with Tours & Tasting, Private Wine & Food Pairings, a Medium Event, and Small Private Tasting event and in the non-harvest season during a typical staffing day and an Auction Event.

Design Wastewater Flows

The greatest practical harvest and non-harvest season peak process and sanitary wastewater flows are summarized in the table below:

TABLE 4: HARVEST AND NON-HARVEST SEASONS' PEAK DAILY FLOW SUMMARY		
Wastewater Source	**Harvest** (gpd)	**Non-Harvest** (gpd)
Process Wastewater	7,500	4,427
Sanitary Wastewater	2,480	3,388

The greatest PW daily flow occurs during the harvest season while the greatest SW daily flow occurs during the non-harvest season. Under the proposed wastewater treatment and dispersal methods, each wastewater stream is addressed independently since the goal for

the proposed condition is to disperse treated PW as irrigation to the vineyard and to disperse the SW using a subsurface drip system.

WASTEWATER TREATMENT AND DISPERSAL METHODS

Existing Wastewater Systems

The existing winery dispersal system is located on APN 022-130-010 (SFAP) and consists of a combined process and sanitary wastewater underground conventional sewage treatment system designed by Summit Engineering in September 1994. The existing system uses a combination of process and sanitary wastewater septic tanks, a grease interceptor tank, and a lift station to collect wastewater from the production facility and hospitality building and deliver it to the leach field for treatment and dispersal. This existing system is proposed to be removed in its entirety.

Proposed Wastewater Treatment and Dispersal Methods

Separate wastewater conveyance, treatment, and dispersal systems are proposed. Process wastewater would be pretreated then surface applied as vineyard irrigation water. Sanitary wastewater would also be pretreated then dispersed via a subsurface drip field.

Process Wastewater Pretreatment System

As summarized in Table 4 above, the separate process and sanitary wastewater systems will need to disperse a peak daily flow of 7,500 and 3,388 gpd, respectively. Both the existing and proposed production facilities' process wastewater conveyance systems will be designed and/or modified to consist of several steps. The floors of both the proposed and the existing production facility (fermentation building, barrel buildings, and covered work areas) will be constructed and/or modified so that they slope to allow PW to be collected in trench drains and floor drains. The drains will be installed so that screened baskets can be inserted to collect a majority of the larger debris. PW in the trench drains and floor drains will gravity flow to new fiberglass reinforced plastic (FRP) septic tanks equipped with effluent filters for solids removal.

A pump station will be necessary to transfer collected PW from the each of the production facilities (existing and proposed) to the pretreatment system which will be located just north of the proposed production facility on APN 022-100-033 (SFAP). This includes a proposed lift station at the existing production facility which will need to pump the PW under the Napa River and to the proposed production facility on APN 022-100-033 (SFAP). Construction of this forcemain will be a directional bore under the Napa River and along vineyard avenues. Examples of the pretreatment system to be constructed at the proposed production facility on APN 022-100-033 (SFAP) include (but are not limited to) Bio-Microbics, Cloacina, or Lyve Systems.

The pretreatment system selected for installation at the proposed production facility is anticipated to include an equalization (EQ) tank, screening equipment, pH adjustment system, a primary treatment tank equipped with an aeration system, and a membrane or media filtration system. The proposed PW pretreatment system must be capable of treating PW to an acceptable level for surface drip irrigation in vineyard areas per jurisdictional requirements. From the pretreatment system, PW effluent is proposed to be pumped to storage tanks prior to vineyard irrigation.

Process Wastewater Surface Drip Irrigation

A PW flow balance was determined by estimating the monthly PW produced (see attached Table I), the average irrigation flow based on estimated vineyard irrigation demands (see attached Table II), and sizing a storage tank(s) to be able to store excess treated PW effluent until it can be properly dispersed via surface drip irrigation throughout the vineyard on APN 022-100-033 (SFAP) (see attached Table III).

Based on the PW flow balance, the storage tank(s) should have a minimum combined volume of 300,000 gallons (see attached Table III) to provide temporary storage of treated effluent through winter months when surface drip land application is minimal and to equalize differences between the wastewater generation rate and the irrigation application rate. It is assumed that available groundwater in the root zone is depleted by April and that irrigation is primarily applied to the vines for the months of April through November. A small irrigation event is assumed to occur in March to help manage storage volumes. In the months where the irrigation demand exceeds the amount of treated effluent that is available for irrigation, it is assumed that the remaining irrigation requirement for the vines is not met or that another water source (one of the existing onsite wells on APN 022-100-033 (SFAP)) is used to supply additional irrigation water.

Vineyard areas where treated PW is dispersed through surface drip irrigation is based on 6.78± acres or approximately 7,385± grape vines located on the same parcel as the proposed production facility (APN 022-100-033 (SFAP)). The area for surface drip irrigation will be verified once all dispersal field setbacks are determined and a final vineyard irrigation plan has been developed. Furthermore, all surface drip dispersal field areas will be labeled with signage indicating the use of treated effluent for irrigation in accordance with PBES standards.

Sanitary Wastewater Subsurface Drip Dispersal Field with Pretreatment

As summarized in Table 4, the SW dispersal field is proposed to have a peak daily flow of 3,388 gpd. Both the existing and proposed production facilities and the hospitality buildings SW will follow a similar wastewater collection and transfer scheme as the afore discussed PW systems. SW at each facility would gravity flow to septic tanks fitted with filters for solids removal. As for the hospitality building on APN 022-130-010 (SFAP), kitchen waste would gravity flow into a grease interceptor prior to entering a septic tank. Septic tank effluent would then gravity flow to a lift station on APN 022-130-010 (SFAP) where it is pumped under the Napa River via a directional bore to a recirculation/dose tank located at the proposed production facility on APN 022-100-033 (SFAP). The proposed production facility's SW would gravity flow to a nearby septic tank (on APN 022-100-033 (SFAP)), and then this SW effluent would gravity flow to the same recirculation/dose tank that SW from the existing winery and hospitality building are pumped to. The combined SW from the existing and proposed wineries would be pretreated through an Orenco AdvanTex AX Treatment System (or approved equal). Pretreated effluent is proposed to be dispersed through a subsurface drip field by means of a timed-dose pumping system.

Based on the site evaluation performed by Bartelt Engineering on November 19, 2019, in an area to the east of the proposed production facility on APN 022-100-033 (SFAP) the results of Test Pits #1 thru #12 are acceptable for subsurface drip primary and replacement dispersal fields. The site evaluation determined the soil in the area of the test pits to be Sandy clay loam with an acceptable depth of 62 to 84 inches. For Sandy clay loam type soil, Napa

County and GeoFlow Incorporated recommend a soil hydraulic loading rate[6,7] 0.60 gal/sf/day. Napa County Standards require a minimum of 24 inches of acceptable soil below the bottom of the drip lines with a minimum of six (6) inches of acceptable soil cover material placed over the drip lines.

The minimum required primary area for the subsurface drip field is calculated below:

$$\text{Subsurface Drip Field Area} = \left(\frac{3{,}388\ \frac{\text{gal}}{\text{day}}}{0.6\ \frac{\text{gal}}{\text{day/ft}^2}}\right) = 5{,}647\ \text{ft}^2\ ;\ \text{use } 6{,}050\ \text{ft}^2$$

The recommended subsurface drip field contains 48 driplines each 63 feet long. Based on site slopes less than 5% in the primary and replacement areas, two (2) foot spacing is recommended between driplines per Napa County Standards. The total recommended SW primary area is 6,050 square feet and the 200% SW replacement area is 12,100 square feet.

WASTEWATER TREATMENT TANK SIZING

Grease Interceptor

Meal preparation is proposed to occur in the existing hospitality building's proposed commercial kitchen during all events except during a large event. Kitchen Waste (KW) consisting primarily of fats, oils, and grease (FOG) in addition to organic material would be generated during these events and require collection, retention, and onsite disposal. PBES regulations require commercial kitchen fixtures be plumbed to a grease interceptor (GI) when an onsite wastewater treatment system is implemented.

During an Auction Event, the kitchen is assumed to prepare at most one (1) meal per guest per hour with multi-service utensils. Hours of operation for the kitchen are also assumed to be less than eight (8) hours per day. The grease interceptor tank would be sized per the following formula[8]:

Grease Interceptor (KW flows only) = (Peak number of meals per hour) x (Wastewater flowrate) x (Retention time) x (Storage factor)

GI (KW flows only) = (250 guests x 1 meals/hour) x (8 gpd per meal) x (2.5) x (1)
= 5,000 gallons; 5,000 gallons recommended

Septic Tank(s)

The proposed septic tank(s) are sized to provide a minimum of three (3) days of hydraulic retention time during peak wastewater flows. The septic tank(s) would be equipped with an effluent filter to aid in the reduction of Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD) in the wastewater effluent stream. Below is a breakdown of the minimum recommended septic tank volumes for the proposed project:

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[6]Hydraulic loading rate is based on *Table III-2 Soil Hydraulic Loading Rates* from Napa County Onsite Wastewater Treatment Systems (OWTS) Technical Standards, Final Draft.

[7] Referenced from *Table 1 Drip Loading Rates Considering Soils Structure* of The Subsurface Drip Dispersal and Reuse Design, Installation and Maintenance Guidelines prepared by GeoFlow Incorporated.

[8] The grease interceptor sizing formula, retention time, and storage factor are based on Napa County's Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems

Production Facility and Hospitality on APN 022-130-010

SW flows = 3 days x 3,388 gpd
= 10,164 gallons; 12,000 gallons recommended

Production Facility on APN 022-100-033 (24 employees x 15 gpd/employee = 360 gpd)

SW flows = 3 days x 360 gpd
= 1,080 gallons; 1,500 gallons recommended

Recirculation Tank

The proposed recirculation tank is sized to provide a minimum of one (1) day of hydraulic retention time during peak wastewater flows. Below is a summary of the recommended tank volume:

SW flows = 1 day x 3,388 gpd
= 3,388 gallons; 4,000 gallons recommended

Subsurface Drip Dosing Tank

The proposed dosing tank is sized to provide a minimum of one and a half (1.5) days of hydraulic retention time during peak wastewater flows. Below is a summary of the recommended tank volume:

SW flows = 1.5 days x 3,388 gpd
= 5,082 gallons, 6,000 gallons recommended

Process Wastewater Equalization Tank

The winery PW pretreatment system is proposed to be preceded by an EQ tank for buffering of peak flows. The proposed EQ tank is sized to provide a minimum of three (3) days of hydraulic retention time. A fine bubble diffused air system may be provided to keep PW adequately mixed prior to entering the primary treatment tank.

PW flows = 3 days x 7,500 gpd
= 22,500 gallons, 30,000 gallons recommended

Operation and Maintenance

Per Napa County requirements, all Alternative Sewage Treatment Systems (ASTS), including winery wastewater systems with pretreatment, are required to have a Service Provider. Duckhorn Vineyards Winery currently has a Service Provider assigned to the existing system who will continue to provide services prior to operation and final approval of the proposed wastewater treatment and dispersal system.

General Waste Discharge Requirements for Winery Process Water

Per the State of California Regional Water Quality Control Board – General Waste Discharge Requirements for Winery Process Water (General Order) and Napa County adoption of the General Order, Duckhorn Vineyards Winery will be required to enroll under the General Order and comply with the requirements administered by the Regional Water Quality Control Board and/or Napa County for the treatment and dispersal of winery process water.

Conclusions

Process and sanitary wastewater generated as a result of the proposed winery expansion can feasibly be treated and dispersed onsite in accordance with Napa County PBES standards.

Full design calculations and construction plans will be completed after approval of the Use Permit Modification under consideration.

Attachments

Proposed Wastewater Treatment Diagram

Table I – Process Wastewater Flow

Table II – Process Wastewater Irrigation

Table III – Process Wastewater Irrigation Storage Tank Balance

Site Evaluation

REFERENCES

California Onsite Wastewater Association (COWA). "Pumping and Pressure Distribution Systems." May 1998.

Napa County Department of Environmental Management. "Design, Construction and Installation of Alternative Sewage Treatment Systems." April 12, 2010.

Telsco Industries. "Turf Irrigation Manual." By James A. Watkins. 1987.

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U.S. Environmental Protection Agency. "Onsite Wastewater Treatment Systems Manual." February 2002.

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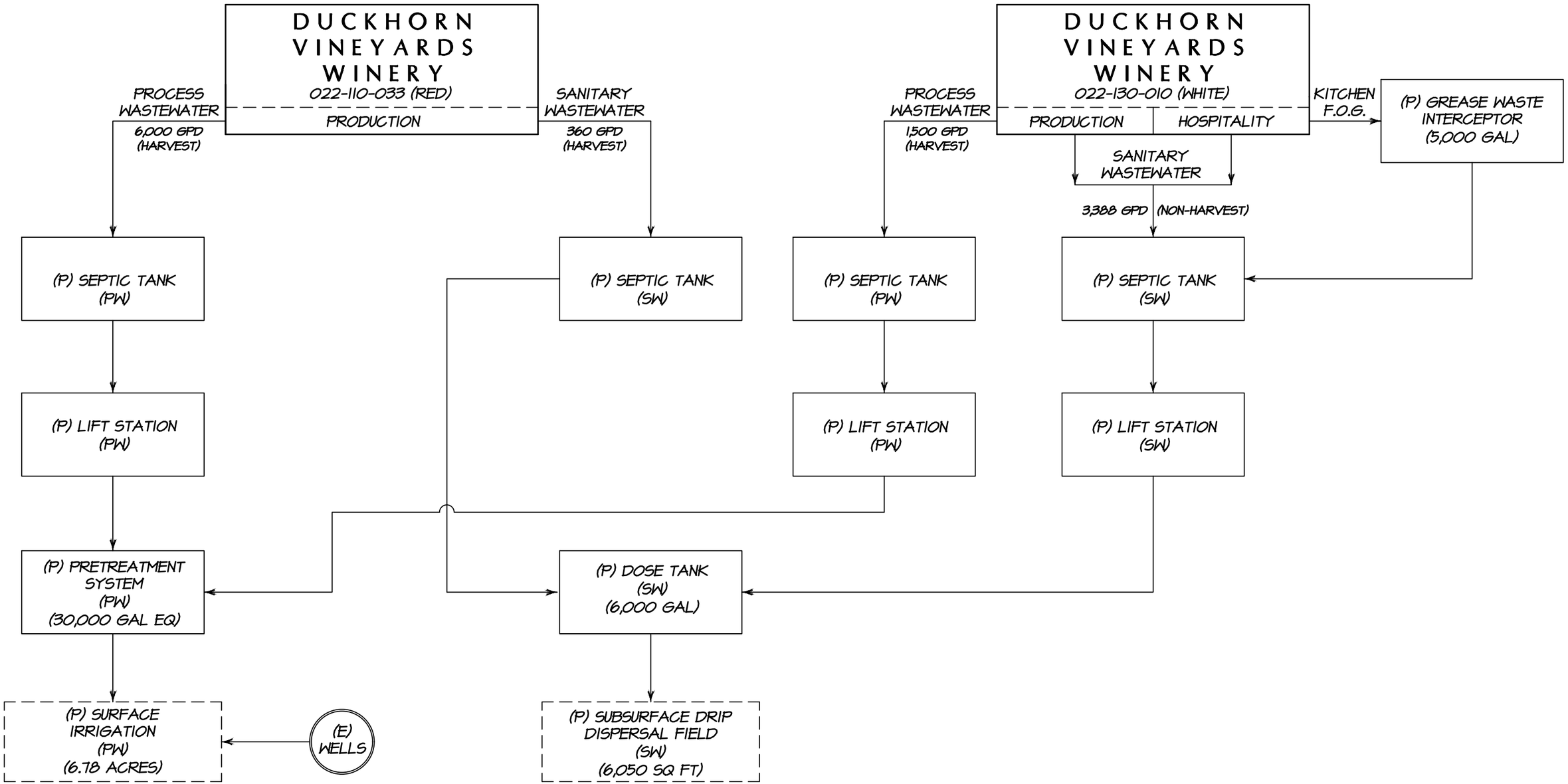

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PROPOSED WASTEWATER TREATMENT DIAGRAM

NO SCALE

Duckhorn Vineyards Winery
1000 & 1098 Lodi Lane
St. Helena, CA 94574
APN 022-130-010, 022-100-033 & -034
Job No. 13-14
August 2022
Sheet 1 of 1

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Process Wastewater Flow
Table I

Total annual wine production (gallons):	**300,000**
Annual water usage per gallon of wine (gallons):	**6**
Annual process wastewater flow (gallons):	1,800,000
Annual Average process wastewater flow (gpd):	4,932
Harvest water usage per gallon of wine (gallons):	1.5
Length of Harvest (days):	60
Average Harvest process wastewater flow (gallons per day):	**7,500**
Non-harvest water usage per gallon of wine (gallons):	4.5
Length of Non-Harvest (days):	305
Average Non-harvest process wastewater flow (gallons per day):	**4,427**

MONTHLY PROCESS WASTEWATER FLOW (gallons/month):

ESTIMATED PROCESS WASTEWATER FLOW		
Month	**Percent**	**Wastewater Flow**
September	**14.00%**	**252,000**
October	**14.00%**	**252,000**
November (End of Harvest Season)	**14.00%**	**252,000**
December	**5.50%**	**99,000**
January	**5.50%**	**99,000**
February	**5.50%**	**99,000**
March	**5.50%**	**99,000**
April	**5.50%**	**99,000**
May	**5.50%**	**99,000**
June	**5.50%**	**99,000**
July	**5.50%**	**99,000**
August (Start of Harvest Season)	**14.00%**	**252,000**
TOTALS	100.0%	1,800,000

Notes:
> Wastewater monthly proportioning is based on general winery operations and a 60 day harvest period
> The annual water usage per gallon of wine is assumed to be 6 gallons

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Vineyard Process Wastewater Irrigation
Table II

Vineyard area (acres)	6.78
Row width (feet):	8.0
Vine spacing (feet):	5.0
Total number of irrigated vines:	7,385
Seasonal irrigation (June - September)	
Seasonal irrigation per vine (gallons/season):	**150**

ESTIMATED VINEYARD PROCESS WASTEWATER IRRIGATION				
	Estimated			
Month	**Seasonal Percent (%)**	**Seasonal Irrigation (gal/vine)**	**Non-Seasonal Irrigation[1] (gal/vine)**	**Total Irrigation (gallons)**
September	10.0%	15.0		110,775
October	23.0%	34.5		254,783
November[1]	0.0%		30	221,550
December[1]	0.0%		10	73,850
January[1]	0.0%		0	0
February[1]	0.0%		0	0
March[1]	0.0%		15	110,775
April	2.0%	3.0		22,155
May	15.0%	22.5		166,163
June	15.0%	22.5		166,163
July	20.0%	30.0		221,550
August	15.0%	22.5		166,163
TOTAL	100.0%	150.0	55.0	**1,513,925**
				4.65 acre-feet

[1] *Total non-seasonal irrigation =*
*= (vineyard area) * (43,560 sq.-ft./acre) * (depth of irrigation/12 in./ft.) * (7.48 gal./cu.-ft.)*

Note:

> Available vineyard area subject to proposed treated process wastewater irrigation limited to APN 022-100-033.

> Existing vineyard area and corresponding vine number reduction is a result of proposed production facility, wastewater dispersal field, and driveway improvements on APN 022-100-033.

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Process Wastewater Irrigation Storage Tank Balance
Table III

ESTIMATED PROCESS WASTEWATER IRRIGATION TANK BALANCE				
Month	**Beginning Balance (gallons)**	**Wastewater Flow (gallons)**	**Vineyard Irrigation (gallons)**	**Tank Volume (gallons)**
September	117,183	252,000	110,775	258,408
October	258,408	252,000	254,783	255,625
November	255,625	252,000	221,550	286,075
December	0	99,000	73,850	25,150
January	25,150	99,000	0	124,150
February	124,150	99,000	0	223,150
March	223,150	99,000	110,775	211,375
April	211,375	99,000	22,155	288,220
May	288,220	99,000	166,163	221,058
June	221,058	99,000	166,163	153,895
July	153,895	99,000	221,550	31,345
August	31,345	252,000	166,163	117,183
	TOTAL	**1,800,000**	**1,513,925**	
	Average	**150,000**	**126,160**	**182,969**

Recommended Tank Storage (gallons): 300,000
Recommended Tank Storage (acre-feet): 0.92

Note:
> Water balance calculations assume storage tank is empty at the beginning of December due to post-harvest irrigation.

> In months when the irrigation demand exceeds the beginning balance plus the wastewater flow it is assumed that the full irrigation demand is not met or that the additional irrigation water is supplied from an alternate source (ie. onsite well).

Napa County Department of
Environmental Management

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 #: E19-00535

APN: 022-100-033 (SFAP)

(County Use Only)
Reviewed by: Date:

PLEASE PRINT OR TYPE ALL INFORMATION

Property Owner Duckhorn Wine Company	☒ New Construction ☐ Addition ☐ Remodel ☐ Relocation ☐ Other:
Property Owner Mailing Address 1000 Lodi Lane	☐ Residential - # of Bedrooms: Design Flow : gpd
City State Zip St. Helena, CA 94574	☒ Commercial – Type: Winery Sanitary Waste: 2,500 gpd Process Waste: 7,500 gpd
Site Address/Location 1098 Lodi Lane, St. Helena, CA	☐ Other: Sanitary Waste: gpd Process Waste: gpd

Evaluation Conducted By:

Company Name Bartelt Engineering	Evaluator's Name Michael Grimes, P.E.	Signature (Civil Engineer, R.E.H.S., Geologist, Soil Scientist) Michael G. Grimes
Mailing Address: 1303 Jefferson Street, 200 B		Telephone Number (707) 258-1301
City State Zip Napa CA 94559		Date Evaluation Conducted November 19, 2019

Primary Area See below	Expansion Area See below
Acceptable Soil Depth: 63 in. Test pits #: 1-6	Acceptable Soil Depth: 64 in. Test pits #: 7-12
Soil Application Rate (gal. /sq. ft. /day): 0.6	Soil Application Rate (gal. /sq. ft. /day): 0.6
System Type(s) Recommended: Subsurface Drip	System Type(s) Recommended: Subsurface Drip
Slope: <5 %. Distance to nearest water source: 100+ feet	Slope: <5 %. Distance to nearest water source: 100+ feet
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)
Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)	Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)

Site constraints/Recommendations:

A site evaluation was conducted on November 19, 2019 by Paul Bartelt, Michael Grimes, and Nick Warnock of Bartelt Engineering. Test pits were excavated by Tony Tregeza of FBC Construction using a John Deere 35G mini-excavator with a 24 inch bucket. Darell Choate of Napa County Environmental Health visited the site to inspect soil conditions. Test pits #1 - #12 showed suitable soil for the installation of an Alternative Sewage Treatment System (ASTS) Subsurface Drip dispersal field within the area tested with required reserve area. All ASTSs currently allowed by the Napa County Department of Environmental Management could be installed based on the soil type, Bouyoucos Hydrometry test results, and test pit depths and locations; however, Bartelt Engineering recommends the installation of a subsurface drip system after considering the proposed project's wastewater volume rate.

Test Pit # 1 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-63*	N/A	0-15	SCL	SAB	H, VH	FRB, F	SS	CVF, FF	FVF, FF, FM	None

Slope = 1-2 %. Acceptable soil depth observed: 63 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 63 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated December 6, 2019.

Test Pit # 2 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-48*		0-15	SCL	SAB	H	F	SS	CVF, CF, FM	FVF, FF	
48-70*	G	0-15	SCL	SAB	SH	FRB	Not Sieved	CVF, CF, FM	None	None

Slope = 1-2 %. Acceptable soil depth observed: 70 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 70 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated December 6, 2019.

Test Pit # 3

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-48		0-15	SCL	SAB	H	F	SS	CVF, CF, FM	FVF, FF	
48-68	G	0-15	SCL	SAB	SH	FRB	Not Sieved	CVF, CF, FM	None	None

Slope = 1-2 %. Acceptable soil depth observed: 68 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 68 inches deep.
No Groundwater observed.

Test Pit # 4

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-64		0-15	SCL	SAB	H, VH	FRB	SS	CVF, CF, CM	FVF	None

Slope = 1-2 %. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 64 inches deep.
No groundwater observed.

Test Pit # 5

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-64		0-15	SCL	SAB	H	F, FRB	SS	CVF, CF	FVF, FF	None

Slope = 1-2%. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 64 inches deep.
No groundwater observed.

Test Pit # 6 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-67*		0-15	SCL	SAB	SH	VFRB, FRB	SS		FVF, FF, FC	None

Slope = 1-2 %. Acceptable soil depth observed: 67 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 67 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated December 6, 2019.

Test Pit # 7

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-64		0-15	SCL	SSB	SH	VFRB	SS	CVF, FF	FVF, FF, FC	None

Slope = 0-1 %. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 64 inches deep.
No groundwater observed.

Test Pit # 8 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-64*		0-15	SCL	SSB	SH	F, FRB	SS	CVF, CF	FVF, FF	None

Slope = 0-1 %. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 64 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated December 6, 2019.

Test Pit # 9

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-62		0-15	SCL	SSB	SH	VFRB	SS	CVF, CF	FVF, FF	None

Slope = 1-2 %. Acceptable soil depth observed: 62 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 62 inches deep.
No groundwater observed.

Test Pit # 10 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-64*		0-15	SCL	SAB	H	FRB	SS	MVF, CF	FVF, FF	None

Slope = 1-2 %. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 64 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated December 6, 2019.

Test Pit # 11

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-64		0-15	SCL	SAB	SH	VFRB	SS	MVF, CF	FF, FVF	None

Slope = 1-2 %. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 64 inches deep.
No groundwater observed.

Test Pit # 12

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-84		0-15	SCL	SAB	SH	FRB	SS	FVF, FF	FF, FVF	None

Slope = 1-2 %. Acceptable soil depth observed: 84 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.8 gal/sf/day for ASTS
PTE 1.0 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 84 inches deep.
No groundwater observed.

Table of 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 **C**=Cemented	**L**=Loose **S**=Soft **SH**=Slighty 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	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **VF**=Very Fine **F**=Fine **M**=Medium **C**=Coarse **VC**=Very Course	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **F**=Fine **M**=Medium **C**=Coarse **VC**=Very Course **ExC**=Extremely Coarse **Contrast:** **Ft**=Faint **D**=Distinct **P**=Prominent

Attach additional sheets as needed

Alternative Sewage Treatment System Soil Application Rates

TEXTURE	STRUCTURE		APPLICATION RATE (Gal/ft^2 /day)	
	Shape	Grade	STE[1]	PTE[1,2]
Coarse Sand, Sand, Loamy Coarse Sand	Single grain	Structureless	1.0	1.2
Fine Sand, Loamy Fine Sand	Single grain	Structureless	0.6	1.0
Sandy Loam, Loamy Sand	Massive	Structureless	0.35	0.5
	Platy	Weak	0.35	0.5
	Prismatic, blocky, granular	Weak	0.5	0.75
		Moderate, Strong	0.8	1.0
Loam, Silt Loam, Sandy Clay Loam, Fine Sandy Loam	Massive	Structureless		
	Platy	Weak, moderate, strong		
	Prismatic, blocky, granular	Weak, moderate	0.5	0.75
		Strong	0.8	1.0
Sandy Clay, Silty Clay Loam, Clay Loam	Massive	Structureless		
	Platy	Weak, moderate, strong		
	Prismatic, blocky, granular	Weak, moderate	0.35	0.5
		Strong	0.6	0.75
Clay, Silty Clay	Massive	Structureless		
	Platy	Weak, moderate, strong		
	Prismatic, blocky, granular	Weak		
		Moderate, strong	0.2	0.25

1. See Table 1 in the Design, Construction and Installation of Alternative Sewage Treatment Systems.
2. A higher application rate for pretreated effluent may only be used when pretreatment is not used for one foot of vertical separation credit.

MINIMUM SURFACE AREA GUIDELINES TO DISPOSE OF 100 GPD OF SECONDARY TREATED EFFLUENT FOR SUBSURFACE DRIP DISPERSAL SYSTEMS

		Soil Absorption Rates		Design Application Rate (Gal/ft^2/day)	Total Area Required Sq. ft./100 gallons per day
Soil Class	Soil Type	Est. Soil Perc. Rate minutes/inch	Hydraulic Conductivity inches/hour		
I	Coarse sand	1 – 5	>2	1.400	71.5
I	Fine sand	5 – 10	1.5 – 2	1.200	83.3
II	Sandy loam	10 – 20	1.0 – 1.5	1.000	100.0
II	Loam	20 – 30	0.75 – 1.0	0.700	143.0
III	Clay loam	30 – 45	0.5 – 0.75	0.600	167.0
III	Silt - clay loam	45 – 60	0.3 – 0.5	0.400	250.0
IV	Clay non-swell	60 – 90	0.2 – 0.3	0.200	500.0
IV	Clay - swell	90 – 120	0.1 – 0.2	0.100	1000.0

1. For design purpose, the “Soil Type” category to be used in the above table shall be based on the most restrictive soil type encountered within two feet below the bottom of the drip line.
2. Dispersal field area calculation: Total square feet area of dispersal field = Design flow divided by loading rate.

Conventional Sewage Treatment System Soil Application Rates

TEXTURE	STRUCTURE		APPLICATION RATE (Gal/ft^2 /day)
	Shape	Grade	STE
Coarse Sand, Sand, Loamy Coarse Sand	Single grain	Structureless	Prohibited
Sandy Loam, Loamy Sand	Massive	Structureless	Prohibited
	Platy	Weak, mod, strong	Prohibited
	Prismatic, blocky, granular	Weak	0.33
		Moderate, strong	0.5
Loam, Silt Loam, Sandy Clay Loam, Fine Sandy Loam	Massive	Structureless	Prohibited
	Platy	Weak, mod, strong	Prohibited
	Prismatic, blocky, granular	Weak	0.25
		Moderate, Strong	0.33
Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, moderate, strong	Prohibited
	Prismatic, blocky, granular	Weak, moderate	0.25
		Strong	0.33
Sandy Clay, Silty Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, moderate, strong	Prohibited
	Prismatic, blocky, granular	Weak, moderate	Prohibited
		Strong	0.25
Clay, Silty Clay	Massive	Structureless	Prohibited
	Platy	Weak, moderate, strong	Prohibited
	Prismatic, blocky, granular	Weak	Prohibited
		Moderate, strong	Prohibited

CONVENTIONAL SEWAGE TREATMENT SYSTEM SOIL APPLICATION RATES BASED ON PERCOLATION RATES	
Percolation Rate (mpi)	Application Rate (STE)
< 5 MPI	Prohibited
5 to 10 MPI	0.5
10-20 MPI	0.33
20-60 MPI	0.25
> 60 MPI	Prohibited

TABLE 1

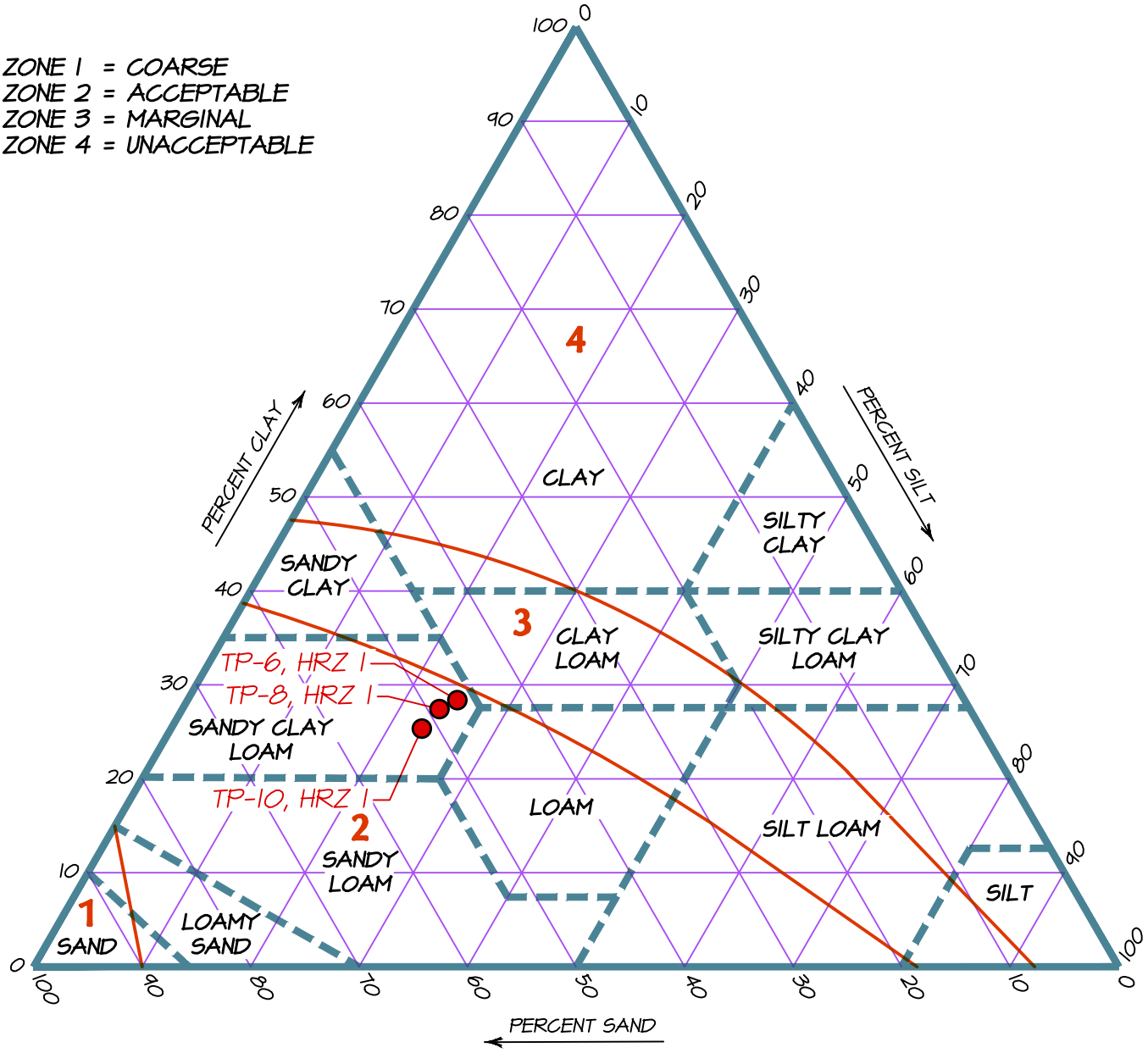
DRIP LOADING RATES CONSIDERING SOIL STRUCTURE.

Table 1 is taken from the State of Wisconsin code and was prepared by Jerry Tyler.
Provided for guidelines and budgeting purposes. Refer to your local regulations and qualified soil scientists to determine best loading rates.

Soil Textures	**Soil Structure**	Maximum Monthly Average **BOD_5<30mg/L TSS<30mg/L** (gallons/ft^2/day)	Maximum Monthly Average **BOD_5>30mg/L TSS>30mg/L** (gallons/ft^2/day)
Course sand or coarser	N/A	1.6	0.4
Loamy coarse sand	N/A	1.4	0.3
Sand	N/A	1.2	0.3
Loamy sand	Weak to strong	1.2	0.3
Loamy sand	Massive	0.7	0.2
Fine sand	Moderate to strong	0.9	0.3
Fine sand	Massive or weak	0.6	0.2
Loamy fine sand	Moderate to strong	0.9	0.3
Loamy fine sand	Massive or weak	0.6	0.2
Very fine sand	N/A	0.6	0.2
Loamy very fine sand	N/A	0.6	0.2
Sandy loam	Moderate to strong	0.9	0.2
Sandy loam	Weak, weak platy	0.6	0.2
Sandy loam	Massive	0.5	0.1
Loam	Moderate to strong	0.8	0.2
Loam	Weak, weak platy	0.6	0.2
Loam	Massive	0.5	0.1
Silt loam	Moderate to strong	0.8	0.2
Silt loam	Weak, weak platy	0.3	0.1
Silt loam	Massive	0.2	0.0
Sandy clay loam	Moderate to strong	0.6	0.2
Sandy clay loam	Weak, weak platy	0.3	0.1
Sandy clay loam	Massive	0.0	0.0
Clay loam	Moderate to strong	0.6	0.2
Clay loam	Weak, weak platy	0.3	0.1
Clay loam	Massive	0.0	0.0
Silty clay loam	Moderate to strong	0.6	0.2
Silty clay loam	Weak, weak platy	0.3	0.1
Silty clay loam	Massive	0.0	0.0
Sandy clay	Moderate to strong	0.3	0.1
Sandy clay	Massive to weak	0.0	0.0
Clay	Moderate to strong	0.3	0.1
Clay	Massive to weak	0.0	0.0
Silty clay	Moderate to strong	0.3	0.1
Silty clay	Massive to weak	0.0	0.0

SOIL TEXTURE ANALYSIS CHART
BY BOUYOUCOS HYDROMETER METHOD

ZONE 1 = COARSE
ZONE 2 = ACCEPTABLE
ZONE 3 = MARGINAL
ZONE 4 = UNACCEPTABLE



INSTRUCTIONS:

1. PLOT TEXTURE ON TRIANGLE BASED ON PERCENT SAND, SILT AND CLAY AS DETERMINED BY HYDROMETER ANALYSIS.
2. ADJUST FOR COARSE FRAGMENTS BY MOVING THE PLOTTED POINT IN THE SAND DIRECTION AN ADDITIONAL 2% FOR EACH 10% (BY VOLUME) OF FRAGMENTS GREATER THAN 2mm IN DIAMETER.
3. ADJUST FOR COMPACTNESS OF SOIL BY MOVING THE PLOTTED POINT IN THE CLAY DIRECTION AN ADDITIONAL 15% FOR SOILS HAVING A BULK-DENSITY GREATER THAN 1.7gm/cc.

NOTE:

FOR SOILS FALLING IN SAND, LOAMY SAND OR SANDY LOAM CLASSIFICATION, A BULK DENSITY ANALYSIS WILL GENERALLY NOT AFFECT SUITABILITY AND ANALYSIS IS NOT NECESSARY.

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Duckhorn Vineyards Winery
1098 Lodi Lane
Saint Helena, CA 94574
APN 022-100-033 (SFAP)

Job No. 13-14 November 2019

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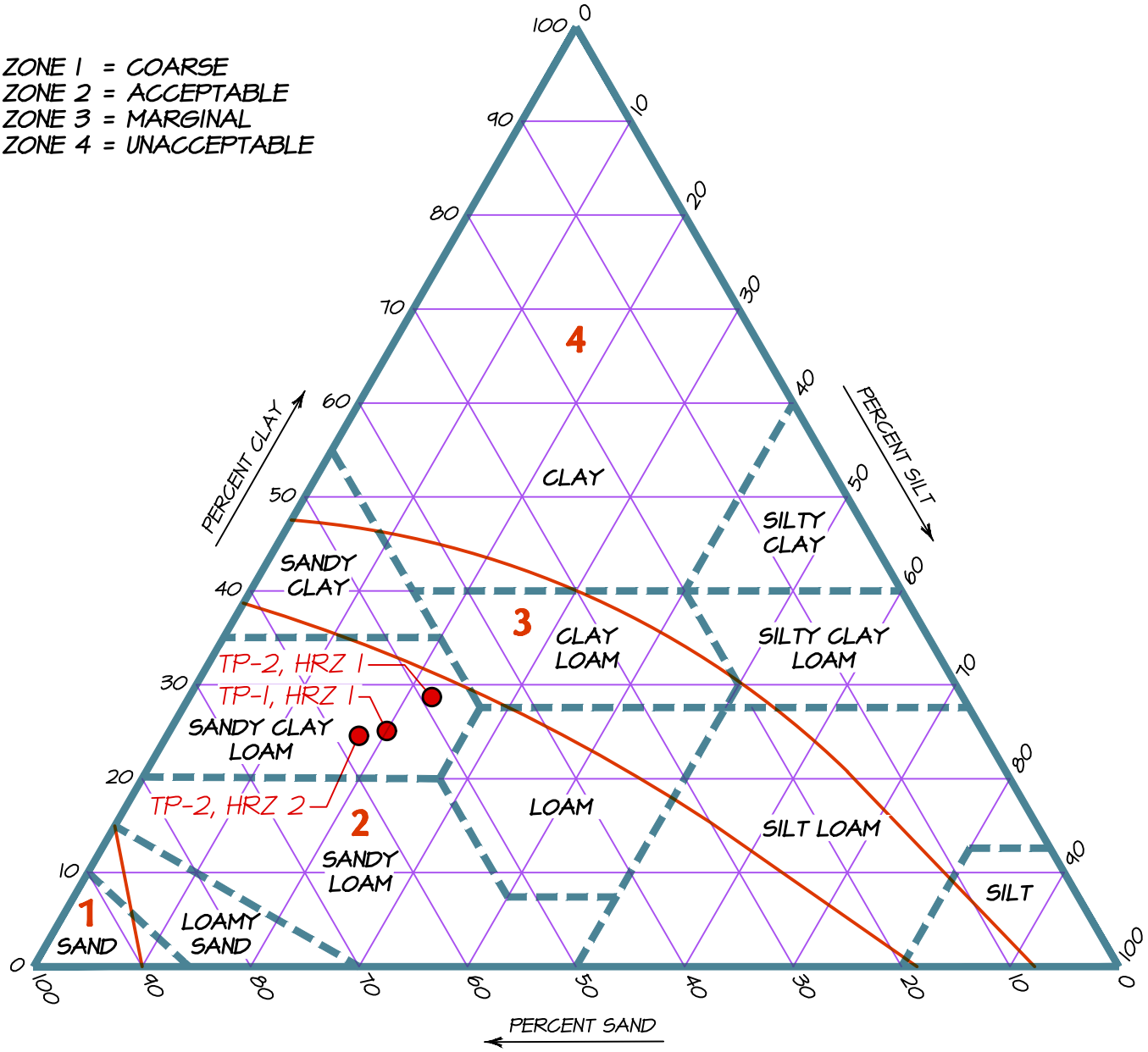
SOIL TEXTURE ANALYSIS CHART
BY BOUYOUCOS HYDROMETER METHOD

ZONE 1 = COARSE
ZONE 2 = ACCEPTABLE
ZONE 3 = MARGINAL
ZONE 4 = UNACCEPTABLE



INSTRUCTIONS:

1. PLOT TEXTURE ON TRIANGLE BASED ON PERCENT SAND, SILT AND CLAY AS DETERMINED BY HYDROMETER ANALYSIS.
2. ADJUST FOR COARSE FRAGMENTS BY MOVING THE PLOTTED POINT IN THE SAND DIRECTION AN ADDITIONAL 2% FOR EACH 10% (BY VOLUME) OF FRAGMENTS GREATER THAN 2mm IN DIAMETER.
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NOTE:

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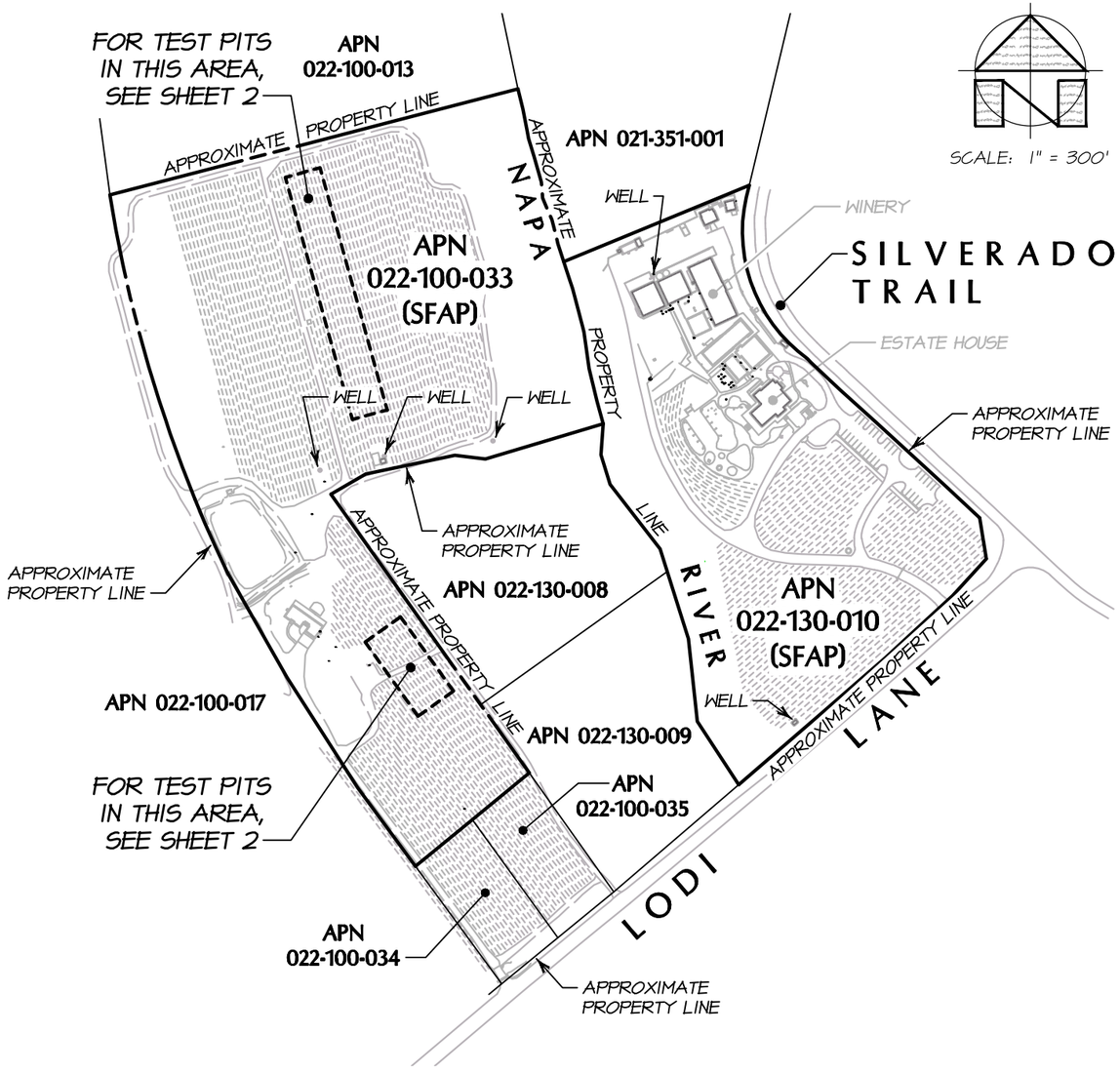
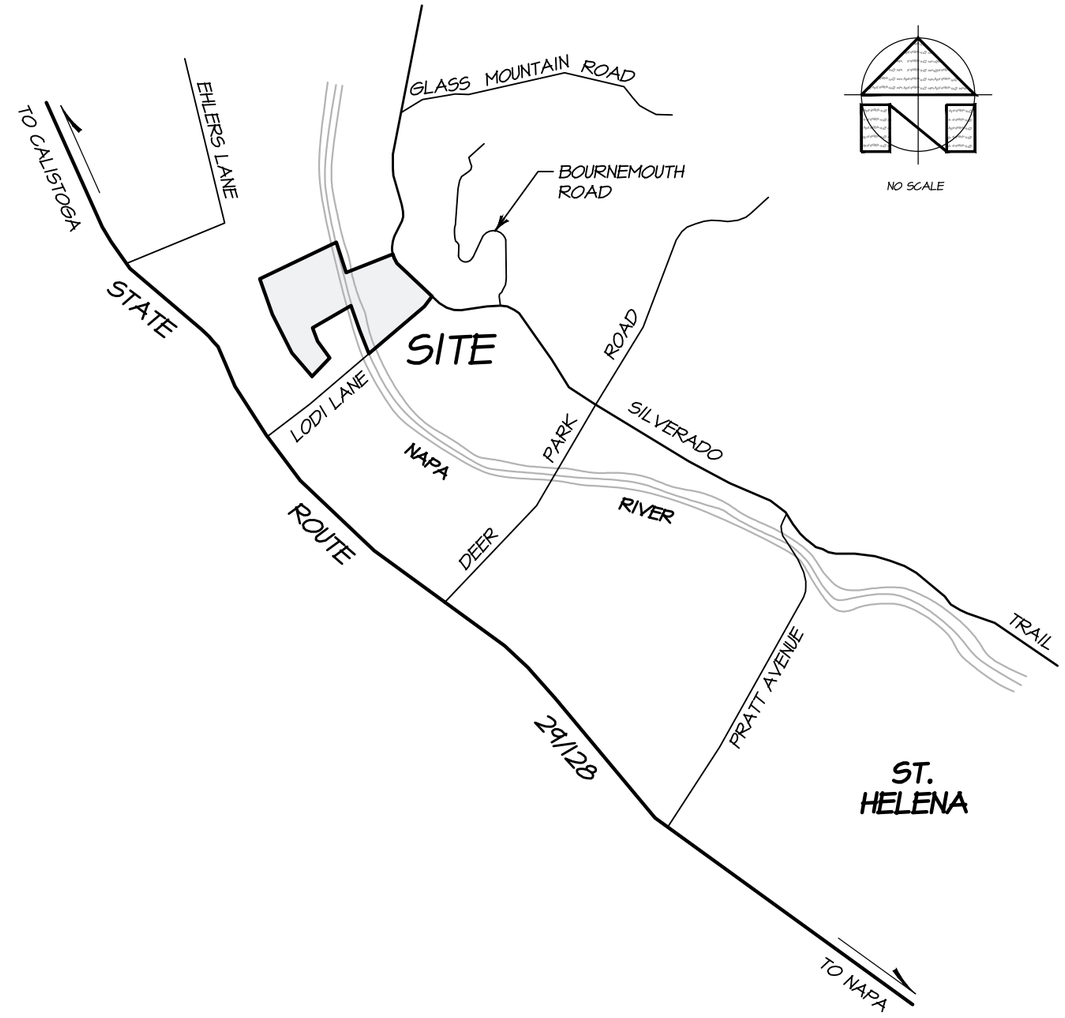


SCALE: 1" = 300'

OVERALL SITE PLAN
TEST PIT EXHIBIT

SCALE: 1" = 300'



NO SCALE

LOCATION MAP

NO SCALE

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Duckhorn Vineyards Winery
1000 & 1098 Lodi Lane
St. Helena, CA 94574
APNs 022-130-010 (SFAP) & 022-100-033 (SFAP)
Job No. 13-14
November 2019
Sheet 1 of 2

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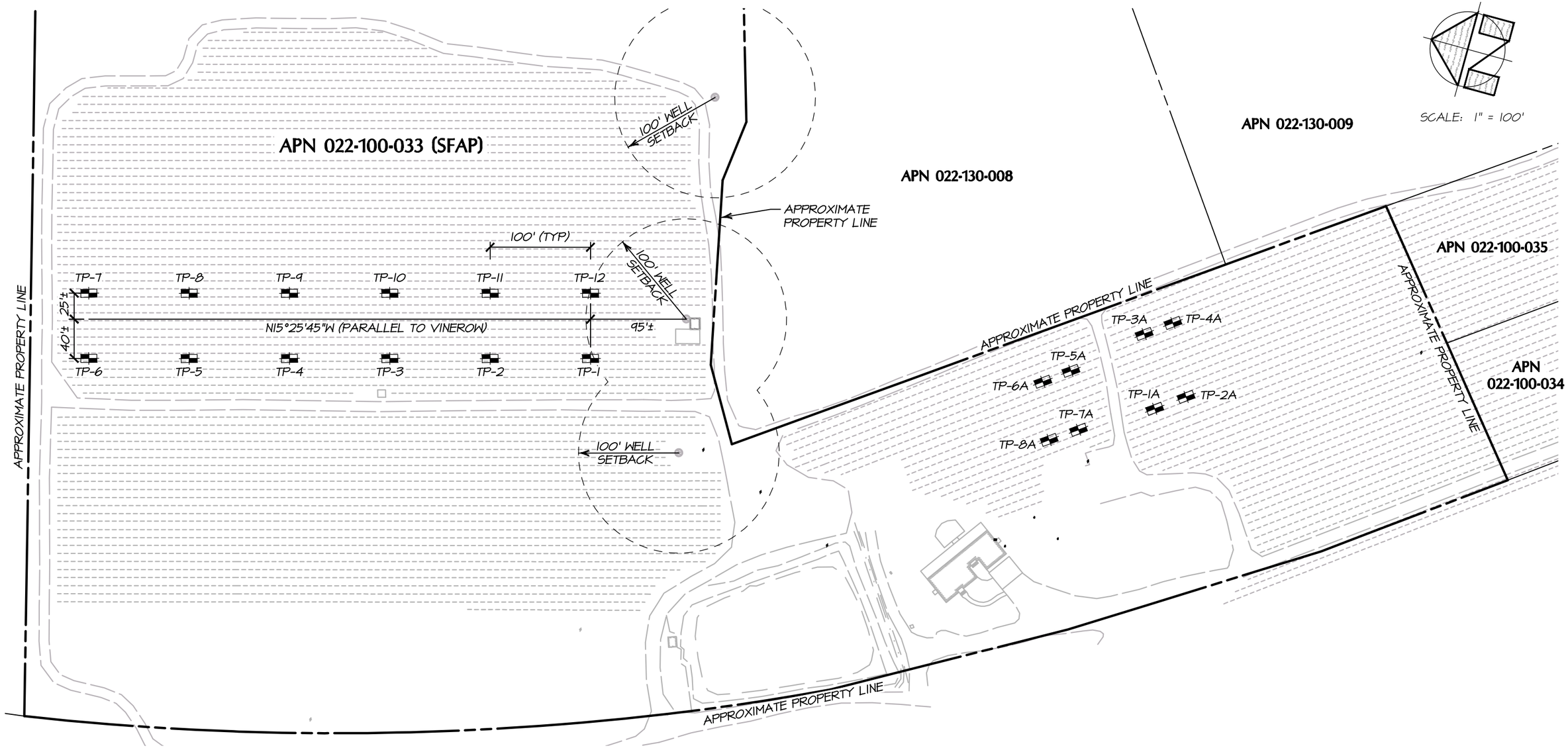

TEST PIT LOCATION MAP

SCALE: 1" = 100'

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TEST PIT EXPLORATION NOTES:

1. ▬ REPRESENTS TEST PIT LOCATION.
2. TEST PITS TP-1 THRU TP-12 WERE EXCAVATED BY FCB CONSTRUCTION ON NOVEMBER 19, 2019 AND WITNESSED BY A REPRESENTATIVE FROM BARTELT ENGINEERING AND NAPA COUNTY ENVIRONMENTAL HEALTH.
3. TEST PITS TP-1A THRU TP-8A WERE EXCAVATED BY DELTA CONSULTING & ENGINEERING AND NAPA COUNTY ON JULY 27, 2011 AND WITNESSED BY A REPRESENTATIVE FROM NAPA COUNTY ENVIRONMENTAL HEALTH.

Duckhorn Vineyards Winery
1000 & 1098 Lodi Lane
St. Helena, CA 94574
APNs 022-130-010 (SFAP) & 022-100-033 (SFAP)
Job No. 13-14
November 2019
Sheet 2 of 2

1/29/2020 - 4:54 PM, Michaelg, S:\LAND PROJECTS\2013-2017\1314\2019 SS\ACAD\EXHIBITS\1314-TP.DWG