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Water Availability Analysis

Etude Winery P15-00355
Planning Commission Hearing December 21, 2016

WATER AVAILABILITY ANALYSIS

Etude Wine Company

Napa, California
APN 047-230-033

SUMMIT
CIVIL STRUCTURAL ELECTRICAL WATER|WASTEWATER

Project No. 2015142
November 18, 2016

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LIST OF ENCLOSURES

ETUDE WINERY
Napa, California
WATER AVAILABILITY ANALYSIS

PROJECT SUMMARY

Etude Wine Company is applying for a Use Permit Modification for the existing winery facility to increase annual wine production capacity from the currently permitted 150,000 gallons to 300,000 gallons per year, and to increase the number of employees and visitors. Summit has prepared the following Water Availability Analysis, which provides a comparison between the proposed water use and the available water capacity on the property.

Total annual water demand at Etude Wine Company associated with the proposed increase in production capacity to 300,000 gallons of wine per year, including production, domestic, vineyard and landscape irrigation, is estimated to be 14.0 ac-ft per year, which represents an increase of 3.0 ac-ft per year from the current water usage. Based on the Tier I analysis, the annual recharge estimated for the parcel is 36.7 ac-ft/year for a normal year or 23.4 ac-ft/year for a drought year. This water availability analysis establishes that the estimated water demand for the facility represents 60% of the total water availability for the parcel for a drought year, and 38% of the total water availability during an average year. The parcel average domestic water demand can be met with the existing domestic wells operating for 24 hours per day at 4.4 gpm.

Etude Wine Company has recently established a connection to the Los Carneros Recycled water pipeline, which has the potential to offset the water demand for vineyard and landscape irrigation and reduce the total parcel water demand by approximately 52% (7.3 ac-ft/year).

SITE DESCRIPTION

The facility is located in a 29.81 acre parcel south of Highway 12/121 and west of highway 29 in an agricultural area with vineyards to the north, east, and west and Cuttings Wharf Road to the south. The site topography slopes gradually downward to the north. Surface drainage flows overland to the east. Prior to the development of the winery, the property was used as agricultural land and a brandy distillery from 1982 to 2003. Distillation no longer occurs at the facility. An overall site plan for the facility is provided in Enclosure A.

The existing winery facility consists of three winery buildings, 10 acres of vineyards, 2.5 acres of landscape, has a winery process wastewater pond, a sanitary sewage wastewater pond, an irrigation reservoir, and a fire protection storage pond. Water sources for the property consist of three groundwater wells, two wells for domestic water supply and one well for irrigation water supply.

WATER DEMAND

EXISTING WATER DEMAND

Current water use at the facility is based on the following needs:

- Process needs for production capacity of 150,000 gallons of wine per year
- Full Time Employees = 19 per day
- Part Time Employees = 5 per day
- Tasting Visitors = 740 average per week, without food pairings
- Private Tasting Visitors = 15 per group, 3 groups per day, 45 visitors per day with food pairings (peak)
- Private Event Visitors = 50 max per event, 2 events per month
- New Release Event Visitors = 250 max per event, 4 events per year
- Non-Specific Event Visitors = 300 max per event, 3 events per year
- Wine Auction Event Visitors = 200 max per event, 2 events per year
- Irrigation of 10 acres of vineyard
- Irrigation of 2.5 acres of landscape

PROPOSED WATER DEMAND

Water use at the facility will be based on the following needs:

- Process needs for production capacity of 300,000 gallons of wine per year
- Full Time Employees = 22 per day
- Part Time Employees = 5 per day
- Tasting Visitors = 1,000 average per week, 350 max per day, 25% of visitors with food pairings
- Private Tasting Visitors = 15 per group, 3 groups per day, 45 visitors per day with food pairings (peak)
- Private Event Visitors = 50 max per event, 2 events per month
- New Release Event Visitors = 250 max per event, 4 events per year
- Industry Event Visitors = 40 max per event, 4 events per year
- Non-Specific Event Visitors = 300 max per event, 3 events per year
- Wine Auction Event Visitors = 200 max per event, 2 events per year
- Irrigation of 10 acres of vineyard
- Irrigation of 2.5 acres of landscape

WINERY PROCESS WATER DEMAND

Water demand for wine production is expected to correlate to the process wastewater (PW) generated at the facility. Based on typical flow data from wineries of similar size and characteristics, the approximate process wastewater generation for the current wine production is calculated as follows:

Existing Annual production	=	150,000 gal wine/year
PW generation rate	=	6 gal PW/gal wine[a]
Annual PW Flow	=	150,000 gal wine x 6 gal PW/gal wine
	=	900,000 gal PW/year
Average PW Flow	=	(900,000 gal PW/year) / (365 days)
	=	2,470 gal PW/day
Peak PW Flow	=	(900,000 gal PW/year x 16.4[b] %)/(30 day)
	=	4,920 gal PW/day
Annual Production Water Demand	=	(900,000 gal water/yr) / (325,851 gal/ac-ft)
	=	2.8 ac-ft water/year

[a] Generation rate based on industry standards and water data for similar wineries
[b] The harvest month of September accounts for approximately 16.4 percent of the annual water demand.

Based on typical flow data from wineries of similar size and characteristics, the projected process wastewater generation for wine production is calculated as follows:

Proposed Annual production	=	300,000 gal wine/year
PW generation rate	=	6 gal PW/gal wine[a]
Annual PW Flow	=	300,000 gal wine x 6 gal PW/gal wine
	=	1,800,000 gal PW/year
Average PW Flow	=	(1,800,000 gal PW/year) / (365 days)
	=	4,940 gal PW/day
Peak PW Flow	=	(1,800,000 gal PW/year x 16.4[b] %)/(30 day)
	=	9,840 gal PW/day
Annual Production Water Demand	=	(1,800,000 gal water/yr) / (325,851 gal/ac-ft)
	=	5.5 ac-ft water/year

[a] Generation rate based on industry standards and water data for similar wineries
[b] The harvest month of September accounts for approximately 16.4 percent of the annual water demand.

The approximate annual water use associated with the existing production capacity is 900,000 gallons of water per year, or 2.8 ac-ft per year. The expected annual water use associated with the proposed production capacity is 1,800,000 gallons per year, or 5.5 ac-ft per year. Winery process water demand will continue to be provided by the existing domestic wells. Refer to Enclosure B for wastewater generation and water demand estimates.

DOMESTIC WATER DEMAND

Domestic water use at the facility is determined based on the total number of employees, visitors and event guests. Domestic water is supplied by the domestic wells. Sanitary Sewage generation is expected to be equivalent to the water demand for domestic uses. Using Napa County Environmental Management's Table 4 from "Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems", annual domestic water usage is estimated as follows:

Table 1. Existing Domestic Water Use at Etude Wine Company

Use Type	Maximum Quantity (persons/day)	Water Demand (gal/person)	Daily Demand (gal/day)	Number of Days (days/year)	Annual Water Use (gal/year)
Full Time Employee	19	15	285	365	104,025
Part Time Employee	5	15	75	365	27,375
Tasting Visitors [a]	246	3	738	156	115,128
Private Tasting Visitors	45	3	135	156	21,060
Private Event Visitors[c]	50	10	500	24	12,000
New Release Event Visitors[c]	250	10	2,500	4	10,000
Non-Specific Event Visitors[c]	300	10	3,000	3	9,000
Wine Auction Event Visitors[c]	200	10	2,000	2	4,000
				Total Water Use	**302,600**
				Total Water Use (ac-ft/yr)	**0.9**

[a] 246 visitors per day for 3 days a week represents the average of 740 visitors per week (156 days/yr)

Table 2. Proposed Domestic Water Use at Etude Wine Company

Use Type	Maximum Quantity (persons/day)	Water Demand (gal/person)	Daily Demand (gal/day)	Number of Days (days/year)	Annual Water Use (gal/year)
Full Time Employee	22	15	330	365	120,450
Part Time Employee	5	15	75	365	27,375
Tasting Visitors [a]	350	3	1,050	156[a]	163,800
Tasting Food Plates Preparation[b]	88	0.75	66	156[a]	10,296
Private Tasting Visitors	45	3	135	156	21,060
Private Event Visitors[c]	50	10	500	24	12,000
New Release Event Visitors[c]	250	10	2,500	4	10,000
Industry Event Visitors[c]	40	10	400	4	1,600
Non-Specific Event Visitors[c]	300	10	3,000	3	9,000
Wine Auction Event Visitors[c]	200	10	2,000	2	4,000
				Total Water Use	**379,600**
				Total Water Use (ac-ft/yr)	**1.2**

[a]350 visitors per day for 3 days a week represents the average of 1,000 visitors per week (156 days/yr)
[b] Food pairing assumed for 25% of tasting visitors
[c] Events will provide catered meals

The estimated existing permitted annual domestic water use is 302,600 gallons per year, or 0.9 ac-ft per year. The expected annual domestic water use for the proposed marketing and visitation plan is 379,600 gallons per year, or 1.2 ac-ft per year. Refer to Enclosure B for wastewater generation and water demand estimates.

IRRIGATION WATER DEMAND

- Vineyard Irrigation

  Water from the agricultural well is used to irrigate 10 acres of vineyards. The total acreage of vineyard will remain the same. Vineyard irrigation demand was estimated using a rate of 0.5 ac-ft per acre of vineyard. Napa County Water Availability Analysis Phase 1 standard rates for vineyard irrigation are 0.2 to 0.5 ac-ft/acre/year.

  10 acres x 0.5 ac-ft/acre/year = 5 ac-ft/yr = 1,630,000 gal/yr

  Vineyard irrigation demand is estimated to be 5 ac-ft per year of water demand.

- Landscape Irrigation

  Water from the agricultural well is used to irrigate 2.5 acres of landscape. The total acreage of landscape will remain the same. The water demand for landscape irrigation was based on the California Department of Water Resources guidelines for Estimated Total Water Use (ETWU) per year:

$$ETWU = (ETo)(0.62)\left(\frac{PF \times HA}{IE} + SLA\right)$$

Where:

ETWU = Estimated Total Water Use per year (gallons)
ETo = Reference Evapotranspiration (inches)
PF = Plant Factor from WUCOLS (see Section 491)
HA = Hydrozone Area [high, medium, and low water use areas] (square feet)
SLA = Special Landscape Area (square feet)
0.62 = Conversion Factor
IE = Irrigation Efficiency (minimum 0.71)

Assumptions:

- Low water use plant types with a plant factor of 0.2 (native plants, shrubs, etc.)
- Napa reference evapotranspiration of 49.4 per CIMIS, 1999
- Irrigation efficiency of 90% for drip systems or similar

$$ETWU = \frac{(49.4 \text{ in/year})\ (0.62)\ (0.2 * 108{,}900 \text{ SF})}{0.9} = 741{,}200 \text{ gal/yr.} = 2.3 \text{ ac-ft. /yr.}$$

TOTAL WATER DEMAND

The total water demand at the facility associated with the proposed production increase is expected to be 14.0 ac-ft per year, which is equivalent to 4.6 million gallons per year.

Table 3. Total Projected Annual Water Demand

Water Use	Gallons per day	Gallons per year	Acre-Feet per year
Wine Production	4,940	1,800,000	5.5
Domestic Use	1,410	379,600	1.2
Vineyard Irrigation[a]	6,650	1,630,000	5.0
Landscape Irrigation[a]	3,030	741,200	2.3
Total	16,030	4,550,800	14.0

[a] Estimated assuming that during the months of November through February no irrigation is required.

Based on the proposed increase in production and employees there is an overall increase in projected water demand of about 3.0 ac-ft/year (see Table 4).

Table 4. Water Demand Comparison

Water Use	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
Wine Production	2.8	5.5	2.7
Domestic Use	0.9	1.2	0.3
Vineyard Irrigation	5.0	5.0	0.0
Landscape Irrigation	2.3	2.3	0.0
Total	11.0	14.0	3.0

Refer to Enclosure B for wastewater generation and water demand estimates.

TIER I ANALYSIS: WATER USE CRITERIA

A Tier I analysis is required for all parcels located within the "All Other Areas" in the WAA draft guidelines. Since Etude Wine Company is not located within the Napa Valley floor or MST areas, a Tier I analysis is required. This analysis is intended to estimate the annual recharge during average and dry years.

ESTIMATED RECHARGE

- Method

  This analysis will include the estimated annual amount of infiltration from rainwater on the Etude Wine Company site. To determine the amount of infiltration onsite, the infiltration rates of the soils were established by the USDA Web Soil Survey (See Enclosure D). These infiltration rates account for soils that are on a steep slope. The mid-point of the infiltration rate range provided by the USDA for each soil type was assumed for analysis. Impervious areas (including buildings) and wastewater ponds were assumed to have an infiltration rate of 0.0 in/hr.

  The rainfall during average and dry years was determined from NOAA data (Enclosure E) for the number of days each year that have precipitation totals of more than 0.1"/day, 0.5"/day, and 1.0"/day. If the daily infiltration (in/day) for the soil is greater than 1" per day, all rain that falls on it is assumed to be infiltrated. If the soil's infiltration rate is between 0.5"/day and 0.99"/day, then it was assumed that it will infiltrate its maximum rate during a 1" storm. During a storm of 0.5"/day to 0.99"/day, the soil was assumed to only infiltrate 0.5" of the storm to be conservative. During a rain event of 0.1" to 0.49", this soil type would infiltrate all of the rain. The example calculation below is for the annual infiltration of “Haire Loam” (0.72 in/day infiltration rate) during an average rain year.

  $$\text{Infiltration During} > 1\text{" Event} = 0.72\ \text{in/day} \cdot 6.7\ \text{days/year} = 4.8\ \text{inches of infiltration}$$

  $$\text{Infiltration During } 0.5 \text{ to } 0.99\text{" Event} = 0.5\ \text{in/day} \cdot 12.3\ \text{days/year} = 6.15\ \text{inches of infiltration}$$

  $$\text{Infiltration During } 0.1\text{" to } 0.49\text{" Event} = 7.6\ \text{inches of infiltration}$$

  $$\text{Total Yearly Infiltration} = (4.8\ \text{in} + 6.15\ \text{in} + 7.6\ \text{in}) \cdot 1\text{ft}/12\text{ft} \cdot 23.7\ \text{acres} = 36.7\ \text{ac} - \text{ft/year}$$

  The full amount of yearly infiltration for each soil type can be found in Enclosure F Tier 1 analysis, infiltration calculation tables.

- Results

  Based on this analysis, it was estimated that the site will infiltrate approximately 36.7 ac-ft/year during an average year and 23.4 ac-ft/year during a 10-year drought from rain (See Enclosure F). These numbers do not account for the amount of water the vegetation will uptake (evapotranspiration). The amount of water use each year was conservatively estimated to be 14.0 ac-ft/year. Assuming that the vegetation uptake is 30% of the infiltrated water during a drought year, the site should still recharge

more water (16.4 ac-ft/year) to the aquifer than the site water demand. This shows that the water use onsite should be less than what will be recharged to the aquifer from rain.

WATER AVAILABILITY

The total estimated water demand of 14.0 ac-ft/year represents 60% of the water availability estimated for the facility during a 10 year drought period (23.4 ac-ft/year), and 38% of the water availability estimated for the facility during an average year (36.7 ac-ft/year).

There are 3 wells on the parcel, as indicated on the attached Site Plan (Enclosure A). The existing domestic well was drilled in 1985, has a depth of 255 ft with a 20 ft seal, a 6 inch PVC casing, and a yield of 50 gpm for a 4.5 hour test. The new domestic well was drilled in 2016, has a depth of 250 ft. with a 50 ft seal, a 6 inch PVC casing, and a yield of 30 gpm for an 8 hour test. The agricultural well has a depth of 237 ft and a well flushing test (not an 8 hour standard pump test) performed by Oakville Pump for the agricultural well resulted in a yield of 21 gpm. Well information is on Enclosure C.

The domestic wells will be required to supply sufficient water to meet the domestic demand. The average domestic water demand should account for 4,940 gal/day of process water and 1,410 gal/day of domestic water, for a total of 6,350 gal/day. The domestic wells will be required to supply on average 4.4 gpm over 24 hours. The domestic wells should have sufficient capacity to supply the potable water demand.

TIER II ANALYSIS: WELL INTERFERENCE

A Tier II analysis is required for all parcels located within the "All Other Areas" in the WAA draft guidelines. This analysis is intended to estimate any interference between wells and springs that could affect their supply capacity due to water usage. The objective of the Tier II analysis is to determine if any well (existing or in the future) within 500 ft of the project's wells could be affected by the drawdown of the project's wells. The analysis was performed for all wells onsite that are within 500 feet of the property line, to cover any possibility of a well existing or being drilled in the future within a 500 ft range from the property wells.

- Method

  Using the Theis equation as indicated in the WAA Napa County guidelines, the groundwater drawdown from all property wells to the edge of the parcel was determined. The assumed closest distance that any neighboring well could be located is the edge of the parcel. Due to the limited data on the aquifer, values that would yield a conservative drawdown estimate were selected from Napa County Water Availability Analysis guidelines.

  Assumptions:

  - Aquifer Thickness of 75 ft.
  - Hydraulic Conductivity range of 10 to 140 ft/day (Water Availability Analysis table F4)
  - Specific Storage range of 1.5×10^{-5} to 3.1×10^{-4} (1/ft) (Water Availability Analysis table F3)

The Theis equation can be seen below along with an example calculation.

$$\text{Theis Equation: Drawdown} = \frac{\text{Flow}}{(4\pi \times \text{Transmissivity})} \times W(u)$$

$$W(u) = \int_u^{\infty} \frac{1}{\omega} e^{-\omega} d\omega$$

$$u = \frac{(\text{Distance}^2 \times \text{Specific Storage})}{(4 \times \text{Transmissivity} \times \text{Time})}$$

$$\text{Transmissivity} = \text{ Hydraulic Conductivity } \times \text{Aquifer Thickness}$$

Example for the domestic well drawdown effect on possible wells on adjacent properties:

$$u = \frac{(124 \text{ ft})^2 \times (1.50 \text{ X } 10^{-5})}{4 \times 10 \frac{\text{ft}}{\text{day}} \times 75 \text{ ft} \times 1\text{day}} = 7.69 \times 10^{-5}$$

With this value of u, W(u) =8.90

$$\text{Drawdown} = \frac{50 \frac{\text{gal}}{\text{min}} \times \ 0.1337 \frac{\text{cuft}}{\text{gal}} \times 1{,}440 \frac{\text{min}}{\text{day}}}{4\pi \ \times 10 \frac{\text{ft}}{\text{day}} \times 75 \text{ ft}} \times 8.90 = 9.09 \text{ ft}$$

The table below shows a summary of the worst case scenario of drawdown results for the two onsite wells. More detailed tables can be found in Enclosure G Tier II, well drawdown calculation tables.

Table 4. Well Drawdown Calculations

	Well Flow Rate (gpm)	Distance to Property Line (ft)	Estimated Drawdown (ft)
Domestic Well	50	124	9.09
New Domestic Well	30	340	4.22
Agricultural Well	21	256	3.20

- Results

Using very conservative estimates for aquifer thickness, specific storage, and hydraulic conductivity, based on values from the Water Availability Analysis guidelines adopted by Napa County, none of the wells should produce a drawdown greater than 10 feet on any existing or future wells that could be adjacent to the property. The Water Availability Analysis guidelines establish a 10 foot drawdown as the default criteria to determine significant adverse effects. Since the wells estimated drawdown is less than 10 ft., no significant drawdown impact is expected for wells in adjacent parcels.

TIER III ANALYSIS: GROUNDWATER AND SURFACE WATER INTERACTION

Based on the screening criteria from the Water Availability Analysis guidelines from May 2015, a Tier III analysis is not required for either the Napa Valley Floor, MST or all other areas, unless substantial evidence determines the need for such analysis. Due to the lack of substantial evidence, no analysis is needed for Tier III.

DROUGHT CONSERVATION

The facility has secured a metered connection to the Los Carneros Recycled Water pipeline which will provide landscape and vineyard irrigation water to the site to offset the irrigation demand from the agricultural well. This irrigation line has the potential to offset 52% of the total water demand for the parcel, by using recycled water for vineyard and landscape irrigation (7.3 ac-ft/yr).

CONCLUSION

Total annual water demand at Etude Wine Company, associated with the proposed increase in production capacity to 300,000 gallons of wine per year, is estimated to be 14.0 ac-ft per year, representing an increase in 3.0 ac-ft per year from the current water uses. Based on the Tier I analysis, the annual recharge estimated for the parcel is 36.7 ac-ft/year for a normal year or 23.4 ac-ft/year for a drought year. This water availability analysis establishes that the estimated water demand for the facility represents 60% of the total water availability for the parcel for a drought year, and 38% of the total water availability for the parcel for an average year. The facility plans to utilize recycled water to offset vineyard and landscape irrigation, which has the potential to reduce the parcel's water demand to approximate 52% less of the total water use. The estimated average domestic water demand can be met with the existing domestic wells operating for 24 hours per day at 4.4 gpm.

ENCLOSURE A

OVERALL SITE PLAN

APPROXIMATE PROPERTY LINE, TYP

VINEYARD EXTENTS

(E) FENCE

WINERY PROCESS WASTEWATER POND (3.78 MGAL)

(E) FENCE

0 50 100

GRAPHIC SCALE IN FEET

100' SETBACK

(E) AGRICULTURAL WELL 3

(E) 16' DOUBLE SWING GATE

(E) PROCESS WASTE SCREENING EQUIPMENT

(E) PROCESS WASTE PUMP SUMP AND PUMPS

(E) CONCRETE COOLING TRAY STRUCTURE

(E) IRRIGATION RESERVOIR

(E) SANITARY WASTEWATER EVAPORATION POND (1.23 MGAL)

(E) WINERY BUILDING

100' SETBACK

(N) WELL 2

(E) WINERY BUILDING

(E) FENCE

CUTTINGS WHARF ROAD

(E) VINEYARD

(E) WELL 1

100' SETBACK

(E) FIRE PROTECTION STORAGE POND

(E) WINERY BUILDING

(E) VINEYARD

EXISTING AND PROPOSED WATER TREATMENT SYSTEM

APN 047-230-033

VINEYARD EXTENTS

VINEYARD EXTENTS

APPROXIMATE PROPERTY LINE, TYP

OVERALL SITE PLAN

SCALE: 1"=50'

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ETUDE WINE COMPANY
1250 CUTTINGS WHARF ROAD
NAPA COUNTY, CALIFORNIA
APN 047-230-033

WATER TREATMENT SYSTEM

OVERALL SITE PLAN

	2016-06-20 PERMIT SUBMITTAL

DATE: XXXX-XX-XX1
JOB NO: 2015097
SCALE: AS SHOWN
DRAWN: TF
CHECKED: CL
SHEET **W1**

ENCLOSURE B

WASTEWATER GENERATION AND WATER DEMAND

SUMMIT ENGINEERING, INC.	ETUDE WINE COMPANY Wastewater Feasibility Study Existing Process Wastewater Flows	PROJECT NO. BY: CHK:	2015142 CL GG

PROCESS WASTEWATER

Annual Volume

Annual Production (projected)					=	62,500	cases wine/year
Generation Rate (assumed)[a]					=	2.4	gal wine/case of wine
Annual Production	62,500	cases wine/year	x	2.4 gal wine/case of wine	=	150,000	gal wine/year
Generation Rate (assumed)[b]					=	165	gal wine/ton grapes
Tons Crushed	150,000	gal wine/year	÷	165 gal wine/ton grapes	=	909	tons grapes/year
Process Wastewater (PW) Generation Rate[c]	(assumed)				=	6.00	gal PW/gal wine
Annual PW Flow	150,000	gal wine/year	x	6.00 gal PW/gal wine	=	***900,000***	***gal PW/year***

Average Day Flow

	900,000	gal PW/year	÷	365 days	=	*2,466*	*gal PW/day*
					=	***2,470***	***gal PW/day***

Average, Day Peak Harvest Month Flow

Assume:	1	16.4%	of the PW flows are accounted for during September
	2	30	days in September

Peak Flow	900,000	gal PW/year	x	16.4%	=	*4,920*	*gal PW/day*
		30 days					
					=	***4,920***	***gal PW/day***

a. 2.4 gallons of wine per case of wine
b. 165 Gal wine per ton of grapes is used as a wine industry standard
c. 6.0 gal of PW per gallon wine produced over the course of 1 year is based on the average of data from approximately 16 wineries
d. Peak week tonnage was based on input from winery (for existing production)

SUMMIT ENGINEERING, INC.	ETUDE WINE COMPANY Wastewater Feasibility Study Process Wastewater Flows	PROJECT NO. BY: CHK:	2015142 CL GG

PROCESS WASTEWATER

Annual Volume

Annual Production (projected)					=	125,000	cases wine/year
Generation Rate (assumed)[a]					=	2.4	gal wine/case of wine
Annual Production	125,000 cases wine/year	x	2.4	gal wine/case of wine	=	300,000	gal wine/year
Generation Rate (assumed)[b]					=	165	gal wine/ton grapes
Tons Crushed	300,000 gal wine/year	÷	165	gal wine/ton grapes	=	1,818	tons grapes/year
Process Wastewater (PW) Generation Rate[c]	(assumed)				=	6.00	gal PW/gal wine
Annual PW Flow	300,000 gal wine/year	x	6.00	gal PW/gal wine	=	***1,800,000***	***gal PW/year***

Average Day Flow

	1,800,000 gal PW/year	÷	365	days	=	*4,932*	*gal PW/day*
					=	***4,940***	***gal PW/day***

Average, Day Peak Harvest Month Flow

Assume:	1	16.4%	of the PW flows are accounted for during September
	2	30	days in September

Peak Flow	1,800,000 gal PW/year	x	16.4%	=	*9,840*	*gal PW/day*
	30 days					
				=	***9,840***	***gal PW/day***

a. 2.4 gallons of wine per case of wine
b. 165 Gal wine per ton of grapes is used as a wine industry standard
c. 6.0 gal of PW per gallon wine produced over the course of 1 year is based on the average of data from approximately 16 wineries
d. Peak week tonnage was based on input from winery (for existing production)

SUMMIT ENGINEERING, INC.	ETUDE WINE COMPANY Wastewater Feasibility Study Existing Sanitary Sewage Flows	PROJECT NO. 2015142 BY: CL CHK: GG

SANITARY SEWAGE

Average Day w/o Event - Non-harvest					Notes
Employee (full-time)	19 x	15 gpcd	=	285 gal/day	
Employee (part-time)	5 x	15 gpcd	=	75 gal/day	
Tasting Visitors	106 x	3 gpcd	=	318 gal/day	Average of 740 visitors per week
Tasting Visitors food pairing	0 x	0.75 gpcd	=	0 gal/day	No food pairing with existing visitation
Private Tasting Visitors*	15 x	3 gpcd	=	45 gal/day	Average private tasting assumed
Total			=	723 gal/day	
			=	***730 gal/day***	

Peak Tasting Day Harvest					
Employee (full-time)	19 x	15 gpcd	=	285 gal/day	
Employee (part-time)	5 x	15 gpcd	=	75 gal/day	
Tasting Visitors	246 x	3 gpcd	=	738 gal/day	Peak visitation assumed (740 visitors in 3 days)
Tasting Visitors food pairing	0 x	0.75 gpcd	=	0 gal/day	No food pairing with existing visitation
Private Tasting Visitors*	45 x	3 gpcd	=	135 gal/day	Peak private tasting assumed
Total			=	1,233 gal/day	
			=	***1,240 gal/day***	

DESIGN FLOW = **1,240 gal/day**

*15 Business visitors, 3 times per day

SS from marketing events will be disposed of by use of portable toilets

SUMMIT ENGINEERING, INC.	ETUDE WINE COMPANY Wastewater Feasibility Study Sanitary Sewage Flows	PROJECT NO. 2015142 BY: CL CHK: GG

SANITARY SEWAGE

Average Day w/o Event - Non-harvest					Notes
Employee (full-time)	22 x	15 gpcd	=	330 gal/day	
Employee (part-time)	5 x	15 gpcd	=	75 gal/day	
Tasting Visitors	143 x	3 gpcd	=	429 gal/day	Average of 1,000 visitors per week
Tasting Visitors food pairing	36 x	0.75 gpcd	=	27 gal/day	25% of tasting assumed to include food pairing
Private Tasting Visitors*	15 x	3 gpcd	=	45 gal/day	Average private tasting assumed
Total			=	906 gal/day	
			=	***910 gal/day***	

Peak Tasting Day Harvest					
Employee (full-time)	22 x	15 gpcd	=	330 gal/day	
Employee (part-time)	5 x	15 gpcd	=	75 gal/day	
Tasting Visitors	350 x	3 gpcd	=	1,050 gal/day	
Tasting Visitors food pairing	88 x	0.75 gpcd	=	66 gal/day	25% of tasting assumed to include food pairing
Private Tasting Visitors*	45 x	3 gpcd	=	135 gal/day	Peak private tasting assumed
Total			=	1,656 gal/day	
			=	***1,660 gal/day***	

DESIGN FLOW = **1,660 gal/day**

*15 Business visitors, 3 times per day

SS from marketing events will be disposed of by use of portable toilets

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	Etude Wine Company WASTEWATER FEASIBILITY STUDY Existing Water Demand	PROJECT NO. 2015142 BY: CL CHK: GG

DOMESTIC WATER DEMAND

Average Day w/o Event - Non-harvest						Notes
Employee (full-time)	19	x	15 gpcd	=	285 gal/day	
Employee (part-time)	5	x	15 gpcd	=	75 gal/day	
Tasting Visitors	106	x	3 gpcd	=	318 gal/day	Average of 740 visitors per week
Tasting Visitors food pairing	0	x	0.75 gpcd	=	0 gal/day	No food pairing with existing visitation
Private Tasting Visitors*	15	x	3 gpcd	=	45 gal/day	Average private tasting assumed
Private Event Visitor	50	x	10 gpcd	=	500 gal/day	Events include catered meals
Total				=	1,223 gal/day	
				=	***1,230 gal/day***	

Peak Tasting Day Harvest W/Event						
Employee (full-time)	19	x	15 gpcd	=	285 gal/day	
Employee (part-time)	5	x	15 gpcd	=	75 gal/day	
Tasting Visitors	246	x	3 gpcd	=	738 gal/day	Peak visitation assumed (740 visitors in 3 days)
Tasting Visitors food pairing	0	x	0.75 gpcd	=	0 gal/day	No food pairing with existing visitation
Private Tasting Visitors*	45	x	3 gpcd	=	135 gal/day	Peak private tasting assumed
Marketing Event Visitors	300	x	10 gpcd	=	3,000 gal/day	Events include catered meals
Total				=	4,233 gal/day	
				=	***4,240 gal/day***	

*15 Business visitors, 3 times per day

SS from marketing events will be disposed of by use of portable toilets

PROCESS WATER DEMAND

Average Day Flow	=	2,470 gal/day
Average, Day Peak Harvest Month Flow	=	4,920 gal/day

TOTAL WATER DEMAND

	Average		Peak	
	gal/day	gal/min **	gal/day	gal/min **
Domestic Water	1,230	0.85	4,240	2.94
Process Water	2,470	1.72	4,920	3.42
Total	3,700	2.57	9,160	6.36

Peaking Factor	=	1.5
MDD (based on peak demand)	**=**	**13,740 gal/day**

**Over 24 hours per day

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	Etude Wine Company WASTEWATER FEASIBILITY STUDY Water Demand	PROJECT NO. 2015142 BY: CL CHK: GG

DOMESTIC WATER DEMAND

Average Day w/o Event - Non-harvest						Notes
Employee (full-time)	22	x	15 gpcd	=	330 gal/day	
Employee (part-time)	5	x	15 gpcd	=	75 gal/day	
Tasting Visitors	143	x	3 gpcd	=	429 gal/day	Average of 1,000 visitors per week
Tasting Visitors food pairing	36	x	0.75 gpcd	=	27 gal/day	25% of tasting assumed to include food pairing
Private Tasting Visitors*	15	x	3 gpcd	=	45 gal/day	Average private tasting assumed
Private Event Visitor	50	x	10 gpcd	=	500 gal/day	Events include catered meals
Total				=	1,406 gal/day	
				=	***1,410 gal/day***	

Peak Tasting Day Harvest W/Event						
Employee (full-time)	22	x	15 gpcd	=	330 gal/day	
Employee (part-time)	5	x	15 gpcd	=	75 gal/day	
Tasting Visitors	350	x	3 gpcd	=	1,050 gal/day	
Tasting Visitors food pairing	88	x	0.75 gpcd	=	66 gal/day	25% of tasting assumed to include food pairing
Private Tasting Visitors*	45	x	3 gpcd	=	135 gal/day	Peak private tasting assumed
Marketing Event Visitors	300	x	10 gpcd	=	3,000 gal/day	Events include catered meals
Total				=	4,656 gal/day	
				=	***4,660 gal/day***	

*15 Business visitors, 3 times per day

SS from marketing events will be disposed of by use of portable toilets

PROCESS WATER DEMAND

Average Day Flow	=	4,940 gal/day
Average, Day Peak Harvest Month Flow	=	9,840 gal/day

TOTAL WATER DEMAND

	Average		Peak	
	gal/day	gal/min **	gal/day	gal/min **
Domestic Water	1,410	1.0	4,660	3.2
Process Water	4,940	3.4	9,840	6.8
Total	6,350	4.4	14,500	10.1

Peaking Factor	=	1.5
MDD (based on peak demand)	**=**	**21,750 gal/day**

**Over 24 hours per day

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	Etude Wine Company WASTEWATER FEASIBILITY STUDY Summary Water & Wastewater Flows	PROJECT NO. 2015142 BY: CL CHK: GG

EXISTING DOMESTIC WATER USE

Use Type	Maximum Quantity (persons/day)	Water Demand (gal/person)	Daily Demand (gal/day)	Number of Days (days/year)	Annual Water Use (gal/year)
Full Time Employee	19	15	285	365	104,025
Part Time Employee	5	15	75	365	27,375
Tasting Visitors [a]	246	3	738	156	115,128
Tasting Food Plates Preparation	0	0.75	0	0	0
Private Tasting Visitors	45	3	135	156	21,060
Private Event Visitors[b]	50	10	500	24	12,000
New Release Event Visitors[b]	250	10	2500	4	10,000
Industry Event Visitors[c]	0	10	0	0	0
Non-Specific Event Visitors[b]	300	10	3000	3	9,000
Wine Auction Event Visitors[b]	200	10	2000	2	4,000
				Total Water Use	**302,600**
				Average Annual Water use (gpd)[c]	**830**
				Total Water Use (ac-ft/yr)	**0.9**

PROPOSED DOMESTIC WATER USE

Use Type	Maximum Quantity (persons/day)	Water Demand (gal/person)	Daily Demand (gal/day)	Number of Days (days/year)	Annual Water Use (gal/year)
Full Time Employee	22	15	330	365	120,450
Part Time Employee	5	15	75	365	27,375
Tasting Visitors [a]	350	3	1,050	156	163,800
Tasting Food Plates Preparation	88	0.75	66	156	10,296
Private Tasting Visitors	45	3	135	156	21,060
Private Event Visitors[b]	50	10	500	24	12,000
New Release Event Visitors[b]	250	10	2,500	4	10,000
Industry Event Visitors[c]	40	10	400	4	1,600
Non-Specific Event Visitors[b]	300	10	3,000	3	9,000
Wine Auction Event Visitors[b]	200	10	2,000	2	4,000
				Total Water Use	**379,600**
				Average Annual Water use (gpd)[c]	**1,040**
				Total Water Use (ac-ft/yr)	**1.2**

TOTAL EXISTING WAA

Water Use	Gallons per day	Gallons per year	Acre-Feet per year
Wine Production	2,470	900,000	2.8
Domestic Use	1,230	302,600	0.9
Vineyard Irrigation[a]	6,650	1,630,000	5.0
Landscape Irrigation[a]	3,030	741,200	2.3
Total	13,380	3,573,800	11.0

TOTAL PROPOSED WAA

Water Use	Gallons per day	Gallons per year	Acre-Feet per year
Wine Production	4,940	1,800,000	5.5
Domestic Use	1,410	379,600	1.2
Vineyard Irrigation[a]	6,650	1,630,000	5.0
Landscape Irrigation[a]	3,030	741,200	2.3
Total	16,030	4,550,800	14.0

WATER DEMAND COMPARISON

Water Use	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
Wine Production	2.8	5.5	2.8
Domestic Use	0.9	1.2	0.2
Vineyard Irrigation	5.0	5.0	0.0
Landscape Irrigation	2.3	2.3	0.0
Total	11.0	14.0	3.0

ENCLOSURE C

WELL LOGS AND PUMP TEST

WELL 1

DUPLICATE
Driller's Copy

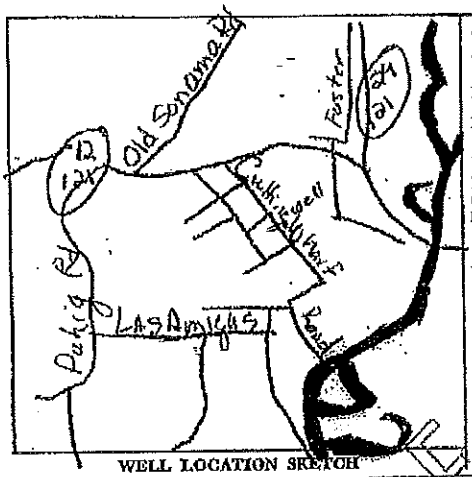
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 151104

Notice of Intent No.
Local Permit No. or Date
State Well No.
Other Well No.

(1) OWNER: Name R.M.S. Vineyards
Address Schramsberg Road
City Calistoga, CA Zip 94515

(2) LOCATION OF WELL (See instructions): APP.#47-230-33
County Napa Owner's Well Number
Well address if different from above 1250 Cuttings Wharf Road
Township Range Section
Distance from cities, roads, railroads, fences, etc.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:
Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size Pea
Diameter of bore 8 3/4"
Packed from 20 to 255 ft.

(7) CASING INSTALLED:
Steel [ ] Plastic [X] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	255	6	160

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size
60	255	Fact/P

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing Concrete

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 35 ft.

(11) WELL TESTS:
Was well test made? Yes [ ] No [ ] If yes, by whom? Driller
Type of test Pump [X] Bailer [ ]
Depth to water at start of test 35 ft. At end of test 90 ft.
Discharge 50 gal/min after 4½ hours Water temperature
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth 255 ft. Depth of completed well 255 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	5	Top soil.
5	23	Brown clay.
23	62	Blue clay.
62	95	Sand and gravel.
95	210	Brown clay with gravel inbedded.
210	255	Brown clay and gravel.

Work started 8-29-85 19 Completed 9-11-85 19

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of m knowledge and belief.
SIGNED (Well Driller)
NAME McLean & Williams (Typed or printed)
Address 878 El Centro Ave.
City Napa, CA Zip 94558
License No. 396352 Date of this report 9-20-85

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

WELL 2

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0310661

Page 1 of 1

Owner's Well Number

Date Work Began 04/04/2016 Date Work Ended 4/12/2016

Local Permit Agency Napa County Planning, Building & Enviromental Service

Permit Number E16-00128 Permit Date 3/22/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N Latitude W Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	5	Top soil.
5	20	Brown clay.
20	60	Grey clay 85% with gravel.
60	80	Gravel and sand 3/8".
80	85	Large gravel and sand 3/4".
85	100	Slowing turned to brown caly.
100	255	Brown clay 95%.

Total Depth of Boring 255 Feet

Total Depth of Completed Well 250 Feet

Well Owner

Name Etude Winery-Treasury Wine Estate American Company

Mailing Address P.O. Box 3382

City Napa State CA Zip 94558

Well Location

Address 1250 Cuttings Wharf Road

City Napa County Napa

Latitude ___ Deg. ___ Min. ___ Sec. N Longitude ___ Deg. ___ Min. ___ Sec. W

Datum ___ Dec. Lat. ___ Dec. Long. ___

APN Book 047- Page 230- Parcel 033-000

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. **Please be accurate and complete.**

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☑ Domestic ☑ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 57 (Feet below surface)

Depth to Static Water Level 70 (Feet) Date Measured 04/12/2016

Estimated Yield * 45 (GPM) Test Type Air Lift

Test Length 5.0 (Hours) Total Drawdown 210 (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	70	12.25	Blank	F480 PVC	.316	6.625		
70	150	12.25	Screen	F480 PVC	.316	6.625	Milled Slots	0.032
150	170	12.25	Blank	F480 PVC	.316	6.625		
170	210	12.25	Screen	F480 PVC	.316	6.625	Milled Slots	0.032
210	230	12.25	Blank	F480 PVC	.316	6.625		
230	250	12.25	Screen	F480 PVC	.316	6.625	Milled Slots	0.032

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	50	Cement	
50	57	Bentonite	
57	250	Pea Gravel	

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name McLean & Williams, Inc.
Person, Firm or Corporation

878 El Centro Ave. Napa CA 94558
Address City State Zip

Signed [signature] 5-16-2016 396352
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Well Drilling & Pump Service
878 El Centro Ave. Napa Ca, 94558
Office 707-255-6450
Fax 707-255-6489
Licenses #396352

WELL INSPECTION REPORT FOR

Attn: Etude Winery/ Treasury Wine Estates **Date of test:** May 5th, 2016
Upon your request, we have checked the well and/or pressure system at
1250 Cuttings Wharf Rd., Napa
Our findings are as follows:

WELL INFORMATION

Casing Size: 6" PVC
Static Water Level: 76' from top of casing
Well Depth: 240' **draw down during test:** 80' from top of casing
Total water draw down in feet from static water level at end of flow test 6'
How tested: Open discharge with test pumping equipment
Well yield after test: 30 Gallons per minute after 8 hours of continuous pumping
Well Comments: Well constructed 05/12/2016 and was estimated to yield approximately 45-50 GPM with air lift test method

WELL EQUIPMENT INFORMATION

Pump Make: Grundfos **HP** 5 **Pump Setting:** 230' plus pump and motor
Type: Submersible **Voltage:** 230 **Pipe Size:** 2" sch.120 pvc
Pump Model: 65S50-12 **Phase:** 3 **Wire Size:** #8-3/wg submersible flat jacket
Pressure tank: None test pump equipment only
Comments: Test Equipment was used to finish developing the new well flush and test equipment was removed at end of test.

WELL TEST INFORMATION

Hours	Time	water level	Draw down	GPM	Comments
0	9:30am	76’	0	30	Clear water color
1	10:30	80’	4’	30	
2	11:30	80’	4’	30	
3	12:30pm	80’	4’	30	
4	1:30	80’	4’	30	
5	2:30	80’	4’	30	
6	3:30	80’	4’	30	
7	4:30	80’	4’	30	
8	5:30	80’	4’	30	
		Inches			
RECOVERY	Time	W/Level	In./ Recovery	Flow/Rate	
.00hr	5:30	80’		0	
.25hr	5:45	76’	4’	0	At original static
.50hr	6:00	76’		0	
.75hr				0	
1.00hr				0	
1.25hr				0	
1.50hr				0	
1.75hr				0	
2.00hr				0	
3.00hr				0	
4.00hr				0	
5.00hr				0	
6.00hr				0	
7.00hr				0	
8.00hr				0	

NOTE: Need to meet 95% recovery by hour 8

Summary:

1. Static Water level at beginning of test: 76’ from top of casing
2. Static Water recovery at end of recovery: 76’ from top of casing
3. Recovery to; _76’_, within: 15 minutes
   (Recovery time)

Draw-down in feet: 4’

4. Well capacity (gpm) _30__ gpm
5. Specific Capacity Well Yield GPM/ft of drawdown: _7.5_ gpm/ft

WATER SAMPLES

Water samples collected and deliver to the laboratory same day, please see attachment.

FINAL COMMENTS

Please note that flow test results by McLean and Williams Inc. represents the well water yield and system condition for the time of the test only.

Gonzalo Salinas
Mclean & Williams Inc.
gonzalo@mcleanandwillimas.com

Thank you, *Gonzalo Salinas*

ENCLOSURE D

USDA WEB SOIL SURVEY

Soil Map—Napa County, California
(Etude soil map)

Map Scale: 1:3,650 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: http://websoilsurvey.nrcs.usda.gov
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 7, Sep 25, 2014

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

Date(s) aerial images were photographed: Feb 4, 2012—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.

Map Unit Legend

Napa County, California (CA055)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
146	Haire loam, 2 to 9 percent slopes	29.8	100.0%
Totals for Area of Interest		**29.8**	**100.0%**

Napa County, California

146—Haire loam, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hdlh
Elevation: 20 to 2,400 feet
Mean annual precipitation: 25 to 30 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Haire and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haire

Setting

Landform: Alluvial fans, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 22 inches: loam
H2 - 22 to 27 inches: sandy clay loam
H3 - 27 to 45 inches: clay
H4 - 45 to 60 inches: sandy clay

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Ecological site: CLAYPAN (R014XD089CA)

Minor Components

Clear lake
Percent of map unit: 5 percent
Landform: Alluvial fans

Data Source Information

Soil Survey Area: Napa County, California
Survey Area Data: Version 7, Sep 25, 2014

ENCLOSURE E

NOAA RAINFALL DATA

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: NAPA STATE HOSPITAL, CA **COOP ID: 046074**

Climate Division: CA 1 **NWS Call Sign:** **Elevation: 35 Feet** **Lat: 38˚17N** **Lon: 122˚16W**

Temperature (˚F)

Month	Mean (1) Daily Max	Mean (1) Daily Min	Mean (1) Mean	Extremes Highest Daily(2)	Extremes Year	Extremes Day	Extremes Highest Month(1) Mean	Extremes Year	Extremes Lowest Daily(2)	Extremes Year	Extremes Day	Extremes Lowest Month(1) Mean	Extremes Year	Degree Days (1) Base Temp 65 Heating	Degree Days (1) Base Temp 65 Cooling	Mean Number of Days (3) Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
Jan	56.6	39.2	47.9	85	1962	8	53.0	1986	19	1937	9	43.4	1972	529	0	.0	.0	28.9	.0	6.4	.0
Feb	61.8	41.8	51.8	85	1948	17	55.3	1991	23	1917	1	47.1	1989	370	0	.0	.0	27.7	@	1.8	.0
Mar	65.4	43.1	54.3	90	1955	8	58.2	1986	23	1949	8	50.7	1985	335	2	.0	.0	31.0	.0	.7	.0
Apr	70.5	44.7	57.6	95+	1981	29	61.7	1987	27+	1933	22	52.3	1975	231	9	.0	.3	30.0	.0	.2	.0
May	75.4	48.8	62.1	103+	2001	31	66.7	1997	30	1974	18	56.9	1977	133	42	.2	2.4	31.0	.0	@	.0
Jun	80.5	52.6	66.6	113	1961	14	72.7	1981	34+	1933	17	61.4	1982	49	94	1.0	4.8	30.0	.0	.0	.0
Jul	82.6	54.5	68.6	112	1972	14	71.5	1988	38+	1933	13	66.1	1994	9	120	1.0	5.4	31.0	.0	.0	.0
Aug	82.4	54.5	68.5	106	1998	4	72.2	1998	37	1932	17	64.8	1980	13	120	.4	5.2	31.0	.0	.0	.0
Sep	81.8	53.1	67.5	109+	1955	2	71.8	1984	36	1932	22	64.2	1972	31	105	.7	6.6	30.0	.0	.0	.0
Oct	76.4	49.0	62.7	106	1980	1	66.0	1986	28	1946	29	59.3	1981	105	34	.3	2.5	31.0	.0	@	.0
Nov	64.1	42.9	53.5	89+	1966	1	59.7	1995	25+	1932	4	48.7	1994	347	3	.0	.0	30.0	.0	1.1	.0
Dec	56.8	38.6	47.7	81	1967	26	53.1	1995	14	1990	22	42.5+	1990	537	0	.0	.0	28.4	.0	6.5	.0
Ann	71.2	46.9	59.1	113	Jun 1961	14	72.7	Jun 1981	14	Dec 1990	22	42.5+	Dec 1990	2689	529	3.6	27.2	360.0	@	16.7	.0

\+ Also occurred on an earlier date(s)

@ Denotes mean number of days greater than 0 but less than .05

Complete documentation available from: www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

(1) From the 1971-2000 Monthly Normals

(2) Derived from station's available digital record: 1917-2001

(3) Derived from 1971-2000 serially complete daily data

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www.ncdc.noaa.gov

Station: NAPA STATE HOSPITAL, CA

COOP ID: 046074

Climate Division: CA 1 **NWS Call Sign:** **Elevation: 35 Feet** **Lat: 38°17N** **Lon: 122°16W**

Precipitation (inches)

Precipitation Totals

Month	Means/ Medians(1) Mean	Means/ Medians(1) Median	Extremes Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year
Jan	5.35	4.73	5.69	1982	4	13.66	1995	.34	1976
Feb	5.03	4.02	3.45	1983	25	15.29	1986	.28	1971
Mar	4.09	3.01	3.28	1940	30	11.97	1995	.13	1988
Apr	1.45	1.27	2.66	1996	1	3.97	1982	.07	1985
May	.78	.20	1.85	1996	16	3.72	1996	.00+	1992
Jun	.16	.00	1.22	1967	2	1.09	1992	.00+	1999
Jul	.05	.00	.81	1974	8	1.05	1974	.00+	2000
Aug	.11	.00	.84	1965	11	1.30	1976	.00+	2000
Sep	.41	.10	1.87	1959	18	2.31	1989	.00+	1995
Oct	1.43	1.21	4.66+	1962	13	3.64	1975	.00+	1995
Nov	3.72	3.01	5.85	1977	21	10.51	1973	.15	1986
Dec	3.88	3.36	4.10	1931	27	12.92	1996	.00	1989
Ann	26.46	24.92	5.85	Nov 1977	21	15.29	Feb 1986	.00+	Aug 2000

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	11.5	7.9	3.7	1.6
Feb	10.0	7.4	3.7	1.4
Mar	10.3	7.7	3.1	.9
Apr	6.3	3.6	.9	.2
May	3.3	1.6	.5	.1
Jun	.8	.5	.1	.0
Jul	.2	.1	@	.0
Aug	.4	.3	.1	.0
Sep	1.8	1.0	.3	.1
Oct	4.0	2.4	1.0	.4
Nov	8.9	5.9	2.8	1.1
Dec	9.7	6.3	2.8	.9
Ann	67.2	44.7	19.0	6.7

Precipitation Probabilities (1)

Probability that the monthly/annual precipitation will be equal to or less than the indicated amount

Monthly/Annual Precipitation vs Probability Levels
These values were determined from the incomplete gamma distribution

Month	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95
Jan	.50	.87	1.60	2.34	3.15	4.07	5.16	6.52	8.40	11.52	14.59
Feb	.38	.71	1.36	2.06	2.83	3.71	4.77	6.11	7.97	11.09	14.18
Mar	.31	.58	1.11	1.67	2.29	3.01	3.88	4.97	6.48	9.02	11.53
Apr	.12	.22	.41	.61	.84	1.09	1.39	1.76	2.29	3.16	4.01
May	.00	.00	.01	.07	.16	.31	.52	.83	1.31	2.21	3.17
Jun	.00	.00	.00	.00	.00	.00	.05	.15	.29	.52	.77
Jul	**	**	**	**	**	**	**	**	**	**	**
Aug	**	**	**	**	**	**	**	**	**	**	**
Sep	.00	.00	.00	.00	.03	.11	.23	.42	.71	1.24	1.80
Oct	.00	.10	.33	.55	.79	1.06	1.38	1.77	2.32	3.24	4.14
Nov	.18	.38	.82	1.31	1.88	2.56	3.39	4.47	5.99	8.58	11.18
Dec	.25	.64	1.25	1.82	2.42	3.08	3.84	4.78	6.05	8.14	10.15
Ann	12.30	14.61	17.80	20.38	22.78	25.18	27.75	30.68	34.37	39.94	44.95

+ Also occurred on an earlier date(s)
# Denotes amounts of a trace
@ Denotes mean number of days greater than 0 but less than .05
****** Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals
(2) Derived from station's available digital record: 1917-2001
(3) Derived from 1971-2000 serially complete daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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Station: NAPA STATE HOSPITAL, CA **COOP ID: 046074**

Climate Division: CA 1 **NWS Call Sign:** **Elevation: 35 Feet** **Lat: 38°17N** **Lon: 122°16W**

Snow (inches)

Snow Totals

Means/Medians (1)

Month	Snow Fall Mean	Snow Fall Median	Snow Depth Mean	Snow Depth Median
Jan	#	.0	0	0
Feb	.0	.0	0	0
Mar	.0	.0	0	0
Apr	.0	.0	0	0
May	.0	.0	0	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	.0	.0	0	0
Oct	.0	.0	0	0
Nov	.0	.0	0	0
Dec	#	.0	0	0
Ann	#	.0	N/A	N/A

Extremes (2)

Month	Highest Daily Snow Fall	Year	Day	Highest Monthly Snow Fall	Year	Highest Daily Snow Depth	Year	Day	Highest Monthly Mean Snow Depth	Year
Jan	#	1979	30	#	1979	0	0	0	0	0
Feb	.0	0	0	.0	0	0	0	0	0	0
Mar	1.0	1987	22	1.0	1987	0	0	0	0	0
Apr	.0	0	0	.0	0	0	0	0	0	0
May	.0	0	0	.0	0	0	0	0	0	0
Jun	.0	0	0	.0	0	0	0	0	0	0
Jul	.0	0	0	.0	0	0	0	0	0	0
Aug	.0	0	0	.0	0	0	0	0	0	0
Sep	.0	0	0	.0	0	0	0	0	0	0
Oct	.0	0	0	.0	0	0	0	0	0	0
Nov	.0	0	0	.0	0	0	0	0	0	0
Dec	#	1972	13	#	1972	0	0	0	0	0
Ann	1.0	Mar 1987	22	1.0	Mar 1987	0	0	0	0	0

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	.0	.0	.0	.0	.0
Feb	.0	.0	.0	.0	.0
Mar	@	@	.0	.0	.0
Apr	.0	.0	.0	.0	.0
May	.0	.0	.0	.0	.0
Jun	.0	.0	.0	.0	.0
Jul	.0	.0	.0	.0	.0
Aug	.0	.0	.0	.0	.0
Sep	.0	.0	.0	.0	.0
Oct	.0	.0	.0	.0	.0
Nov	.0	.0	.0	.0	.0
Dec	.0	.0	.0	.0	.0
Ann	@	@	.0	.0	.0

Snow Depth >= Thresholds

Month	1	3	5	10
Jan	.0	.0	.0	.0
Feb	.0	.0	.0	.0
Mar	.0	.0	.0	.0
Apr	.0	.0	.0	.0
May	.0	.0	.0	.0
Jun	.0	.0	.0	.0
Jul	.0	.0	.0	.0
Aug	.0	.0	.0	.0
Sep	.0	.0	.0	.0
Oct	.0	.0	.0	.0
Nov	.0	.0	.0	.0
Dec	.0	.0	.0	.0
Ann	.0	.0	.0	.0

+ Also occurred on an earlier date(s) #Denotes trace amounts

@ Denotes mean number of days greater than 0 but less than .05

-9/-9.9 represents missing values
Annual statistics for Mean/Median snow depths are not appropriate

(1) Derived from Snow Climatology and 1971-2000 daily data

(2) Derived from 1971-2000 daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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Freeze Data

Spring Freeze Dates (Month/Day)

Temp (F)	Probability of later date in spring (thru Jul 31) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	5/05	4/25	4/17	4/11	4/05	3/30	3/23	3/16	3/05
32	4/06	3/22	3/12	3/02	2/22	2/13	2/04	1/25	1/10
28	2/08	1/27	1/18	1/10	1/02	12/23	12/09	0/00	0/00
24	12/20	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00
20	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00
16	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00

Fall Freeze Dates (Month/Day)

Temp (F)	Probability of earlier date in fall (beginning Aug 1) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	10/30	11/04	11/08	11/11	11/15	11/18	11/21	11/25	11/30
32	11/05	11/15	11/23	11/29	12/05	12/11	12/18	12/25	1/05
28	11/27	12/08	12/15	12/23	12/30	1/08	1/24	0/00	0/00
24	12/28	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00
20	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00
16	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	258	246	237	230	223	216	209	200	188
32	348	324	309	296	285	273	261	246	227
28	>365	>365	>365	>365	362	344	333	323	310
24	>365	>365	>365	>365	>365	>365	>365	>365	>365
20	>365	>365	>365	>365	>365	>365	>365	>365	>365
16	>365	>365	>365	>365	>365	>365	>365	>365	>365

***** Probability of observing a temperature as cold, or colder, later in the spring or earlier in the fall than the indicated date.

0/00 Indicates that the probability of occurrence of threshold temperature is less than the indicated probability.

Derived from 1971-2000 serially complete daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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Climate Division: CA 1 **NWS Call Sign:** **Elevation: 35 Feet** **Lat: 38˚17N** **Lon: 122˚16W**

Degree Days to Selected Base Temperatures (˚F)

Heating Degree Days (1)

Base Below	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
65	529	370	335	231	133	49	9	13	31	105	347	537	2689
60	375	233	194	116	52	10	0	0	5	31	213	383	1612
57	288	157	125	67	23	3	0	0	0	11	146	297	1117
55	233	114	90	41	12	1	0	0	0	5	108	242	846
50	119	39	25	9	1	0	0	0	0	0	43	128	364
32	0	0	0	0	0	0	0	0	0	0	0	0	0

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	494	555	690	768	932	1036	1134	1130	1064	952	645	486	9886
55	13	25	67	119	231	347	421	417	374	244	64	15	2337
57	7	12	41	85	180	289	359	355	314	188	41	9	1880
60	0	3	16	43	116	206	266	263	228	115	18	2	1276
65	0	0	2	9	42	94	120	120	105	34	3	0	529
70	0	0	0	0	9	27	27	31	30	4	0	0	128

Growing Degree Units (2)

Base	Growing Degree Units (Monthly)												Growing Degree Units (Accumulated Monthly)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
40	268	362	458	545	697	809	897	893	839	723	430	262	268	630	1088	1633	2330	3139	4036	4929	5768	6491	6921	7183
45	130	220	303	395	542	659	742	738	689	568	281	133	130	350	653	1048	1590	2249	2991	3729	4418	4986	5267	5400
50	46	103	161	247	387	509	587	583	539	413	145	45	46	149	310	557	944	1453	2040	2623	3162	3575	3720	3765
55	3	28	56	120	235	359	432	428	389	259	54	4	3	31	87	207	442	801	1233	1661	2050	2309	2363	2367
60	0	1	9	39	110	212	277	273	240	127	9	0	0	1	10	49	159	371	648	921	1161	1288	1297	1297
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	129	194	261	330	421	493	561	563	513	440	243	133	129	323	584	914	1335	1828	2389	2952	3465	3905	4148	4281

(1) Derived from the 1971-2000 Monthly Normals
(2) Derived from 1971-2000 serially complete daily data
Note: For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

Notes

a. The monthly means are simple arithmetic averages computed by summing the monthly values for the period 1971-2000 and dividing by thirty. Prior to averaging, the data are adjusted if necessary to compensate for data quality issues, station moves or changes in station reporting practices. Missing months are replaced by estimates based on neighboring stations.

b. The median is defined as the middle value in an ordered set of values. The median is being provided for the snow and precipitation elements because the mean can be a misleading value for precipitation normals.

c. Only observed validated values were used to select the extreme daily values.

d. Extreme monthly temperature/precipitation means were selected from the monthly normals data.
Monthly snow extremes were calculated from daily values quality controlled to be consistent with the Snow Climatology.

e. Degree Days were derived using the same techniques as the 1971-2000 normals.
Compete documentation for the 1971-2000 Normals is available on the internet from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

f. Mean "number of days statistics" for temperature and precipitation were calculated from a serially complete daily data set .
Documentation of the serially complete data set is available from the link below:

g. Snowfall and snow depth statistics were derived from the Snow Climatology.
Documentation for the Snow Climatology project is available from the link under references.

Data Sources for Tables

Several different data sources were used to create the Clim20 climate summaries. In some cases the daily extremes appear inconsistent with the monthly extremes and or the mean number of days statistics. For example, a high daily extreme value may not be reflected in the highest monthly value or the mean number of days threshold that is less than and equal to the extreme value. Some of these difference are caused by different periods of record. Daily extremes are derived from the station's entire period of record while the serial data and normals data were are for the 1971-2000 period. Therefore extremes observed before 1971 would not be included in the 1971-2000 normals or the 1971-2000 serial daily data set. Inconsistencies can also occur when monthly values are adjusted to reflect the current observing conditions or were replaced during the 1971-2000 Monthly Normals processing and are not reconciled with the Summary of the Day data.

a. Temperature/ Precipitation Tables
   1. 1971-2000 Monthly Normals
   2. Cooperative Summary of the Day
   3. National Weather Service station records
   4. 1971-2000 serially complete daily data

b. Degree Day Table
   1. Monthly and Annual Heating and Cooling Degree Days Normals to Selected Bases derived from 1971-2000 Monthly Normals
   2. Daily Normal Growing Degree Units to Selected Base Temperatures derived from 1971-2000 serially complete daily data

c. Snow Tables
   1. Snow Climatology
   2. Cooperative Summary of the Day

d. Freeze Data Table
   1971-2000 serially complete daily data

References

U.S. Climate Normals 1971-2000, www.ncdc.noaa.gov/normals.html
U.S. Climate Normals 1971-2000-Products Clim20, www.ncdc.noaa.gov/oa/climate/normals/usnormalsprods.html
Snow Climatology Project Description, www.ncdc.noaa.gov/oa/climate/monitoring/snowclim/mainpage.html
Eischeid, J. K., P. Pasteris, H. F. Diaz, M. Plantico, and N. Lott, 2000: Creating a serially complete, national daily time series of temperature and precipitation for the Western United States. J. Appl. Meteorol., 39, 1580-1591,
www1.ncdc.noaa.gov/pub/data/special/ serialcomplete_jam_0900.pdf

ENCLOSURE F

TIER I ANALYSIS: INFILTRATION CALCULATION TABLES

SUMMIT ENGINEERING, INC.	ETUDE WINE COMPANY Water Availability Tier I: Infiltration Calculation	PROJECT NO. 2015142 BY: CL CHK: GG

Average Year Rain Events

Daily Rainfall	Rainfall (Days/Year)	Average Rainfall (in/day)	Annual Rainfall (in/year)
1" or More	6.7	1.220	8.2
0.5" to 0.99"	12.3	0.745	9.2
0.1" to 0.49"	25.7	0.295	7.6
Total	44.7	2.3	24.9

Annual Rain Volume (ac-ft/year) = 61.9

Soil Type	Slope	Infiltration Rate (in/hr)	Infiltration Rate (in/day)	Area (Acres)	Infiltration > 1 in/day	Infiltration ≥ 0.5 in/day	Infiltration ≥ 0.1 in/day	Total Infiltration (ft./day)	Annual Infiltration (ac-ft/year)
Impervious	N/A	0.00	0	3.5	0	0	0	0.0	0.0
Haire Loam	2-9%	0.03	0.72	23.7	4.8	6.15	7.6	1.5	36.7
Water (ponds)	N/A	0.00	0	2.6	0	0	0	0.0	0.0
TOTAL				**29.8**					**36.7**

Notes:
1. Total Annual Rainfall should represent the annual median precipitation for the site
2. Annual Rainfall for the respective daily rainfall (in) bracket, is estimated based on the days of rainfall and the average inches of rain for those days
3. Impervious area is based on currently built structures
4. Annual Rain Volume is estimated based on the total acres of the parcel and total annual rainfall
5. Soil Infiltration Rates are obtained from the USDA soil data for the respective soil type for the parcel
6. Annual Infiltration Volume for each soil type is based on the infiltration capacity of the soil and a conservative estimate of the inches of rain that could infiltrate the soil during a rain event

Average Year Rain Events

Daily Rainfall	Rainfall (Days/Year)	Average Rainfall (in/day)	Annual Rainfall (in/year)
1" or More	2.8	1.220	3.4
0.5" to 0.99"	5.7	0.745	4.2
0.1" to 0.49"	23.6	0.295	7.0
Total	32.1	2.3	14.6

Annual Rain Volume (ac-ft/year) = 36.3

Soil Type	Slope	Infiltration Rate (in/hr)	Infiltration Rate (in/day)	Area (Acres)	Infiltration > 1 in/day	Infiltration ≥ 0.5 in/day	Infiltration ≥ 0.1 in/day	Total Infiltration (ft./day)	Annual Infiltration (ac-ft/year)
Impervious	N/A	0.00	0	3.5	0	0	0	0.0	0.0
Haire Loam	2-9%	0.03	0.72	23.7	2.0	2.85	7.0	1.0	23.4
Water (ponds)	N/A	0.00	0	2.6	0	0	0	0.0	0.0
TOTAL				**29.8**					**23.4**

Notes:
1. Total Annual Rainfall should represent the annual 0.1 precipitation probability level
2. Annual Rainfall for the respective daily rainfall (in) bracket, is estimated based on the days of rainfall and the average inches of rain for those days
3. Impervious area is based on currently built structures
4. Annual Rain Volume is estimated based on the total acres of the parcel and total annual rainfall
5. Soil Infiltration Rates are obtained from the USDA soil data for the respective soil type for the parcel
6. Annual Infiltration Volume for each soil type is based on the infiltration capacity of the soil and a conservative estimate of the inches of rain that could infiltrate the soil during a rain event

ENCLOSURE G

TIER II ANALYSIS: WELL DRAWDOWN CALCULATION TABLES

Appendix C

Theis Well Function, W(u)

u x	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
1.E+00	0.2194	4.89E−2	1.31E−2	3.78E−3	1.15E−3	3.60E−4	1.16E−4	3.76E−5	1.24E−5
1.E−01	1.823	1.223	0.906	0.702	0.560	0.454	0.374	0.311	0.260
1.E−02	4.038	3.355	2.959	2.681	2.468	2.295	2.151	2.027	1.919
1.E−03	6.332	5.639	5.235	4.948	4.726	4.545	4.392	4.259	4.142
1.E−04	8.633	7.940	7.535	7.247	7.024	6.842	6.688	6.555	6.437
1.E−05	10.94	10.24	9.837	9.550	9.326	9.144	8.990	8.856	8.739
1.E−06	13.24	12.55	12.14	11.85	11.63	11.45	11.29	11.16	11.04
1.E−07	15.54	14.85	14.44	14.15	13.93	13.75	13.60	13.46	13.34
1.E−08	17.84	17.15	16.74	16.46	16.23	16.05	15.90	15.76	15.65
1.E−09	20.15	19.45	19.05	18.76	18.54	18.35	18.20	18.07	17.95
1.E−10	22.45	21.76	21.35	21.06	20.84	20.66	20.50	20.37	20.25
1.E−11	24.75	24.06	23.65	23.36	23.14	22.96	22.81	22.67	22.55
1.E−12	27.05	26.36	25.96	25.67	25.44	25.26	25.11	24.97	24.86
1.E−13	29.36	28.66	28.26	27.97	27.75	27.56	27.41	27.28	27.16
1.E−14	31.66	30.97	30.56	30.27	30.05	29.87	29.71	29.58	29.46
1.E−15	33.96	33.27	32.86	32.58	32.35	32.17	32.02	31.88	31.76

SUMMIT ENGINEERING, INC.	ETUDE WINE COMPANY Water Availability Tier II: Well Drawdown Analysis	PROJECT NO. 2015142 BY: CL CHK: GG

Well 01 Drawdown	Well Flow (gpm)	Radius (ft)	Specific Storage (1/ft)	Transmissivity (ft2/day)	Time (days)	Aquifer Thickness (ft)	Hydraulic Conductivity (ft/day)
Data	50	124	1.50E-05	750	1	75	10
Theis Eq =	0.0472	u =	7.69E-05	W (u) =	8.90	Drawdown (ft) =	9.09

Theis Function	X	Y
a	7.00E-05	8.99
b	8.00E-05	8.856

Well 01 (50 gpm) Calculated Drawdown

Aquifer Thickness Assumed = 75 ft
Time = 1 day

Specific Storage (1/ft)	Hydraulic Conductivity (ft/day)	Minimum Distance To Neighboring Well (ft)	Drawdown (ft)
3.10E-04	10	124	6.05
1.50E-05	10	124	9.09
3.10E-04	140	124	0.62
1.50E-05	140	124	0.84

Well 02 Drawdown	Well Flow (gpm)	Radius (ft)	Specific Storage (1/ft)	Transmissivity (ft2/day)	Time (days)	Aquifer Thickness (ft)	Hydraulic Conductivity (ft/day)
Data	30	340	1.50E-05	750	1	75	10
Theis Eq =	0.0219	u =	5.78E-04	W (u) =	6.88	Drawdown (ft) =	4.22

Theis Function	X	Y
a	5.00E-04	7.024
b	6.00E-04	6.842

Well 02 (30 gpm) Calculated Drawdown

Aquifer Thickness Assumed = 75 ft
Time = 1 day

Specific Storage (1/ft)	Hydraulic Conductivity (ft/day)	Minimum Distance To Neighboring Well (ft)	Drawdown (ft)
3.10E-04	10	340	2.39
1.50E-05	10	340	4.22
3.10E-04	140	340	0.28
1.50E-05	140	340	0.42

Well 03 (Ag) Drawdown	Well Flow (gpm)	Radius (ft)	Specific Storage (1/ft)	Transmissivity (ft2/day)	Time (days)	Aquifer Thickness (ft)	Hydraulic Conductivity (ft/day)
Data	21	256	1.50E-05	750	1	75	10
Theis Eq =	0.0166	u =	3.28E-04	W (u) =	7.46	Drawdown (ft) =	3.20

Theis Function	X	Y
a	3.00E-04	7.535
b	4.00E-04	7.247

Well 03 - Ag (21 gpm) Calculated Drawdown

Aquifer Thickness Assumed = 75 ft
Time = 1 day

Specific Storage (1/ft)	Hydraulic Conductivity (ft/day)	Minimum Distance To Neighboring Well (ft)	Drawdown (ft)
3.10E-04	10	256	1.9
1.50E-05	10	256	3.2
3.10E-04	140	256	0.22
1.50E-05	140	256	0.31

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