“I”

Water Availability Analysis

Gandona Winery P17-00068-MOD & P17-00069-VAR
Planning Commission Hearing Date 3 October 2018

WATER AVAILABILITY ANALYSIS

For

GANDONA WINERY
1535 SAGE CANYON ROAD
ST HELENA, CA 94574

APN 032-010-079

Prepared for:
Manuel Pires
1533 Sage Canyon Road
St Helena, CA 94574

Project# 4116034.0
February 10, 2017
Revised: July 28, 2017

Executive Summary

These calculations document the existing and proposed water use for the Gandona Winery. The existing winery is located on APN 032-010-079. The parcel has an area of 114.72 acres. The proposed Use Permit modification will add a building for office and barrel storage and increase marketing activities. There will be no increase in production or vineyard area.

A Groundwater Recharge Rate of 0.82 ac-ft/ac/year has been adopted for parcel 032-010-079 from the RSA+ Groundwater Recharge Report attached. This yields an annual estimated recharge (Allowable Water Allotment) of 94.07 ac/ft in an average rainfall year. In accordance with the Napa County Water Availability Analysis (WAA), the estimated groundwater recharge rate for average and dry years is included. In a dry year, the groundwater recharge rate is assumed to be 75% of the average year.

There are 2 wells on the property. One well is near the vineyard in the southern part of the property. The other well is in the Northern part of the property, next to the primary residence. The 2 wells supply domestic, process, and irrigation water for the winery, residence, and vineyards.

Below is a summary of the existing and proposed water use. Detailed calculations can be found on the following page.

Usage Type	Existing Usage [af/yr]	Proposed Usage [af/yr]
Vineyard		
Irrigation (No change under revised UP)	9.82	9.82
Winery		
Process Water	0.31	0.31
Domestic Water	0.05	0.14
Landscape	0.10	0.10
Residence	0.50	0.50
Totals (Acre-ft per year)	**10.78**	**10.87**
Groundwater Recharge (Acre ft per year)	**94.07**	**94.07**

The proposed water demand of 10.87 ac-ft per year is less than the estimated annual recharge of 94.07 ac-ft per year in an average rainfall year and less than the estimated annual recharge rate of 70.55 ac-ft per year in a dry year.

Water Usage Calculations

Groundwater Recharge – See attached Annual Groundwater Recharge Rate report for detailed calculations.

Recharge rate - (0.82 af/acre-yr x	114.72	acres) =	**94.07**	**af/yr**
Recharge rate (dry year) - (0.82 af/acre-yr x 0.75 x	114.72	acres) =	**70.55**	**af/yr**

Vineyard Irrigation Demand

Existing Vineyard – (0.5 af/ac-yr x	19.64	acres vineyard) =	9.82	af/yr
		Total Existing (Existing Vineyard) =	**9.82**	**af/yr**

Existing Winery Demand

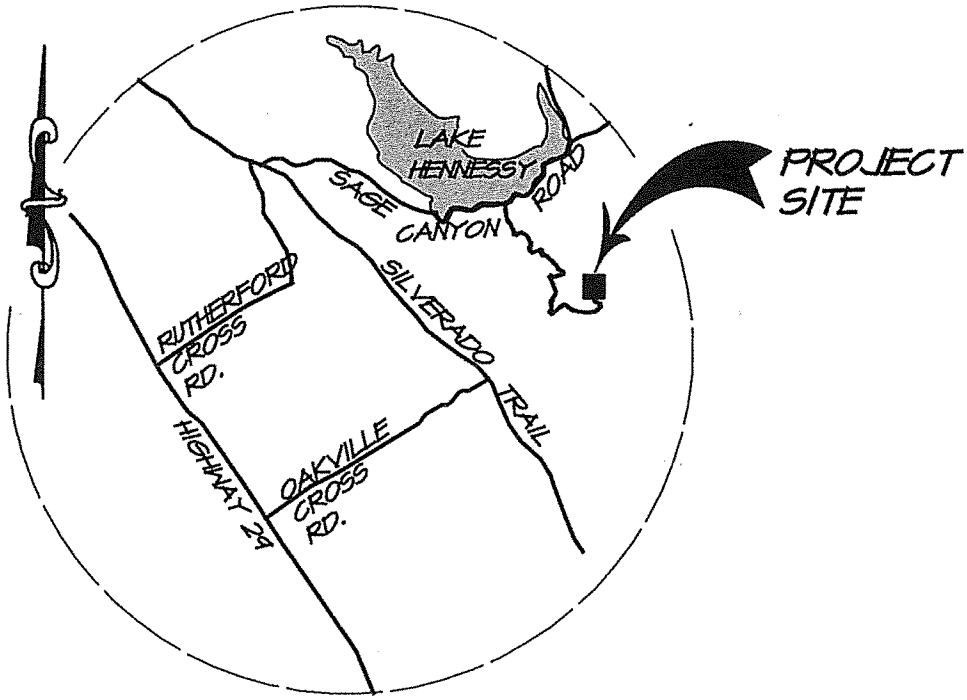
Process Water – (5 gal water / 1 gallon wine x	20,000	gal wine/year) =	**0.31**	**af/yr**
FT Employees – (15 gal/person x 300 days/yr x	2	employees/day) =	0.03	af/yr
PT Employees – (15 gal/person x 300 days/yr x	1	employees/day) =	0.01	af/yr
Visitors – (3 gal/person x 52 weeks/yr x	18	visitors/week) =	0.01	af/yr
Marketing Events, Off-Site Catered – (15 visitors @ 10 gpd x	5	days/yr) =	0.002	af/yr
Marketing Events, Off-Site Catered – (50 visitors @ 10 gpd x	1	days/yr) =	0.002	af/yr
		Total Existing Domestic Water (Employees + Visitors + Events) =	**0.05**	**af/yr**
Winery Landscape (0.5 AF/yr/100,000 gal wine x	20,000	gal wine/yr) =	**0.10**	**af/yr**

Proposed Winery Domestic Water Demand

Process Water – (5 gal water / 1 gallon wine x	20,000	gal wine/year) =	**0.31**	**af/yr**
FT Employees – (15 gal/person x 300 days/yr x	4	employees/day) =	0.06	af/yr
PT Employees – (15 gal/person x 300 days/yr x	2	employees/day) =	0.03	af/yr
Visitors – (3 gal/person x 52 weeks/yr x	72	visitors/week) =	0.03	af/yr
Marketing Events, Off-Site Catered – (25 visitors @ 10 gpd x	10	days/yr) =	0.01	af/yr
Marketing Events, Off-Site Catered – (150 visitors @ 10 gpd x	3	days/yr) =	0.01	af/yr
		Total Proposed Domestic Water (Employees + Visitors + Events) =	**0.14**	**af/yr**
Winery Landscape – (0.5 AF/yr/100,000 gal wine	20,000	Gal wine/yr) =	**0.10**	**af/yr**

GANDONA WINERY
VICINITY MAP

NAPA COUNTY CALIFORNIA



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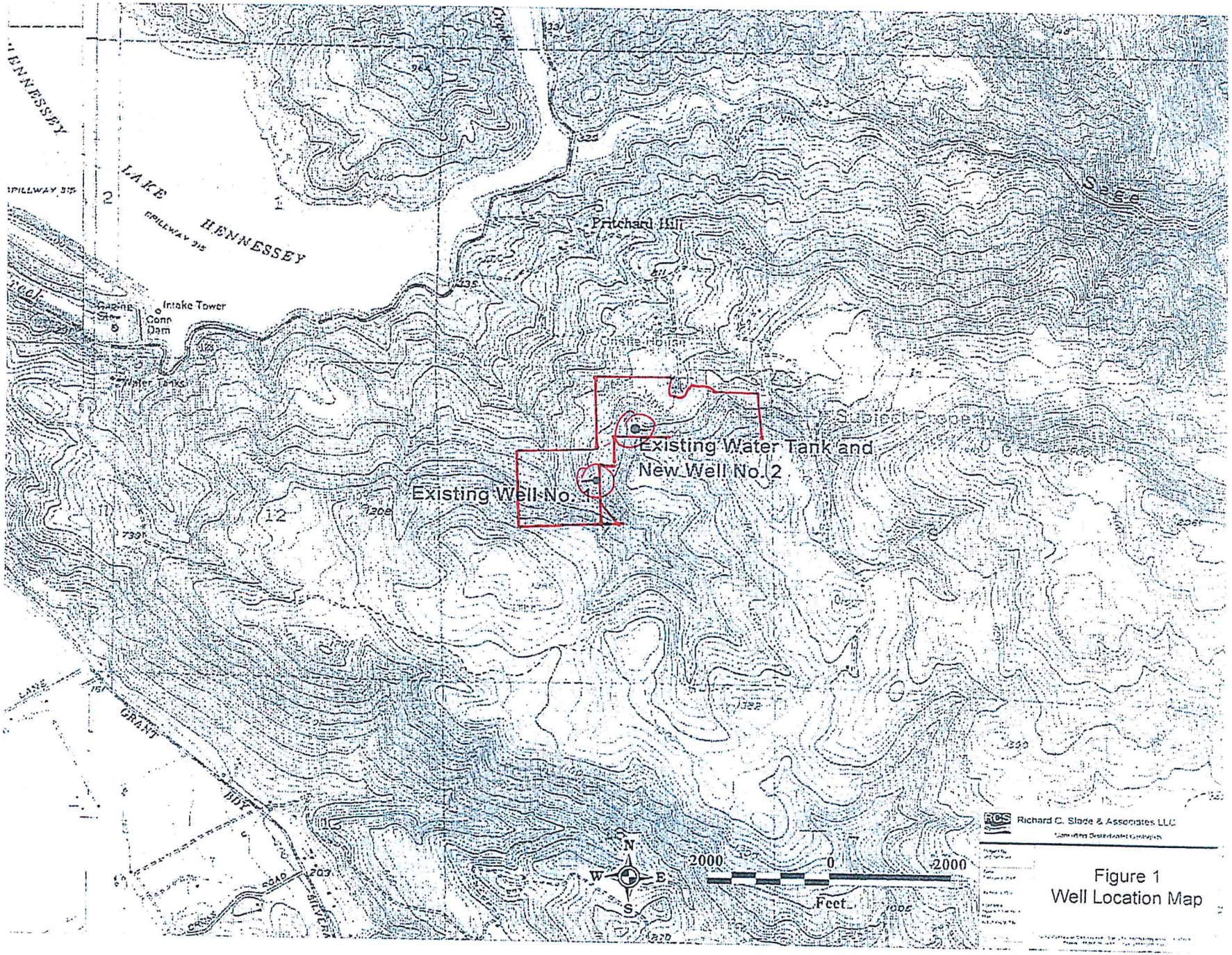

Figure 1
Well Location Map

ANNUAL GROUNDWATER RECHARGE RATE

GANDONA WINERY
1533 SAGE CANYON ROAD
ST HELENA, CA 94574

APN 032-010-079

Prepared for:
Manuel Pires
1535 Sage Canyon Road
St Helena, CA 94574

Project# 4116034.0
February 10, 2017

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

INTRODUCTION

This report determines the annual groundwater recharge rate for the Gandona Winery property. The proposed winery is located on APN 032-010-079, a parcel of 114.72 acres. The parcel has slopes ranging from 5-30%.

For the analysis, the parcel has been divided into five areas: impervious; rock outcrop; vineyard; grass and shrubs; and oak tree areas.

METHODOLOGY

The groundwater recharge rate has been determined by examining the annual rainfall, runoff and species specific evapotranspiration during winter months. The Annual Precipitation Chart and Watershed Types and Factors page in the Napa County Road and Street Standards were used to determine the annual rainfall amount and site runoff volumes. It was determined that the average annual rainfall amounts to 32 inches per year.

The runoff volumes were determined by calculating the site specific runoff coefficient. The runoff coefficients were calculated using aerial images to view the terrain and the county topography to estimate the slopes in each area.

The evapotranspiration losses were calculated using the Water Use Classifications of Landscape Species (WUCOLS) methodology for the vineyard, grass and shrub, and oak tree areas. A landscape coefficient of 0.20 was adopted for the shrubs growing over the rock outcrop area. Only evapotranspiration from the winter was considered, as it is assumed that evapotranspiration in summer will be from irrigation water.

The groundwater recharge rate was calculated as the difference of the total annual rainfall and losses from the stormwater runoff and evapotranspiration. Refer to attached calculations.

Average Recharge Rate = Average Rainfall - Runoff – Evapotranspiration

Under the proposed improvements to the winery, 2,969 sq. ft. of winery building will be built, replacing the same area of existing grassland. The Existing and Proposed Recharge rates were calculated separately.

CONCLUSION

The Gandona Winery property has an annual rainfall of 32 inches per year, equating to 305.9 acre-feet per year for the parcel.

Total evapotranspiration volume that occurs through the vineyard, grass and shrub, and oak tree areas on the parcel is 41.13 acre-feet per year. The stormwater runoff from the parcel totals 170.27 acre-feet per year. The total average evapotranspiration and runoff is 211.59 acre-feet per year.

This equates to a groundwater recharge rate of 0.82 acre-feet per acre per year. The proposed improvements to the Gandona Winery do not significantly affect the groundwater recharge rate of the parcel.

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Gandona Winery

Groundwater Recharge Rate (existing)

Parcel 032-010-079

Site Description	Hydrologic Soil Group	Area (ac)	Total Annual Rainfall (in/yr)	Total Rainfall (ft^3/yr)	Total Rainfall (ac-ft/yr)
Impervious Area	C	3.28	32	381,005	8.75
Rock Outcrop (shrubs)		1.90	32	220,704	5.07
Vineyard Area	C	19.64	32	2,281,382	52.37
Grass/Shrubs	C	0.90	32	104,544	2.40
Oak Trees	C	89.00	32	10,338,240	237.33
Total		**114.72**		**13,325,875**	**305.92**

Evapotranspiration (ET_o)

Site	January (Et_o) (in)	February (Et_o) (in)	March (Et_o) (in)	October (Et_o) (in)	November (Et_o) (in)	December (Et_o) (in)	Total ET_o (in)	Landscape Coefficient (k_c)	Landscape Evapotrans. (Et_c) (in) = Total Et_o x k_c	Total Landscape Evapotranspiration (ft^3/yr)
Impervious Area	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Rock Outcrop (shrubs)	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.20	2.37	16,318
Vineyard Area	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.08	0.95	67,472
Grass/Shrubs	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.68	8.04	26,281
Oak Trees	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.44	5.21	1,681,644
Total										**1,791,715**

Runoff

Site	Run-Off Coefficient (C)	Total Runoff (ft^3/yr)
Impervious Area	0.90	342,904
Rock Outcrop (shrubs)	0.74	163,321
Vineyard Area	0.56	1,277,574
Grass/Shrubs	0.56	58,545
Oak Trees	0.54	5,582,650
Total		**7,424,994**

Groundwater Recharge Rate

Site	Total Rainfall (ft^3/yr)	Total Crop Evapotranspiration (ft^3/yr)	Total Runoff (ft^3/yr)	Total Stormwater loss on site (ft^3/yr)	Groundwater Recharge Rate (ft^3/yr)	Groundwater Recharge Rate (ac-ft/ac/yr)
Impervious Area	381,005	0	342,904	342,904	38,100	0.27
Rock Outcrop (shrubs)	220,704	16,318	163,321	179,639	41,065	0.50
Vineyard Area	2,281,382	67,472	1,277,574	1,345,046	936,336	1.09
Grass/Shrubs	104,544	26,281	58,545	84,826	19,718	0.50
Oak Trees	10,338,240	1,681,644	5,582,650	7,264,294	3,073,946	0.79
Total	**13,325,875**	**1,791,715**	**7,424,994**	**9,216,709**	**4,109,166**	**0.82**

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Gandona Winery

Groundwater Recharge Rate (After proposed improvements)

Parcel 032-010-079

Site Description	Hydrologic Soil Group	Area (ac)	Total Annual Rainfall (in/yr)	Total Rainfall (ft^3/yr)	Total Rainfall (ac-ft/yr)
Impervious Area	C	3.35	32	388,904	8.93
Rock Outcrop		1.90	32	220,704	5.07
Vineyard Area	C	19.64	32	2,281,382	52.37
Grass/Shrubs	C	0.90	32	104,544	2.40
Oak Trees	C	88.93	32	10,330,341	237.15
Total		**114.72**		**13,325,875**	**305.92**

Evapotranspiration (ET_o)

Site	January (Et_o) (in)	February (Et_o) (in)	March (Et_o) (in)	October (Et_o) (in)	November (Et_o) (in)	December (Et_o) (in)	Total ET_o (in)	Landscape Coefficient (k_c)	Landscape Evapotrans. (Et_c) (in) = Total Et_o x k_c	Total Landscape Evapotranspiration (ft^3/yr)
Impervious Area	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Rock Outcrop	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.20	2.37	16,318
Vineyard Area	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.08	0.95	67,472
Grass/Shrubs	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.68	8.04	26,281
Oak Trees	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.44	5.21	1,680,359
Total										**1,790,430**

Runoff

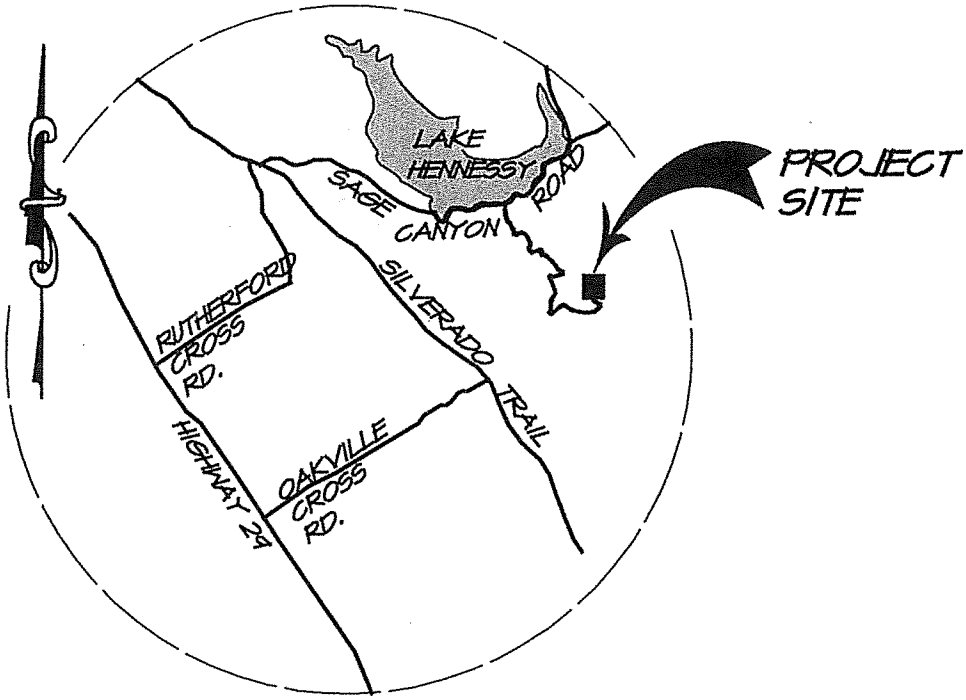
Site	Run-Off Coefficient (C)	Total Runoff (ft^3/yr)
Impervious Area	0.90	350,013
Rock Outcrop	0.74	163,321
Vineyard Area	0.56	1,277,574
Grass/Shrubs	0.56	58,545
Oak Trees	0.54	5,578,384
Total		**7,427,837**

Groundwater Recharge Rate

Site	Total Rainfall (ft^3/yr)	Total Crop Evapotranspiration (ft^3/yr)	Total Runoff (ft^3/yr)	Total Stormwater loss on site (ft^3/yr)	Groundwater Recharge Rate (ft^3/yr)	Groundwater Recharge Rate (ac-ft/ac/yr)
Impervious Area	388,904	0	350,013	350,013	38,890	0.27
Rock Outcrop	220,704	16,318	163,321	179,639	41,065	0.50
Vineyard Area	2,281,382	67,472	1,277,574	1,345,046	936,336	1.09
Grass/Shrubs	104,544	26,281	58,545	84,826	19,718	0.50
Oak Trees	10,330,341	1,680,359	5,578,384	7,258,743	3,071,598	0.79
Total	**13,325,875**	**1,790,430**	**7,427,837**	**9,218,268**	**4,107,608**	**0.82**

GANDONA WINERY
VICINITY MAP

NAPA COUNTY CALIFORNIA



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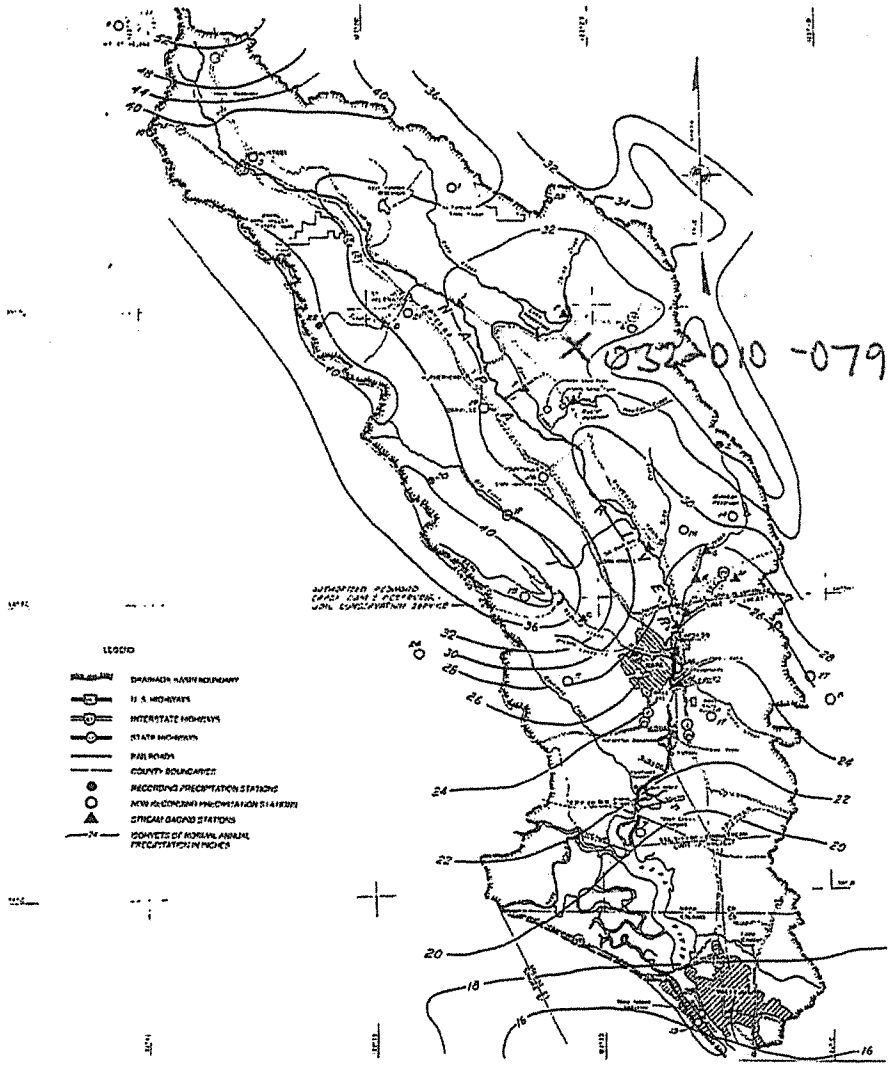

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ANNUAL RAINFALL = 32 IN/yr

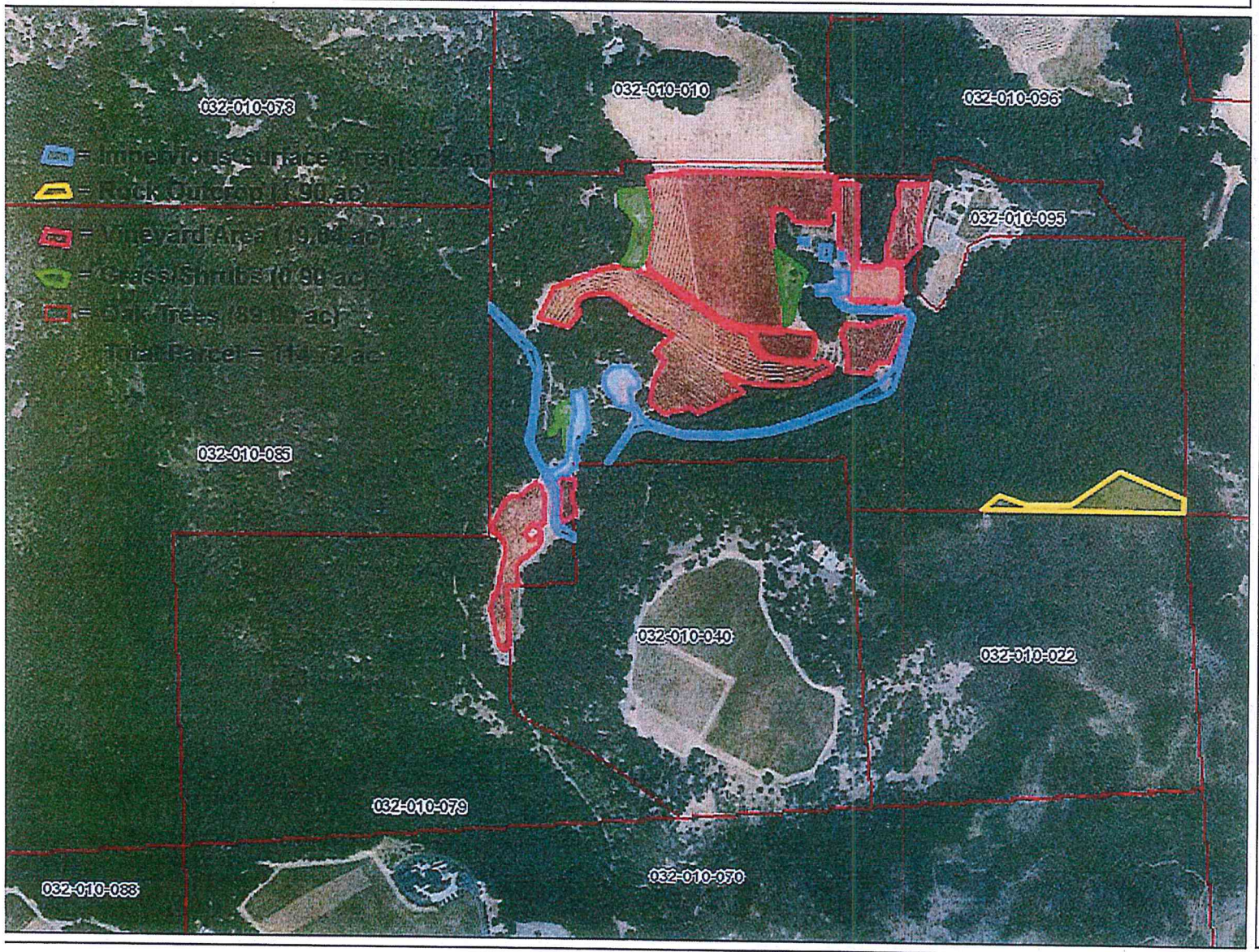
PRECIPITATION CHART
LOWER COUNTY

FLOOD CONTROL
GENERAL DESIGN MEMORANDUM
NAPA RIVER CHANNEL IMPROVEMENTS
NAPA COUNTY, CALIFORNIA
HYDROLOGY AND HYDRAULIC ANALYSIS
NORMAL ANNUAL PRECIPITATION AND HYDROLOGIC INDEX MAP
U.S. ARMY ENGINEER DISTRICT, SAN FRANSICO, CORPS OF ENGINEERS

TO ACCOMPANY REPORT DATED 12 March 75

FILE NO. 50-47-1

Gandona Winery Surface Areas, Parcel 032-010-079



Legend

- ☐ Parcels
- ☐ County Boundary

1,504.7 0 752.33 1,504.7 Feet

Disclaimer: This map was prepared for informational purposes only.
No liability is assumed for the accuracy of the data delineated hereon.

This map was printed on 7/21/2016

Notes

Rock Outcrop.

WATERSHED TYPES AND FACTORS

RUN-OFF PRODUCING CHARACTERISTICS OF WATERSHEDS SHOWING FACTORS FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES				
WATERSHED TYPES AND FACTORS				
Run-off Producing Features	**Extreme**	**High**	**Normal**	**Low**
Relief	0.28 – 0.38 Steep, rugged terrain, with average slopes above 30%	0.20 – 0.28 Rolling, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.08 – 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 – 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 – 0.06 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.
Vegetation Cover	0.12 – 0.16 No effective plant cover; bare or very sparse cover.	0.08 – 0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.10 – 0.12 Negligible; surface depressions, few and shallow; drainage ways steep and small; no marshes.	0.08 – 0.10 Low well-defined system of small drainage ways; no ponds or marsh.	0.06 – 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes.	0.04 – 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

C = 0.74

Vineyard Area.

WATERSHED TYPES AND FACTORS

RUN-OFF PRODUCING CHARACTERISTICS OF WATERSHEDS SHOWING FACTORS FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES				
WATERSHED TYPES AND FACTORS				
Run-off Producing Features	**Extreme**	**High**	**Normal**	**Low**
Relief	0.28 – 0.38 Steep, rugged terrain, with average slopes above 30%	0.24 0.20 – 0.28 Rolling, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.10 0.08 – 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 – 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 – 0.06 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.
Vegetation Cover	0.12 – 0.16 No effective plant cover; bare or very sparse cover.	0.12 0.08 – 0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.10 – 0.12 Negligible; surface depressions, few and shallow; drainage ways steep and small; no marshes.	0.10 0.08 – 0.10 Low well-defined system of small drainage ways; no ponds or marsh.	0.06 – 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes.	0.04 – 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

C = 0.56

Grass/Shrubs

WATERSHED TYPES AND FACTORS

RUN-OFF PRODUCING CHARACTERISTICS OF WATERSHEDS SHOWING FACTORS FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES

WATERSHED TYPES AND FACTORS

Run-off Producing Features	Extreme	High	Normal	Low
Relief	0.28 – 0.38 Steep, rugged terrain, with average slopes above 30%	0.20 – 0.28 Rolling, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.10 0.08 – 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 – 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 – 0.06 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.
Vegetation Cover	0.12 – 0.16 No effective plant cover; bare or very sparse cover.	0.08 – 0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.06 0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.12 0.10 – 0.12 Negligible; surface depressions, few and shallow; drainage ways steep and small; no marshes.	0.08 – 0.10 Low well-defined system of small drainage ways; no ponds or marsh.	0.06 – 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes.	0.04 – 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

C = 0.56.

Oak Trees

WATERSHED TYPES AND FACTORS

RUN-OFF PRODUCING CHARACTERISTICS OF WATERSHEDS SHOWING FACTORS FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES				
WATERSHED TYPES AND FACTORS				
Run-off Producing Features	**Extreme**	**High**	**Normal**	**Low**
Relief	0.28 – 0.38 (circled) Steep, rugged terrain, with average slopes above 30%	0.20 – 0.28 Rolling, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.10 0.08 – 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 – 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 – 0.06 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.
Vegetation Cover	0.12 – 0.16 No effective plant cover; bare or very sparse cover.	0.08 – 0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.07 0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.10 – 0.12 Negligible; surface depressions, few and shallow; drainage ways steep and small; no marshes.	0.09 0.08 – 0.10 Low well-defined system of small drainage ways; no ponds or marsh.	0.06 – 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes.	0.04 – 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

Total = 0.54

TABLE 1. Crop coefficients used in daily modeling of soil water processes in vineyards, oak trees and grasslands

Vineyards		Oak trees		Grasslands	
Period	K_c	Period	K_c	Period	K_c
3/1–4/15	0.10	3/1–3/31	0.5	3/1–3/15	0.90
4/16–4/30	0.20	4/1–10/1	0.6	3/16–4/30	0.95
5/1–5/15	0.25	10/2–11/25	0.5	5/1–5/15	0.25
5/16–5/31	0.30	11/26–2/28	0.4	5/16–6/15*	0.10
6/1–6/15	0.35			6/16*–10/13	0.00
6/16–6/30	0.40			10/14–10/31	0.25
7/1–9/30	0.50			11/1–2/28	0.75
10/1–10/15	0.30				
10/16–10/31	0.20				
11/1–11/15	0.15				
11/16–11/30	0.05				
12/1–2/28	0.01				

Sources: Allen et al. 1998 (grasses and trees); Caprile 2007 (vineyards).
* Variable date depending on available soil moisture.

Oak Trees - weighted average for October to March

Time Period	# of Days	K_c	Days * K^c	
3/1-3/31	31	0.5	15.5	
10/01	1	0.6	0.6	Weighted Kc=
10/2-11/25	55	0.5	27	80.7/182 = 0.44
11/26-2/28	95	0.4	37.6	
Totals=	182		80.7	

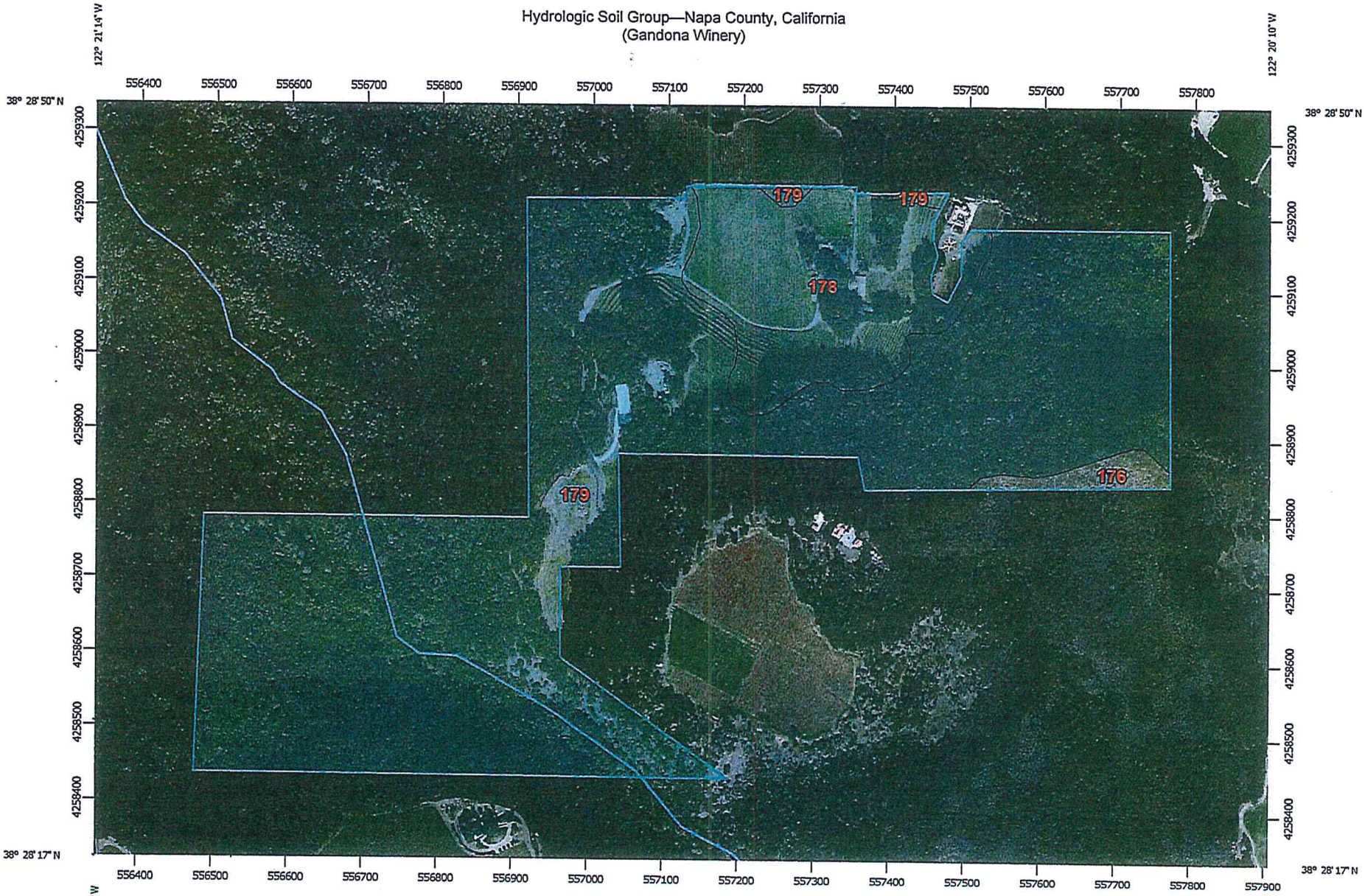
Vineyard - weighted average for October to March

Time Period	# of Days	K_c	Days * K^c	
3/1-4/15	31	0.1	3.1	
10/1-10/15	15	0.3	4.5	
10/16-10/31	16	0.2	3.2	
11/1-11/15	15	0.15	2.25	Weighted Kc=
11/16-11/30	15	0.05	0.75	14.7/182 = 0.08
12/1-2/28	90	0.01	0.9	
Total=	182		14.7	

Grasslands - weighted average for October to March

Time Period	# of Days	K_c	Days * K^c	
3/1-3/15	15	0.9	13.5	
3/16-3/31	16	0.95	15.2	Weighted Kc=
10/1-10/13	13	0.00	0.00	123.2/182 = 0.68
10/14-10/31	18	0.25	4.5	
11/1-2/28	120	0.75	90	
Totals=	182		123.2	

Hydrologic Soil Group—Napa County, California
(Gandona Winery)



Map Scale: 1:7,140 if printed on A landscape (11" x 8.5") sheet.

N

0 100 200 400 600 Meters

0 300 600 1200 1800 Feet

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

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- 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: 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 8, Sep 23, 2015

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Napa County, California (CA055)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
176	Rock outcrop-Hambright complex, 50 to 75 percent slopes		1.9	1.5%
178	Sobrante loam, 5 to 30 percent slopes	C	20.3	16.3%
179	Sobrante loam, 30 to 50 percent slopes	C	102.3	82.2%
Totals for Area of Interest			124.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

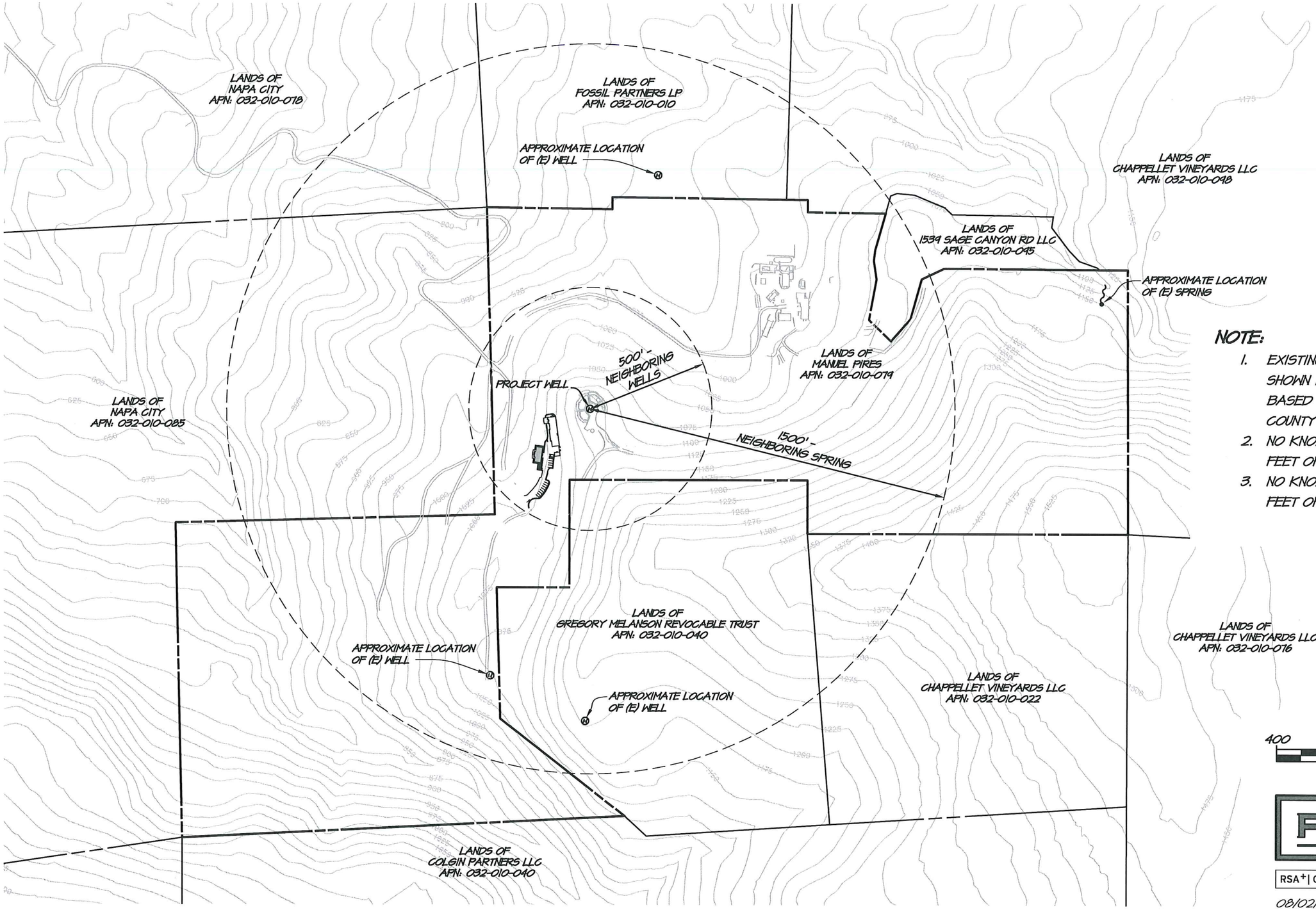
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

GANDONA WINERY
WATER AVAILABILITY ANALYSIS TIER 2 EXHIBIT



REGISTERED PROFESSIONAL ENGINEER
BRUCE FENTON
17859
Exp. 06/30/2019
CIVIL
STATE OF CALIFORNIA

NOTE:

1. EXISTING WELLS AND SPRING ARE SHOWN IN APPROXIMATE LOCATIONS BASED ON INFORMATION FROM NAPA COUNTY ENVIRONMENTAL FILES.
2. NO KNOWN WELLS EXIST WITHIN 500 FEET OF PROJECT WELL
3. NO KNOWN SPRINGS EXIST WITHIN 1,500 FEET OF THE PROJECT WELL

GRAPHIC SCALE

400 0 400 800

(IN FEET)
1 inch = 400 FT

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