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Wastewater Feasibility Study

Brasswood (formerly Cairdean) Winery, Use Permit Major Modification
Application No. P19-00004-MOD
Planning Commission Hearing, November 20, 2019

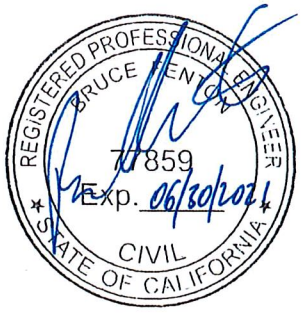
WINERY WASTEWATER FEASIBILITY REPORT

BRASSWOOD CELLARS
3125 ST. HELENA HWY. NORTH
ST. HELENA, CA 94574

APN 022-070-028

Prepared for:

Brasswood Cellars
3125 St. Helena Hwy. North
St. Helena, CA 94574



#4118030.0

October 7, 2019

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APPENDICES

I. Introduction

The Brasswood Winery is applying for a Use Permit Modification to increase their annual production. The purpose of this report is to demonstrate that their existing Process Wastewater system is capable of treating wastewater from the production of up to 95,000 gallons of wine per year with some modification. The winery proposes no increase in visitation and no new construction. The existing 4 full-time and 6 part-time employees will be converted to 10 full-time employees with no increase in the total number of employees. The existing domestic wastewater system will not be altered. Please refer to Appendix A for a Vicinity Map, USGS Map, and Soils Map.

II. Existing Wastewater System

The existing process wastewater system consists of a 750-gallon lift station, a 10,000-gallon equalization tank, a Lyve system designed for a peak flow of 2,000 gpd, and 30,000 gallons of storage. The treated process wastewater is then used for surface irrigation for both vineyard area and oak woodlands.

The existing domestic wastewater system consists of a 3,000-gallon septic tank, two Advantex AX-20 treatment pods, and a 3,000-gallon dosing tank. Treated effluent is discharged to a Geoflow subsurface drip leach field sized for 760 gpd.

III. Winery Process Wastewater Characteristics

The following is a summary of the winery wastewater characteristics:

Wine Production:	95,000 gallons of wine per year 2.38 gallons of wine per case 39,916 cases/year
Wastewater Production:	5 gallons of wastewater/gallon of wine 475,000 gallons/year
Peak Daily Waste Water Flow:	Crush Period = 60 days Annual wine production x 1.5 / 60 2,375 gallons/day
Average Daily Flow:	475,000/365 = 1,301 gallons/day

Monthly Wastewater Flows:

TABLE 1

	% By Month	Waste/Month	
Sep	14%	66,500	Gal/Month
Oct	14%	66,500	Gal/Month
Nov	11%	52,250	Gal/Month
Dec	8%	38,000	Gal/Month
Jan	4%	19,000	Gal/Month
Feb	6%	28,500	Gal/Month
Mar	6%	28,500	Gal/Month
Apr	5%	23,750	Gal/Month
May	6%	28,500	Gal/Month
Jun	7%	33,250	Gal/Month
Jul	9%	42,750	Gal/Month
Aug	10%	47,500	Gal/Month
Totals	100%	475,000	Gal/Year

IV. WINERY DOMESTIC WASTEWATER CHARACTERISTICS

The existing winery domestic wastewater system was sized to accommodate a peak flow of 760 gpd. The winery proposes to employ 10 full-time employees, no part-time employees, and 4 harvest employees. The proposed total number of employees will remain constant and the estimated proposed peak flows are shown in Table 3 below.

TABLE 2

Use	Source	Number	Projected Flow (gpd)	Total Flow No Event Day (gpd)	Total Flow Small Event Day (gpd)	Total Flow Medium Event Day (gpd)	Total Flow Large Event Day (gpd)
Winery	Full-time employees	10	15	150	150	150	150
	Part-time harvest employees	4	15	60	0	0	0
	Visitors	25	3	75	75	75	75
	Small Event (offsite catered)	25	10	0	250	0	0
	Medium Event (offsite catered)	50	10	0	0	500	0
	Large Event (offsite catered)	100	10	0	0	0	1000
Total Proposed Peak Flow				285	475	725	1225

On event days, there will be no part-time harvest employees. For events with more than 50 visitors, portable sanitation devices will be required. The existing domestic wastewater system has adequate capacity for days with no events, small events, and medium events.

V. WINERY PROCESS WASTEWATER – SURFACE DRIP IRRIGATION

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. The winery is served by an existing process wastewater system. The current Lyve system is designed to serve a peak flow of 2,000 gpd. This system will be upgraded by Lyve for a flow capacity of 2,500 gpd.

The 50,000 gallons of treated wastewater from the current use permit will continue to be dispersed on the blue oak woodland and remain consistent with the Process Wastewater Dispersal Area – Tree Protection Plan shown in Appendix C. The irrigation water balance for the oak woodlands, shown in Appendix B, has been updated to include the current monthly average evapotranspiration rates. This reduced the volume of storage required from 27,148 gallons to 25,274 gallons. The existing 30,000 gallons of storage will remain unchanged.

The treated process wastewater generated by the 45,000 gallons of proposed additional production will be used for vineyard and cover crop irrigation. Dispersal to the vineyard includes allowances for evaporation and infiltration and will not require additional storage capacity, as shown in the vineyard irrigation balance in Appendix B.

Monthly wastewater production is based on a percentage of the total annual wastewater production. No discharge will occur within 48-hours of a forecasted rain event. All treated process wastewater will be used for irrigation during the summer months or acceptable dry periods during the winter months. The amount of water allowed to be applied is estimated by the typical plant demand, infiltration, and evaporation for the area.

VI. Conclusions

This report demonstrates that enough dispersion area is available making surface drip irrigation a feasible option for treating the winery process wastewater at Brasswood Cellars. The proposed modifications to the existing on-site process wastewater system will support the peak flow of 2,375 gpd.

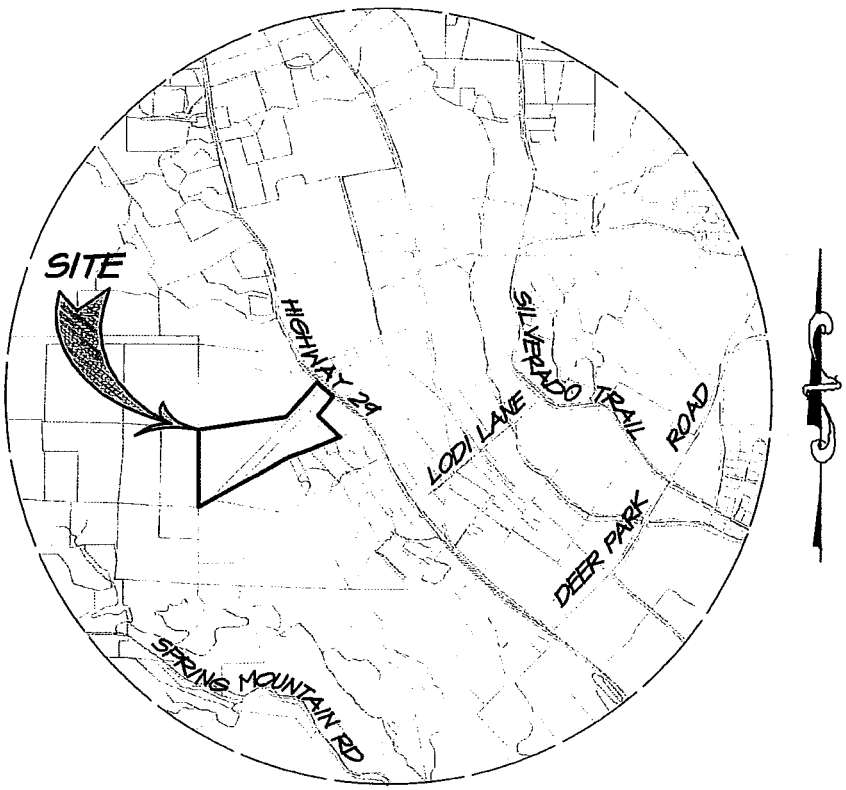
The existing domestic system is adequately sized as there is no change to domestic wastewater flows.

The above methodology results in a design that meets the Napa County Environmental Management Design Standards for the treatment of winery wastewater.

Appendix A

Vicinity Map, USGS Map, Soils Map

BRASSWOOD CELLARS
VICINITY MAP
NAPA COUNTY CALIFORNIA



VICINITY MAP

SCALE: 1" = 3000'

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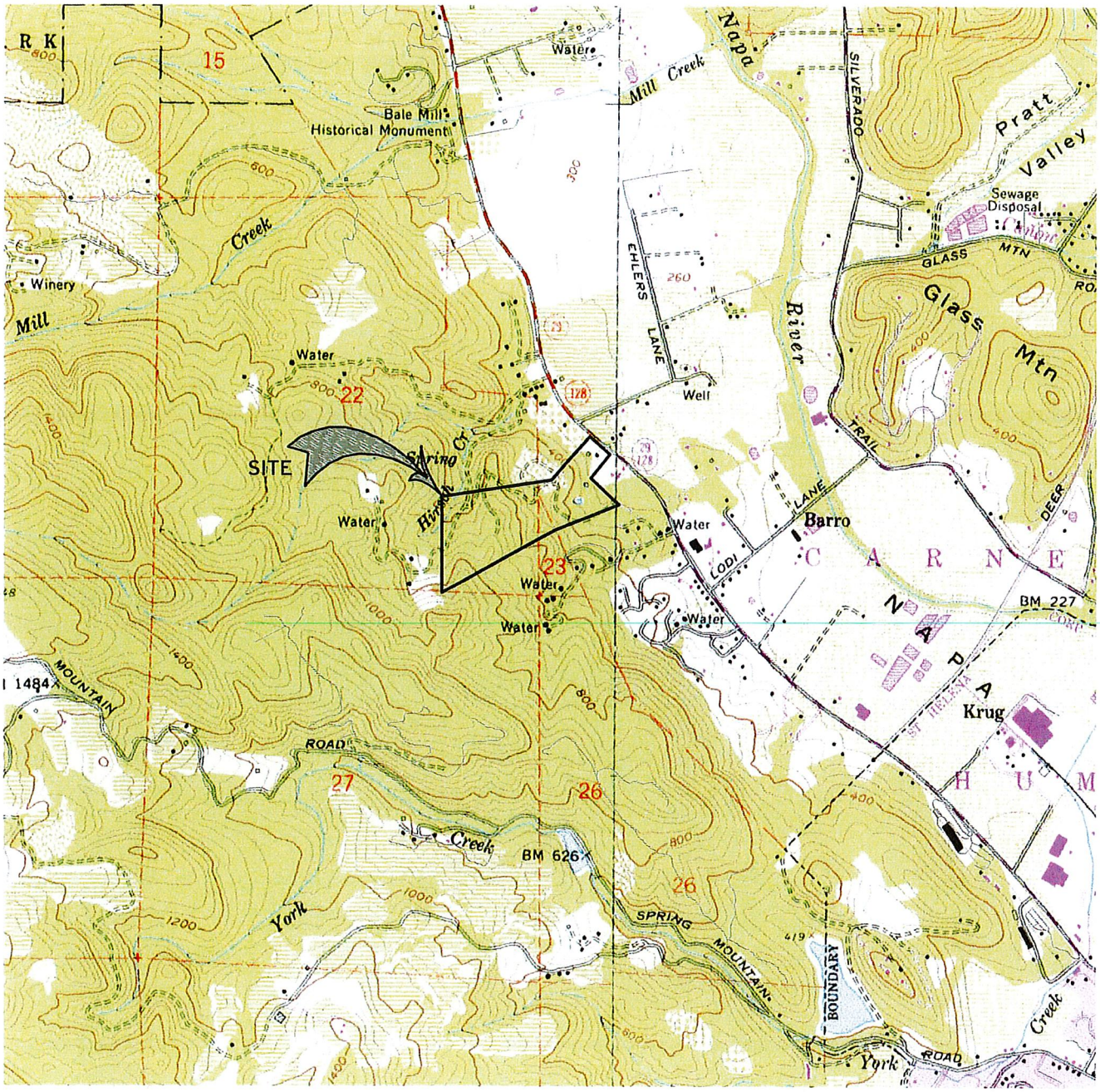
BRASSWOOD CELLARS
USGS QUAD MAP

APN: 022-070-028



SCALE: 1"=2000'

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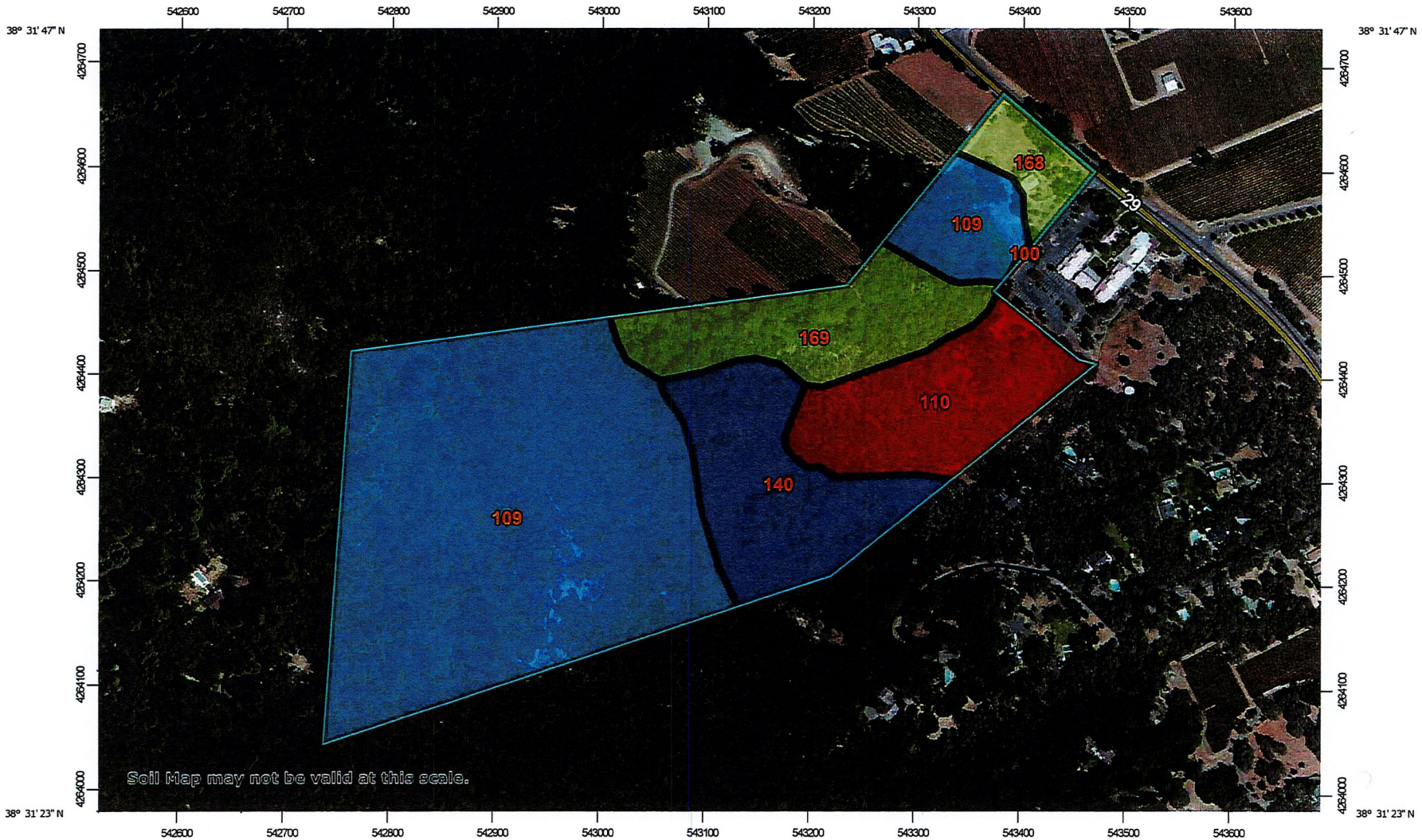
SEPT 26, 2018 4118030.0 Exh-USGS.dwg

Saturated Hydraulic Conductivity (Ksat)—Napa County, California
(Brasswood Winery)



Map Scale: 1:5,310 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 2.4892
- > 2.4892 and <= 3.1653
- > 3.1653 and <= 4.8486
- > 4.8486 and <= 6.4868
- > 6.4868 and <= 10.2539
- Not rated or not available

Soil Rating Lines
- <= 2.4892
- > 2.4892 and <= 3.1653
- > 3.1653 and <= 4.8486
- > 4.8486 and <= 6.4868
- > 6.4868 and <= 10.2539
- Not rated or not available

Soil Rating Points
- <= 2.4892
- > 2.4892 and <= 3.1653
- > 3.1653 and <= 4.8486
- > 4.8486 and <= 6.4868
- > 6.4868 and <= 10.2539
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Napa County, California
Survey Area Data: Version 10, Sep 25, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 2, 2010—Feb 17, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
100	Aiken loam, 2 to 15 percent slopes	3.1653	0.0	0.1%
109	Boomer gravelly loam, volcanic bedrock, 14 to 60 percent slopes, MLRA 15	6.4868	30.6	57.3%
110	Boomer-Forward-Felta complex, 30 to 50 percent slopes	2.4892	6.9	12.9%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	10.2539	7.5	14.0%
168	Perkins gravelly loam, 2 to 5 percent slopes	4.8486	1.9	3.6%
169	Perkins gravelly loam, 5 to 9 percent slopes	4.8486	6.5	12.1%
Totals for Area of Interest			**53.4**	**100.0%**

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)

Appendix B

Process Wastewater Irrigation Balance, Vineyard Irrigation Exhibit, Monthly Average Evapotranspiration

Reclaimed Process Wastewater
Water Balance for Vineyard Irrigation and Storage

Project Description		Annual Process Waste Flow Volume		
Project Number:	4118030.0	Wine Production:	45,000	gal/year
Project Name:	Brasswood Cellars			
Prepared By:	JCK	Annual Process Waste per Gallon Wine:	5	gal/year
Date:	October 25, 2018	Total Annual Process Waste Generated:	225,000	gal/year

Vineyard Irrigation Parameters		Cover Crop Irrigation Parameters			Infiltration Parameters		
Acres of irrigated vineyard:	0.79 acres	Crop type / name:	Vineyard cover crop		Soil Type	Acres	Infiltration Rate
Row spacing:	8.0 feet	Total irrigated acres of crop:	0.79	acres	Boomer Forward Felta Complex	0.79	0.35 in/hr
Vine spacing:	5.0 feet						
Total number of vines:	860 vines						
Water use per vine per month (peak):	26 gal						
Total peak monthly irrigation demand:	22,368 gal				Assumed steady state maximum		0.035 in/hr

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]:	9,000	13,500	13,500	11,250	13,500	15,750	20,250	22,500	31,500	31,500	24,750	18,000

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)	0	0	0	0	0	0	0	0	0	0	0	119
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):	1.6	1.6	2.6	26.0	26.0	26.0	26.0	26.0	26.0	26.0	2.6	2.6
Total vineyard irrigation demand [gallons]:	1,342	1,342	2,237	22,368	22,368	22,368	22,368	22,368	22,368	22,368	2,237	2,237
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]	1,342	1,342	2,237	11,250	13,500	15,750	20,250	22,368	22,368	22,368	2,237	2,237
Remaining vineyard irrigation demand after using this month's process water [gallons]	0	0	0	11,118	8,868	6,618	2,118	0	0	0	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	11,118	8,868	6,618	2,118	0	0	0	0	0
Net storage after vineyard irrigation drawdown [gallons]	0	0	0	0	0	0	0	0	0	0	0	119
This month's process wastewater, remaining after vineyard irrigation, available for landscape irrigation[gallons]	7,658	12,158	11,263	0	0	0	0	132	9,132	9,132	22,513	15,763

Water balance continues on next page for cover crop irrigation.

Reclaimed Process Wastewater
Water Balance for Vineyard Irrigation and Storage

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)*	7,658	12,158	11,263	0	0	0	0	132	9,132	9,132	22,513	15,763
Reference ET (ETo) (in/month) (see note 1)	1.32	1.80	3.32	4.78	6.11	6.84	7.07	6.30	4.90	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]	16,989	23,166	42,729	61,520	78,637	88,032	90,993	81,082	63,064	44,402	22,394	16,603
Will cover crop 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]	7,658	12,158	11,263	0	0	0	0	132	9,132	9,132	22,394	15,763
Cover Crop irrigation water required from storage or other source [gallons]	9,331	11,009	31,466	61,520	78,637	88,032	90,993	80,951	53,932	35,270	0	839
Drawdown from storage for cover crop irrigation [gallons]	0	0	0	0	0	0	0	0	0	0	0	119
Process wastewater generated this month, unused for irrigation, to be reclaimed and stored [gallons]	0	0	0	0	0	0	0	0	0	0	119	0
Net end-of-month reclaimed water storage after all irrigation [gallons]	0	0	0	0	0	0	0	0	0	0	119	0
Process waterwater applied to cover crop areas (gallons)	7,658	12,158	11,263	0	0	0	0	132	9,132	9,132	22,394	15,882
Process waterwater applied to cover crop areas (inches)	0.36	0.57	0.53	0.00	0.00	0.00	0.00	0.01	0.43	0.43	1.04	0.74
Monthly Evaporation & Infiltration Capacity												
Average Monthly Precipitation (inches)	7.60	6.53	4.32	2.10	0.85	0.25	0.03	0.07	0.29	1.72	3.93	6.90
100-year Monthly Precipitation (inches)	30.20	25.95	17.17	8.34	3.38	0.99	0.12	0.28	1.15	6.83	15.62	27.42
Total Monthly Soil Infiltration Capacity (inches)	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
Total Monthly Infiltration after 100-year Precipitation (inches)	0.0	0.0	8.2	17.1	22.0	24.4	25.3	25.1	24.2	18.6	9.8	0.0
Monthly Pan Evaporation (inches)	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	5.72	2.48	1.66
Net Monthly Infiltration & Evaporation capacity available in addition to Vineyard and Cover Crop evapotranspiration (inches)	1.5	2.2	12.0	22.9	30.9	35.4	38.5	37.2	32.9	24.3	12.3	1.7
Net Monthly Infiltration & Evaporation capacity available in addition to Vineyard and Cover Crop evapotranspiration (gallons)	32,819	46,118	257,947	490,718	663,331	759,519	825,892	797,600	706,131	520,963	263,090	35,608
Net Monthy Storage after all irrigation, evaporation, and infiltration [gallons]	0	0	0	0	0	0	0	0	0	0	0	0
End of Water Balance												

Peak Monthly Storage = 0 gallons

Annual Process Wastewater Reclaimed For Vineyard Irrigation = 137,249 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.

Reclaimed Process Wastewater
Water Balance for Oak Woodland Irrigation and Storage

RSA+

Project Description		Annual Process Waste Flow Volume		
Project Number:	4118030.0	Wine Production:	50,000	gal/year
Project Name:	Brasswood Cellars			
Prepared By:	JCK	Annual Process Waste per Gallon Wine:	5	gal/year
Date:	September 26, 2018	Total Annual Process Waste Generated:	250,000	gal/year

Vineyard Irrigation Parameters		Cover Crop Irrigation Parameters		
Acres of irrigated vineyard:	0.00 acres	Crop type / name:	Oak Woodland	
Row spacing:	8.0 feet	Total irrigated acres of crop:	1.20 acres	
Vine spacing:	4.0 feet			
Total number of vines:	0 vines			
Water use per vine per month (peak):	26 gal			
Total peak monthly irrigation demand:	0 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]:	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	35,000	35,000	27,500	20,000

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)	25,274	22,371	19,776	2,324	0	0	0	0	0	11,052	12,328	19,985
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):	1.6	1.6	2.6	26.0	26.0	26.0	26.0	26.0	26.0	26.0	2.6	2.6
Total vineyard irrigation demand [gallons]:	0	0	0	0	0	0	0	0	0	0	0	0
Will vineyard be irrigated with reclaimed water this month?	N	N	N	N	N	N	N	N	N	N	N	N
Process wastewater generated this month, reclaimed for vineyard irrigation [gallons]	0	0	0	0	0	0	0	0	0	0	0	0
Remaining vineyard irrigation demand after using this month's process water [gallons]	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0
Net storage after vineyard irrigation drawdown [gallons]	25,274	22,371	19,776	2,324	0	0	0	0	0	11,052	12,328	19,985
This month's process wastewater, remaining after vineyard irrigation, available for landscape irrigation[gallons]	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	35,000	35,000	27,500	20,000

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)*	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	35,000	35,000	27,500	20,000
Reference ET (ETo) (in/month) (see note 1)	1.32	1.80	3.32	4.78	6.11	6.84	7.07	6.30	4.90	3.45	1.74	1.29
Crop Coefficient (k_c) (see note 2)	0.30	0.30	0.30	0.20	0.20	0.20	0.20	0.20	0.15	0.30	0.35	0.35
Crop water demand per acre [inches]	0.40	0.54	1.00	0.96	1.22	1.37	1.41	1.26	0.74	1.04	0.61	0.45
Crop water demand per acre [gallons]	10,752	14,662	27,044	25,958	33,180	37,144	38,393	34,212	19,957	28,103	16,536	12,259
Total crop water demand for irrigated area [gallons]	12,903	17,595	32,453	31,149	39,816	44,573	46,072	41,054	23,948	33,723	19,843	14,711
Will cover crop 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]	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	23,948	33,723	19,843	14,711
Cover Crop irrigation water required from storage or other source [gallons]	2,903	2,595	17,453	18,649	24,816	27,073	23,572	16,054	0	0	0	0
Drawdown from storage for cover crop irrigation [gallons]	2,903	2,595	17,453	2,324	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	11,052	1,277	7,657	5,289
Net end-of-month reclaimed water storage after all irrigation [gallons]	22,371	19,776	2,324	0	0	0	0	0	11,052	12,328	19,985	25,274
End of Water Balance												

Peak Monthly Storage = 25,274 gallons

Annual Process Wastewater Reclaimed For Vineyard Irrigation = 0 gallons

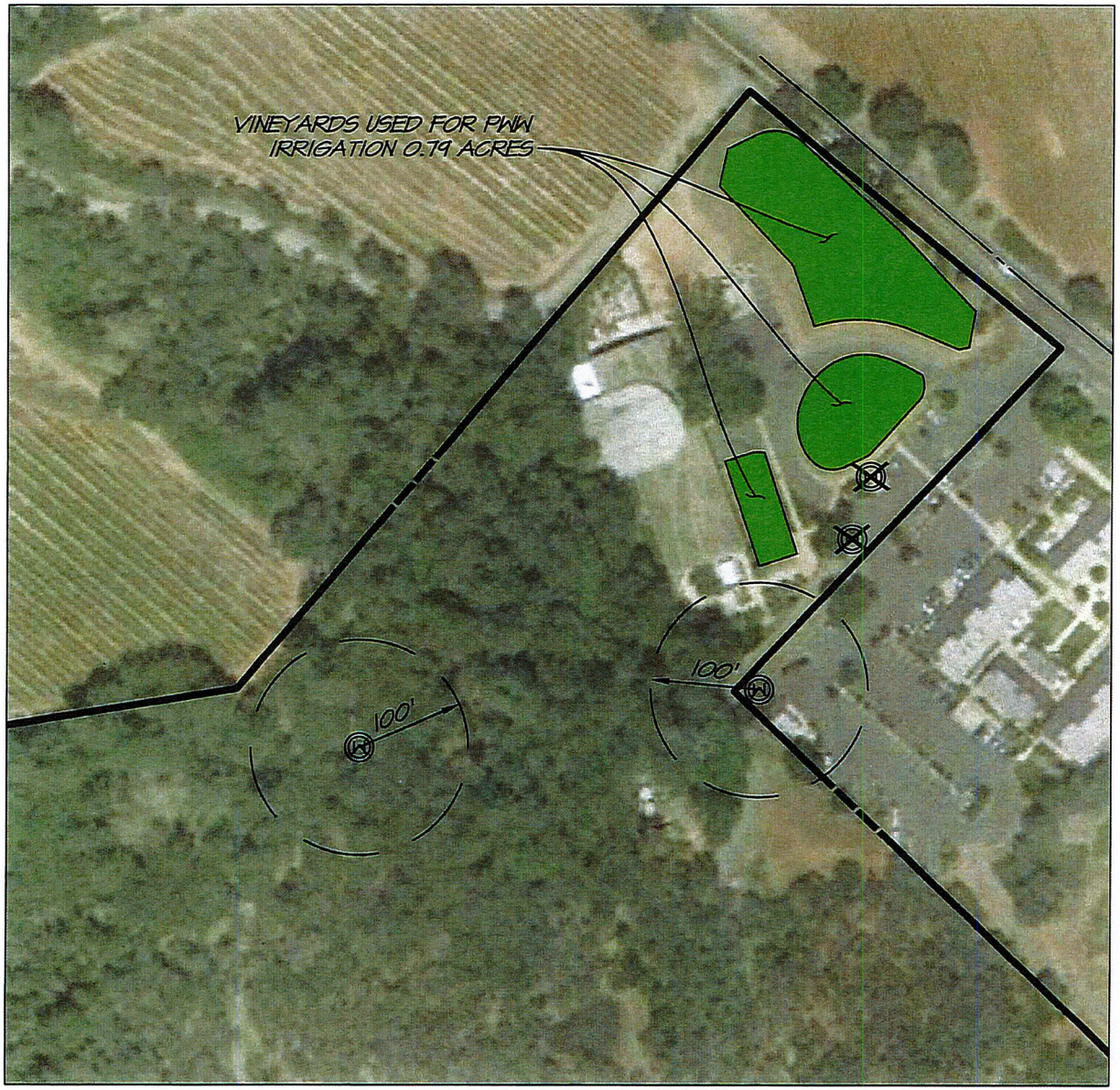
Notes:

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.

BRASSWOOD CELLARS
VINEYARD IRRIGATION

ST HELENA CALIFORNIA

SCALE: 1" = 150'



LEGEND

⊛	WELL LOCATION
⊗	DESTROYED WELL

RSA+

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

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

SEPT 26, 2018 4118030.0 Exh-Vineyard Irrigation

California Irrigation Management Information System (CIMIS)

CIMIS Monthly Average ETo Report

Rendered in ENGLISH Units.
Printed on Tuesday, July 31, 2018

Average ETo Values by Station

Stn Id	Stn Name	CIMIS Region	Jan (in)	Feb (in)	Mar (in)	Apr (in)	May (in)	Jun (in)	Jul (in)	Aug (in)	Sep (in)	Oct (in)	Nov (in)	Dec (in)	Total (in)
77	Oakville	NCV	1.32	1.80	3.32	4.78	6.11	6.84	7.07	6.30	4.90	3.45	1.74	1.29	48.92
109	Carneros	SFB	1.26	1.88	3.22	4.44	5.67	6.03	6.22	5.46	4.59	3.14	1.64	1.08	44.63

CIMIS Region Abbreviations		
BIS - Bishop	CCV - Central Coast Valleys	ICV - Imperial/Coachella Valley
LAB - Los Angeles Basin	MBY - Monterey Bay	NCV - North Coast Valleys
NEP - Northeast Plateau	SAV - Sacramento Valley	SBE - San Bernardino
SFB - San Francisco Bay	SJV - San Joaquin Valley	SFH - Sierra Foothill
SCV - South Coast Valleys		

Appendix C

2013 Septic Design Report
Process Wastewater Dispersal Area – Tree Protection Plan

CONSULTING CIVIL ENGINEERS
RIECHERS & SPENCE ASSOCIATES

SEPTIC SYSTEM DESIGN REPORT

CAIRDEAN WINERY
3125 N ST HELENA HIGHWAY
ST. HELENA, CALIFORNIA

APN 022-070-028

Property Owner:

Edwin and Stacia Williams
1840 Partridge Court
St. Helena, CA 94574

June 25, 2014
July 30, 2013
4111016.0

1515 Fourth Street, Napa, CA 94559 www.rsacivil.com 707.252.3301.v 707.252.4966.f

SEPTIC SYSTEM DESIGN REPORT
Cairdean Vineyards

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Appendices

1. Vicinity Map & USGS Quad Map
2. Site Evaluation
3. Cave Setback Exhibit
4. Irrigation Water Balance
5. Lyve L10
6. Advantex System
7. Process Waste Water Dispersal Area – Tree Protection Plan

INTRODUCTION AND PROJECT DESCRIPTION

The owners have obtained a Winery Use Permit from the County of Napa that will allow operation of a 50,000 gallon per year winery on a 50+/- acre parcel located at 3125 St. Helena Highway North, St. Helena, California. The Assessor's Parcel Number is 022-070-028. Appendix 1 contains a Site Location Map and a USGS Site Map showing the parcel topography, features and boundary.

This report accompanies a set of Wastewater Disposal System Construction Plans and describes the design of the proposed wastewater systems for domestic wastewater and process wastewater. Process wastewater and domestic wastewater will be treated in separate systems.

EXISTING SEPTIC SYSTEM

Information retrieved from Napa County Environmental Health files for the parcel show an existing septic system for the house consisting of two tanks and a septic drain field. These are located near the existing gravel drive and South of the existing house. The existing septic system will be abandoned.

SITE EVALUATION

Riechers Spence & Associates (RSA) conducted a site evaluation on the subject parcel on June 22, 2011. Appendix 3 contains a map of test pit locations and test pit logs for the site evaluation.

The site evaluation was conducted by Hugh Linn and Bruce Fenton of RSA and inspected by Kim Withrow and Rebecca Setliff of Napa County Environmental Health.

A representative soil sample was collected during the site evaluation and analyzed by RGH Consultants Inc. The soil samples underwent a soil texture analysis by the Bouyoucos Hydrometer Method. The soil sample results are shown in Appendix 2.

All test pit locations were acceptable for a Geoflow subsurface drip dispersal system with a minimum of 24" of suitable soil cover over limiting conditions. The area proposed for the primary drain field has 30" of suitable soil and no additional cover material is required. There is 24" of suitable soil in the area proposed for the reserve area. If the reserve area is used, 6" of clay loam cover is required.

WINERY DOMESTIC WASTEWATER CHARACTERISTICS

The winery domestic waste system has been sized to accommodate the peak flow unit values in Table 1 below. The number of visitors and employees is based on information provided by the owner/applicant and approved in the Use Permit. There will be up to 50 events per year at this facility. The projected flow is based on Napa County Environmental Health Alternative Sewage Treatment System Design Guidelines, Table 4. The following is a summary of the flows for the winery.

Table 1

Use	Source	Number	Projected Flow (gpd)	Total Flow (gpd)
WINERY	Full-time employees	4	15	60
	Part-time employees	6	15	90
	Part-time harvest employees	4	15	60
	Visitors	100	3	300
	Private Promotional w/ Meals (external caterer)	25	10	250
	Total People	139	**Total Peak Flow**	**760**

The number of visitors is based on a maximum expected daily visitor count. Marketing events exceeding 25 persons in a single day, or any combination of events where the expected total people on site exceeds 139 in a single day will require the use of portable sanitation facilities.

DOMESTIC WASTEWATER TREATMENT SYSTEMS

Wastewater will undergo primary treatment in a septic tank and pre-treatment through Advantex treatment pods. Final disposal from the Advantex system will be to a subsurface Geoflow Drip Dispersal system. The treatment goal is to meet Napa County discharge limits for discharge of pre-treated effluent to a Drip Dispersal system of 30 mg/l BOD_5 and 30 mg/l TSS.

Domestic Wastewater System Design

For pretreatment, the Advantex treatment system will be used with a design loading of 760 gpd. System sizing, tank sizing, and treatment system settings are based on Orenco manufacturer's specifications to achieve the design treatment goals of 30 mg/l BOD_5 and 30 mg/l TSS. Pump sizing, timer settings and treatment system calculations are found in Appendix 6 of this report.

Primary Treatment

The winery domestic wastewater will collect in a 3,000 gallon septic tank. The septic portion of the tank has been sized to hold approximately 2.5 times the peak daily flow.

Advantex Pretreatment

Domestic wastewater will flow into the second chamber of the septic tank where it will be recirculation recirculated through the AX-20 treatment pods (dosing alternates between the two pods with each pump cycle).

To achieve the treatment goal of 30 mg/l BOD_5 and 30 mg/l TSS for wastewater that is sub-surface dripped, Orenco recommends a maximum hydraulic loading of not more than 27.0 gpd/ft^2 to the AX-20 treatment pods. Using a conservative figure of 25 gpd/ft^2, for a flow of 760 gpd, 30 ft^2 of

treatment area is required. Each pod has 20 ft^2 of treatment area, therefore two pods are required.

The recirculation tank has been sized based on recommendations from Orenco Systems. Wastewater will be pumped to the AX-20 treatment pods and will return by gravity flow to the recirculation tank. Effluent will then flow into a 3,000 gallon dosing tank for final dispersal to the Geoflow field. Control of the recirculation and dosing tanks will be provided by the same Orenco T-Comm telemetry control panel monitoring the floats and pump in the pump tank. Float settings, pump timer calculations for the Advantex system are included in Appendix 6.

A flow meter will be installed to measure the volume discharged to the Geoflow system and a second meter will measure the field flush flow returned to the septic tank. Net discharge will be calculated as the difference between the two meter readings. Calculations for dosing and pump sizing are included in Appendix 6.

Geoflow Drip Dispersal System

The Geoflow field and reserve area will be located as shown on sheet SS2 of the attached plans. Soil depth is at least 30 inches in the primary dispersal field area and will require no fill placement. The reserve dispersal field areas have a soil depth of at least 24" and will require 6 inches of clay loam fill.

The most restricting soil horizon is clay loam with moderate sub-angular blocky structure. Referring to Table 2 of the Geoflow Design, Installation and Maintenance Guidelines, a Geoflow system installed in Clay Loam soil with moderate, sub angular blocky structure will accept 0.6 gpd/sf/day. For a total daily flow of 760 gpd this equates to base dispersal area of square feet.

$$Drip\ Dispersal\ Field\ Area = \frac{760 gpd}{0.6 gpd / SF} = 1267 square\ feet$$

The Geoflow field will therefore consist of 633 lineal feet of Wasteflow PC drip line, 0.5 gallons per hour-per emitter, at 2 foot spacing between emitters and 2 foot spacing between lines. The lines will be oriented along the contours with supply and flush manifolds at either end of the system, as shown on sheet SS3.0 of the attached plans. The flush return will discharge into the first chamber of the septic tank where it will be re-treated through the Advantex System.

As required for sloping sites, two monitoring wells will be installed within the dispersal field, two will be installed 10 feet uphill, and two will be installed 25 feet downhill. Geoflow field and pump sizing calculations are found in Appendix 6 of this report.

WINERY PROCESS WASTEWATER CHARACTERISTICS

Wine Production: 50,000 gallons of wine per year
2.38 gallons of wine per case

= 50,000 gal/year/2.38 cases/year
= 21,008 cases/year

Wastewater Production: 5 gallons of wastewater/gallon of wine
= 50,000 gal/year x 5 gal wastewater/gal
= 250,000 gal/year wastewater

Peak Daily Waste Water Flow: Crush Period = 45 days
Annual wine production x 1.5 / 45
= 1,667 gallons/day

Average Daily Flow: 250,000 gal/year + 36,500 gal/year backwash (estimated ave)
= 286,500 gallons/year/365
= 785 gallons/day

Monthly Wastewater Flows: (See Table 2)

TABLE 2

Monthy Break Down

	% By Month	Waste/Month	
Sep	15%	42,975	Gal/Month
Oct	15%	42,975	Gal/Month
Nov	11%	30,083	Gal/Month
Dec	8%	21,488	Gal/Month
Jan	4%	11,460	Gal/Month
Feb	6%	17,190	Gal/Month
Mar	6%	17,190	Gal/Month
Apr	5%	12,893	Gal/Month
May	6%	17,190	Gal/Month
Jun	7%	20,055	Gal/Month
Jul	9%	24,353	Gal/Month
Aug	10%	28,650	Gal/Month

WINERY PROCESS WASTEWATER TREATMENT SYSTEMS

The winery process waste will be surface dripped on landscape vegetation and vineyards around the winery site. 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 septic tank, a pump tank, an equalization tank and a Lyve Systems, Inc. (Lyve), L10 winery wastewater activated sludge system will be utilized. The Lyve winery wastewater system internally consists of a selector zone, an aeration zone, a clarifier zone and sludge digester zone and can process up to 2,000 gallons per day. Information and calculations for this system can be found in Appendix 5.

Lift Station

A 750 gallon lift station will be provided to pump process wastewater to the equalization tank. septic/pump tank. This station will be equipped with dual pumps.

Screen

An in-line screen will be used to remove solids from the process wastewater as it is being pumped to the equalization tank.

Equalization Tank

A 10,000 gallon above ground equalization tank will serve to buffer peak flows and strengths from overwhelming the system and impairing treatment. This tank will provide 6.5 days of peak wastewater storage. The tank will be aerated from a blower in the Lyve system in order to avoid the contents from becoming septic.

Selector Zone

The selector zone mixes the incoming wastewater and a portion of the sludge. The influents will be mixed and then flow into the aeration zone.

Aeration Zone

The aeration zone is a basin in the Lyve system that is sized for one day retention time. In the basin, fine bubble air diffusers will add air to the wastewater to assist the bacteria to utilize the

organic constituents of the wastewater for cell growth and multiplication. The waste stream then flows into the clarifier zone.

Clarifier Zone

The clarifier zone will serve to separate the bacteria and the purified water. The bacteria will settle to the bottom of the clarifier and the purified water will overflow and be discharged. The discharge rate is based on 0.5 gpm/sqft. The bacteria will be pumped back to the selector zone or the sludge digester zone.

Sludge Digester Zone

Excess solids are periodically wasted into the digester zone where they will be removed when necessary. Removal will be by a typical septic tank pump truck.

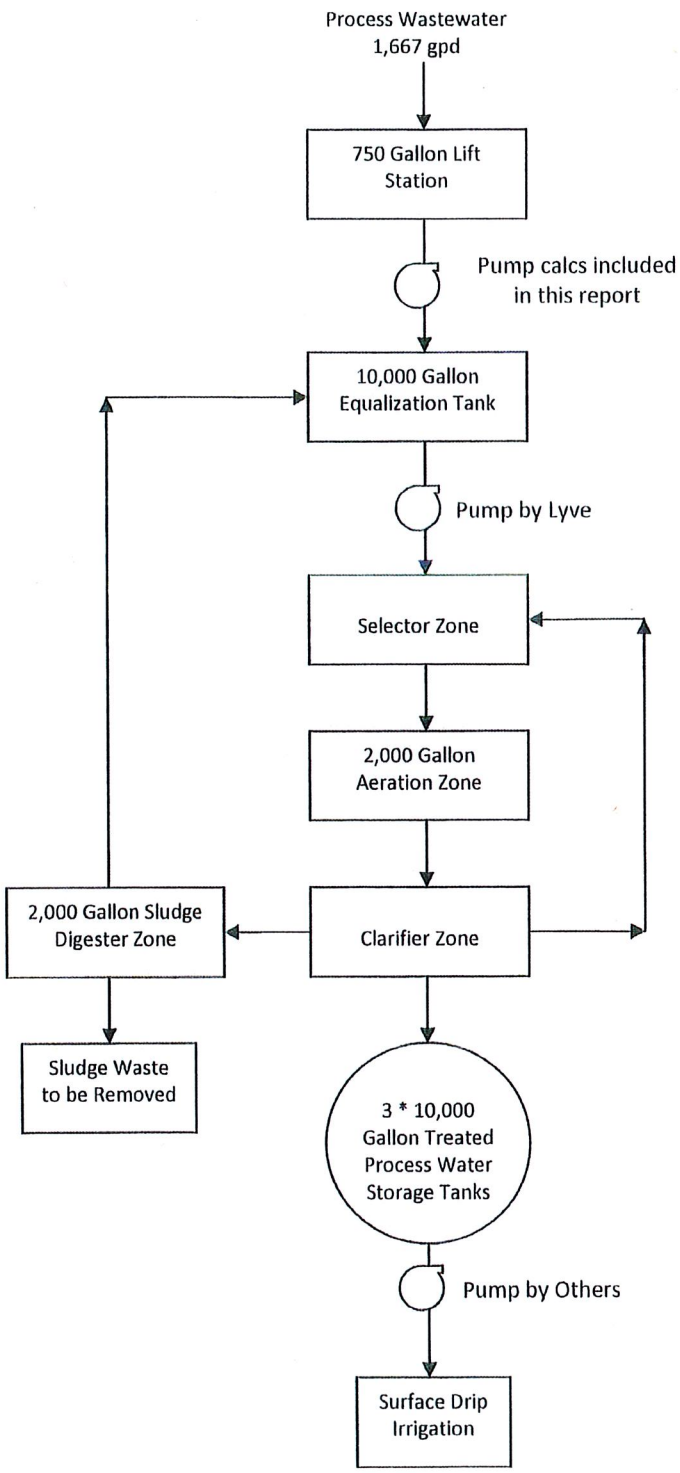
Holding Tanks and Irrigation

Treated process wastewater will be dispersed on blue oak woodland or used for vineyard irrigation. 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 treated wastewater that cannot be discharged during the winter months. All stored water will then be used for irrigation during the summer months, or acceptable dry periods during the winter months.

To provide an estimate of the amount of storage tanks required, a monthly water balance has been prepared, as shown in Appendix 4. Monthly wastewater production is based on a percentage of the total annual wastewater production. The amount of water allowed to be applied is estimated by the typical plant water demand. Dispersal of treated process wastewater to the Blue Oak Woodland will be consistent with the Process Wastewater Dispersal Area – Tree Protection Plan contained in Appendix 7. All areas to be irrigated take into account a 100 ft setback from potable water wells.

Figure 2 shows a schematic of the process wastewater system.

FIGURE 2


Process Wastewater
1,667 gpd
750 Gallon Lift Station
Pump calcs included in this report
10,000 Gallon Equalization Tank
Pump by Lyve
Selector Zone
2,000 Gallon Aeration Zone
2,000 Gallon Sludge Digester Zone
Clarifier Zone
Sludge Waste to be Removed
3 * 10,000 Gallon Treated Process Water Storage Tanks
Pump by Others
Surface Drip Irrigation

CONCLUSIONS

Based on the information contained in this report, we conclude that that the estimated volume of process wastewater generated by the winery can be successfully treated by the Lyve Systems, Inc., L10 winery wastewater activated sludge system. It will meet the applicable Napa County discharge limits for final discharge to surface drip irrigation disposal. It is demonstrated that enough irrigation area is available for dispersion of process wastewater through irrigation of landscape vegetation and vineyards.

We also conclude that the estimated volume of domestic wastewater generated by the winery can be successfully treated by the Orenco Advantex system and that the subsurface drip dispersal area is sufficiently designed for the soil conditions and the peak flow.

CONSULTING CIVIL ENGINEERS
RIECHERS & SPENCE ASSOCIATES

PROCESS WASTE WATER DISPERSAL AREA

TREE PROTECTION PLAN

CAIRDEAN WINERY
3125 ST. HELENA HIGHWAY
ST. HELENA, CALIFORNIA

APN 022-070-028

#4111016.0

June 5, 2014

1515 Fourth Street, Napa, CA 94559 www.rsacivil.com 707.252.3301.v 707.252.4966.f

Cairdean Winery Blue Oak Woodland Wastewater Irrigation Analysis:

A 1.2 acre upland area has been evaluated and selected for dispersal of winery waste water. The area, as designated on the RSA plan map has been laid out to maintain a 100 foot setback from the existing pond and 25 foot setbacks from 2 minor ephemeral drainages.

Dominant vegetation in these areas consists of blue oak, with an understory of common manzanita, (*Arctostaphylos manzanita*) toyon, (*Heteromeles arbutifolia*) douglas fir saplings, (*Pseudotsuga menziesii*) and poison oak, (*Toxicodendron diversilobum*). Associated oak savannah grassland vegetation consists primarily of wild oats, (*Avena fatua*) , dogtail, (*Cynocerus echinatus*), big quaking grass, (*Briza major*), ripgut bromegrass, (*Bromus diandrus*) and to a limited degree, a few small patches of purple needlegrass, (*Nassella pulchra*), and blue wildrye, (*Elymus glaucus*).

Typical vegetative cover. Blue oak is the dominant overstory, with common manzanita, Poison oak, a few toyon shrubs, and an oak savannah grassland understory.

Ground Preparation for Irrigation:

Some limited clearing will be necessary to accommodate irrigation system layout and drip irrigation system distribution of waste water. The clearing of vegetation will not involve grading or soil disturbance- only the cutting of manzanita, and poison oak at ground level. Trenching of the wastewater pipeline will, however involve some minor soil disturbance. Trenched areas will be treated for erosion control, using native perennial grasses and straw mulch.

Clearing of the understory, which is allowed under ***Ordinance 18.108.050, Exemptions, Item F***, will also have the added benefit of wildfire fuel load reduction. No sensitive plants will be impacted by cutting of the understory vegetation, which will only require chainsaws and hand tools to accomplish.

Cool season native grasses will be sown throughout the understory irrigation area. Native grass establishment will minimize the potential for seepage or runoff during winter months and further reduce the likelihood of wildfire ignition. Red fescue, (*Festuca rubra*), and California meadow barley, (*Hordeum brachyantherum*) will become the dominant understory where waste water irrigation is applied. These grasses, will also be superior to the existing Mediterranean annual grassland in utilizing summer season irrigation water, with sufficiently high evapotranspiration rates to further buffer blue oaks from excess soil moisture buildup.

Irrigation Design:

Drip hoses and drip emitters will be layed out to maintain a minimum 5 ft. by 5 ft. spacing for emitters, and care will be taken to keep emitters at least several feet away from the trunks of blue oaks. Emitter rates should not exceed 2 gallons per minute to avoid excess water from moving laterally in the soil and contacting the tree crown. The University of California recommends that established oak trees can be safely irrigated in summer months if water is applied well away from the trunk crown area, "Summer Irrigation of Established Oak Trees" UCCE publication, (Gary W. Hickman, UCCE Environmental Horticulture Advisor, San Joaquin County, CA).

Example placement of main pipeline and drip hoses. Understory vegetation, consisting primarily of manzanita and poison oak will be cleared, to allow for laying of drip tubing and drip emitters. Drip tubes will be positioned at least several feet away from the trunks of blue oak trees and drip emitters will be spaced 5 feet apart on the drip tubing.

The California Irrigation Management Information System, (CIMIS) Crop Evapotranspiration Formula for California Zone 8, (Napa County area) was used to evaluate the suitability of the blue oak woodland for use as an irrigated landscape. The formula, jointly developed by the University of California and the California Department of Water Resources predicts irrigation water needs of native and non-native plant landscapes, using Water Use Classification of Landscape Species, (WUCOLS III) factors.

Cairdean Winery
3125 St. Helena Highway
St. Helena, CA

The following factors were used in running an evaluation of winery waste water output, in comparison with the capacity of the blue oak woodland to serve as a dispersal area:

- 1.2 acres of oak woodland available for wastewater application.
- The woodland, following fuel load reduction will consist primarily of Blue oak and grassland.
- WUCOLS III Species factor, (K_s) for Blue oak is "low" to "very low", (use 0.1 or less).
- WUCOLS III K_d and K_{mc} are both 1.0, factoring average canopy and no non-natural influencing factors.
- An average ET_o 6.43 inches for the critical summer period, (monthly values for CIMIS Zone 8)
- Irrigation efficiency of 65%, (drip irrigation emitters, high evaporation potential in rough terrain layout).
- The woodland will be most sensitive to disease, (primarily Armillaria fungus, and Phytophthora crown rot) during the dry summer months.
- For October through April irrigations, rates proposed by RSA for irrigation water balance can be accommodated by the woodland, with the requirement that irrigation will not occur within 48 hours of any rainfall event.
- USDA NRCS Soil Survey mapping for the site is Boomer-Forward-Felta complex. The Forward series component is most restrictive, at 0.06 inches per inch of soil available water capacity, (also the most restrictive value). For the 35 inch total soil profile depth, the most restrictive scenario allows for a total of **2.1"** of water holding capacity.

Cairdean Winery Wastewater Use Evaluation
Spring Summer Irrigation Summary Table*

Month	May	June	July	August	September
Gallons of Waste Water To Be Applied	15,000	17,500	22,500	25,000	23,802
Maximum Gallons Recommended	31,000	35,000	37,000	33,000	25,400

Note: See comment above the table, regarding October through April irrigation.

Summary:

1) The analysis indicates that during the 5 critical spring/ summer months, wastewater irrigation can be applied without detriment to the blue oaks.
2) Maximum potential output of 25,000 gallons is equal to 0.9 inches of water, well within the minimum soil profile water holding capacity of 2.1 inches. This further buffers the lands capacity to retain wastewater where evapotranspiration demand is sub-normal for any given month.
3) WUCOLS III factors for perennial grass moisture consumption were not used. Once native grasses are established, the need for the woodland to supply moisture consumption will be further diminished.

Reserve Area Reclaimed Process Wastewater
Water Balance for Irrigation and Storage

Project Description		Annual Process Waste Flow Volume		
Project Number:	4111016.0	Wine Production:	50,000	gal/year
Project Name:	Caldean Winery			
Prepared By:	Bruce Penton	Annual Process Waste per Gallon Wine:	5	gal/year
Date:	May 19, 2014	Total Annual Process Waste Generated:	250,000	gal/year

Vineyard Irrigation Parameters		Landscape Irrigation Parameters		
Acres of irrigated vineyard:	0.00 acres	Crop type / name:	Blue Oak Woodland	
Row spacing:	8.0 feet	Total irrigated acres of cover crop:	1.20 acres	
Vine spacing:	4.0 feet			
Total number of vines:	0 vines			
Water use per vine per month (peak):	26 gal			
Total peak monthly irrigation demand:	0 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]:	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	35,000	35,000	27,500	20,000

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)	27,148	27,080	27,124	13,484	0	0	0	0	0	11,198	11,693	20,490
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	26	26	26	26	26	26	26	3	3
Total vineyard irrigation demand [gallons]:	0	0	0	0	0	0	0	0	0	0	0	0
Will vineyard be irrigated with reclaimed water this month?	N	N	N	N	N	N	N	N	N	N	N	N
Process wastewater generated this month, reclaimed for vineyard irrigation [gallons]	0	0	0	0	0	0	0	0	0	0	0	0
Remaining vineyard irrigation demand after using this month's process water [gallons]	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0
Net storage after vineyard irrigation drawdown [gallons]	27,148	27,080	27,124	13,484	0	0	0	0	0	11,198	11,693	20,490
This month's process wastewater, remaining after vineyard irrigation, available for landscape irrigation[gallons]	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	35,000	35,000	27,500	20,000

Water balance continues on next page for cover crop irrigation.

Monthly Landscape 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 landscape irrigation[gallons] *(From sheet 1)*	10,000	15,000	15,000	12,500	15,000	17,500	22,500	25,000	35,000	35,000	27,500	20,000
Reference ET (ETo) (in/month) (see note 1)	1.03	1.53	2.93	4.71	5.82	6.85	7.21	6.44	4.87	3.53	1.64	1.17
Crop Coefficient (k_c) (see note 2)	0.30	0.30	0.30	0.20	0.20	0.20	0.20	0.20	0.15	0.30	0.35	0.35
Crop water demand per acre [inches]	0.31	0.46	0.88	0.94	1.16	1.37	1.44	1.29	0.73	1.06	0.57	0.41
Crop water demand per acre [gallons]	8,390	12,463	23,867	25,578	31,605	37,199	39,154	34,972	19,835	28,754	15,585	11,119
Total crop water demand for irrigated area [gallons]	10,068	14,956	28,640	30,693	37,926	44,639	46,985	41,967	23,802	34,505	18,703	13,343
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 landscape irrigation [gallons]	10,000	14,956	15,000	12,500	15,000	17,500	22,500	25,000	23,802	34,505	18,703	13,343
Landscape irrigation water required from storage or other source [gallons]	68	0	13,640	18,193	22,926	27,139	24,485	16,967	0	0	0	0
Drawdown from storage for landscape irrigation [gallons]	68	0	13,640	13,484	0	0	0	0	0	0	0	0
Process wastewater generated this month, unused for irrigation, to be reclaimed and stored [gallons]	0	44	0	0	0	0	0	0	11,198	495	8,797	6,657
Net end-of-month reclaimed water storage after all irrigation [gallons]	27,080	27,124	13,484	0	0	0	0	0	11,198	11,693	20,490	27,148
Net Gallons applied to landscape area	10,068	14,956	28,640	25,984	15,000	17,500	22,500	25,000	23,802	34,505	18,703	13,343
Net application of irrigation water to landscape area (inches)	0.31	0.46	0.88	0.80	0.46	0.54	0.69	0.77	0.39	1.04	0.30	0.21

End of Water Balance

Peak Monthly Storage = 27,148 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.