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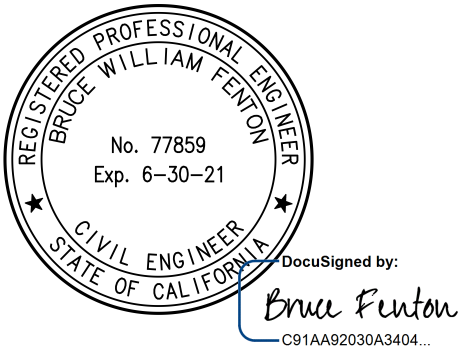
Water Availability Analysis
Kenzo Estate
P19-00396-MOD

WATER AVAILABILITY ANALYSIS

KENZO ESTATE
3200 MONTICELLO ROAD
NAPA, CA

APN 033-110-075

Property Owner:
Kenzo Estate, Inc.
3200 Monticello Road
Napa, CA



Project #4119018.0
August 28, 2020

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

I. Executive Summary

Kenzo Estate (APN 033-110-075) proposes to increase production from 102,000 gallons of wine per year to 150,000 gallons with no increase in full time employees or visitors. Employee and visitor numbers are based on the Use Permit Modification #P15-00293. There is one well on the 36.13-acre parcel. A groundwater recharge rate of 0.48 ac-ft/yr has been adopted from the attached Groundwater Recharge Rate Report by RSA+ dated August 8, 2015. This provides an annual allowable water allotment of 17.34 ac-ft/yr for the 36.13-acre parcel.

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

Usage Type	Existing Usage [af/yr]	Proposed Usage [af/yr]
Vineyard		
Irrigation – Well	5.50	5.50
Landscaping	0.51	0.51
Winery		
Process Water	1.57	2.30
Domestic Water	0.42	0.42
Totals (Acre-ft per Year)	**8.00**	**8.73**
Estimated Water Recharge Rate (Acre-ft per Year)	**17.34**	**17.34**

The proposed modifications for the Kenzo Estate project will result in an increase in the use of groundwater of 0.73 af/yr for a total annual usage of 8.73 af/yr which is less than the estimated groundwater recharge rate for the parcel of 17.34 af/yr.

II. Groundwater Use Calculation

Existing Vineyard Irrigation and Landscaping Water Demand					
Vineyard – Irrigation from well – (0.5 af/ac-yr x	11	acres vineyard) =		5.50	af/yr
Landscape – (0.5 af / 100,000-gallon wine x	102,000	gal wine/year) =		0.51	af/yr
Existing Winery Process Water Demand					
Process Water – (5-gal water / 1-gallon wine x	102,000	gal wine/year) =		1.57	af/yr
Existing Winery Domestic Water Demand					
FT Employees – (15 gal/person/day x 260 days/yr x	17	employees/day) =		0.20	af/yr
PT Employees – (15 gal/person/day x 165 days/yr x	6	employees/day) =		0.05	af/yr
Average Visitors – (3 gal/person/day x 52 weeks/yr x	200	visitors/week) =		0.10	af/yr
Marketing Events – (50 visitors @ 10 gal/guest x	36	days/yr) =		0.06	af/yr
Marketing Events – (75 visitors @ 10 gal/guest x	2	days/yr) =		0.00	af/yr
Marketing Events – (150 visitors @ 10 gal/guest x	4	days/yr) =		0.02	af/yr
			Total =	0.42	af/yr
Total Existing Water Demand			**Total =**	**8.00**	**af/yr**
Proposed Vineyard Irrigation and Landscaping Water Demand					
Vineyard – Irrigation from well – (0.5 af/ac-yr x	11	acres vineyard) =		5.50	af/yr
		Landscape – (no change from existing) =		0.51	af/yr
Proposed Winery Process Water Demand					
Process Water – (5-gal water / 1-gallon wine x	150,000	gal wine/year) =		2.30	af/yr
Proposed Winery Domestic Water Demand					
FT Employees – (15 gal/person/day x 260 days/yr x	17	employees/day) =		0.20	af/yr
PT Employees – (15 gal/person/day x 165 days/yr x	6	employees/day) =		0.05	af/yr
Average Visitors – (3 gal/person/day x 52 weeks/yr x	200	visitors/week) =		0.10	af/yr
Marketing Events – (50 visitors @ 10 gal/guest x	36	days/yr) =		0.06	af/yr
Marketing Events – (75 visitors @ 10 gal/guest x	2	days/yr) =		0.00	af/yr
Marketing Events – (150 visitors @ 10 gal/guest x	4	days/yr) =		0.02	af/yr
			Total =	0.42	af/yr
Total Proposed Water Demand			**Total =**	**8.73**	**af/yr**

ANNUAL GROUNDWATER RECHARGE RATE

KENZO ESTATE WINERY
3200 MONTICELLO ROAD
NAPA, CALIFORNIA

APN 033-110-075

PROPERTY OWNER:

Kenzo Estate
3200 Monticello Road
Napa, CA 94558

Project# 4112041.0

August 18, 2015

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 hillside area on the Kenzo Estate Winery property. The property is located at 3200 Monticello Road in Napa, parcel number 033-110-075. The parcel is 36.13 acres and has slopes ranging from 5-20%. The parcel has been divided into four areas, impervious, vineyard, grass and shrubs, and coastal 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 26 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 coastal oak tree areas. 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

CONCLUSION

The Kenzo Estate Winery property has an annual rainfall of 26 inches per year, equating to 3.4 million cubic feet per year for the entire site.

Total evapotranspiration volume that occurs through the vineyard, grass and shrub, and oak tree areas on-site is 0.97 million cubic feet per year. The stormwater runoff from the site totals 1.7 million cubic feet per year. The total average evapotranspiration and runoff from the site is 2.65 million cubic feet per year.

The average annual groundwater recharge is 0.76 million cubic feet per year for the 36.13 acre site. This equates an annual groundwater recharge rate of 0.48 acre-feet per acre per year.

RSA+

Kenzo Winery

Groundwater Recharge Rate

Site Description	Hydrologic Soil Group	Area (ac)	Total Annual Rainfall (in/yr)	Total Rainfall (ft^3/yr)
Impervious Area	Sobrante Loam, C	4.21	26	397,340
Vineyard Area	Sobrante Loam, C	10.30	26	972,114
Grass and Shrubs	Sobrante Loam, C	11.00	26	1,038,180
Coastal Oak Trees	Sobrante Loam, C	10.62	26	1,002,316
Total		**36.13**	**26**	**3,409,949**

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	0	0	0	0	0	0	0	0.00	0
Vineyard Area	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.8	9.46	353,849
Grass and Shrubs	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.8	9.46	377,898
Coastal Oak Trees	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.5	5.92	228,027
Total										**959,774**

Runoff		
Site	Run-Off Coefficient (C)	Total Runoff (ft^3/yr)
Impervious Area	0.90	357,606
Vineyard Area	0.46	447,172
Grass and Shrubs	0.41	425,654
Coastal Oak Trees	0.46	461,065
Total		**1,691,497**

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	397,340	0	357,606	357,606	39,734	0.22
Vineyard Area	972,114	353,849	447,172	801,022	171,092	0.38
Grass and Shrubs	1,038,180	377,898	425,654	803,551	234,629	0.49
Coastal Oak Trees	1,002,316	228,027	461,065	689,092	313,224	0.68
Total	**3,409,949**	**959,774**	**1,691,497**	**2,651,271**	**758,678**	**0.48**

Hydrologic Soil Group—Napa County, California
(Kenzo Estate Winery)

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:4,620 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

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 4, Dec 10, 2007

Date(s) aerial images were photographed: 6/30/2005

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
151	Hambright-Rock outcrop complex, 2 to 30 percent slopes	D	0.7	1.6%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	D	2.1	4.9%
178	Sobrante loam, 5 to 30 percent slopes	C	26.5	60.8%
179	Sobrante loam, 30 to 50 percent slopes	C	14.2	32.6%
Totals for Area of Interest			**43.5**	**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.

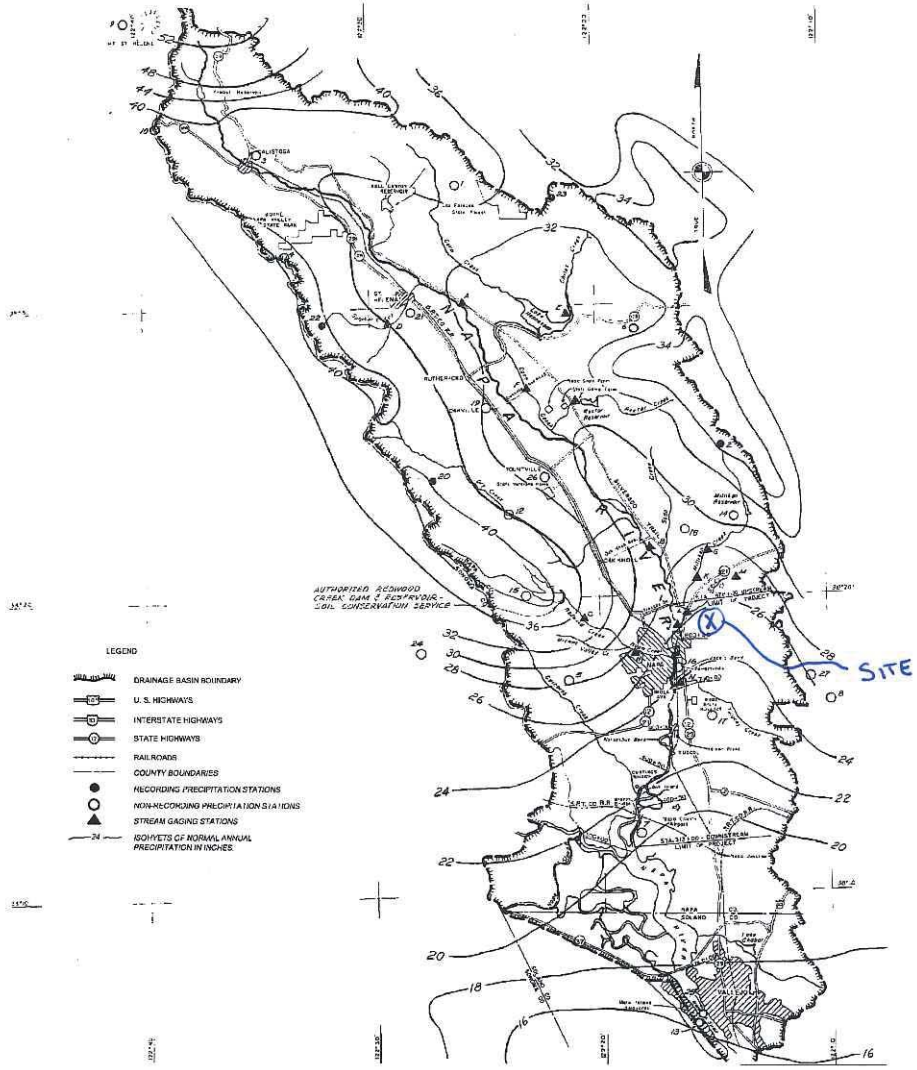
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher



ANNUAL AVERAGE RAINFALL = 26 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

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%	**0.20 – 0.28** Rolling, with average slopes of 10 to 30%	0.19 **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 = 0.46

Grass and Shrubs 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%	**0.20 – 0.28** Rolling, with average slopes of 10 to 30%	0.15 **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 – 0.08** Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.06 **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 = 0.41

Coastal Oak Trees 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%	0.22 **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 – 0.08** Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.05 **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

C = 0.46

A specialized weather station (CIMIS station) or a Class A evaporation pan (background) can be used to determine reference evapotranspiration (ET_o) for a site. Daily CIMIS data is available online at **www.cimis. water.ca.gov**.

The **crop coefficient (K_c)** is determined from field research. Water loss from a crop is measured over an extended period of time. Water loss and estimated reference evapotranspiration are used to calculate K_c as follows:

$$K_c = \frac{ET_c}{ET_o}$$

As seen in the above equation, the crop coefficient (K_c) is simply the fraction of water lost from the crop relative to reference evapotranspiration. Typically, crop water loss is less than reference evapotranspiration and, therefore, the crop coefficient is less than 1.0. For example, if water loss from corn was measured to be 4 inches in a month, and reference evapotranspiration for the same month was 8 inches, then the crop coefficient would be 0.5. Crop coefficients have been established for many crops and for turfgrasses. A sample of values is given in Table 1.

Table 1—
Crop Coefficients for Various Crops and Turfgrasses

K_c values for agricultural crops typically change during the seasons: low values are for early season (March/April) or late season (September/October) and high values for midseason (May/June/July).

K_c values		
	Low	High
Deciduous orchard*	0.50	0.97
Deciduous orchard with cover crop**	0.98	1.27
Grape	0.06	0.80
Olive	0.58	0.80
Pistachio	0.04	1.12
Citrus	0.65	year-round
Turfgrass		
Cool season species	0.8	year-round
Warm season species	0.6	year-round

Source: UC Leaflet Nos. 21427 and 21428 (see references)
* Deciduous orchard includes apples, cherries, and walnuts
** When an active cover crop is present, K_c may increase by 25 to 80%.

In summary, an estimate of crop evapotranspiration is made from reference evapotranspiration and crop coefficient values. Estimates can be made for any location where reference evapotranspiration data exists and for any crop (or turfgrass) that has a crop coefficient.

Example: A grape grower in Monterey County wants to estimate how much water the vineyard may lose in the month of July. Using the ET_c formula, two numbers are needed: reference evapotranspi-

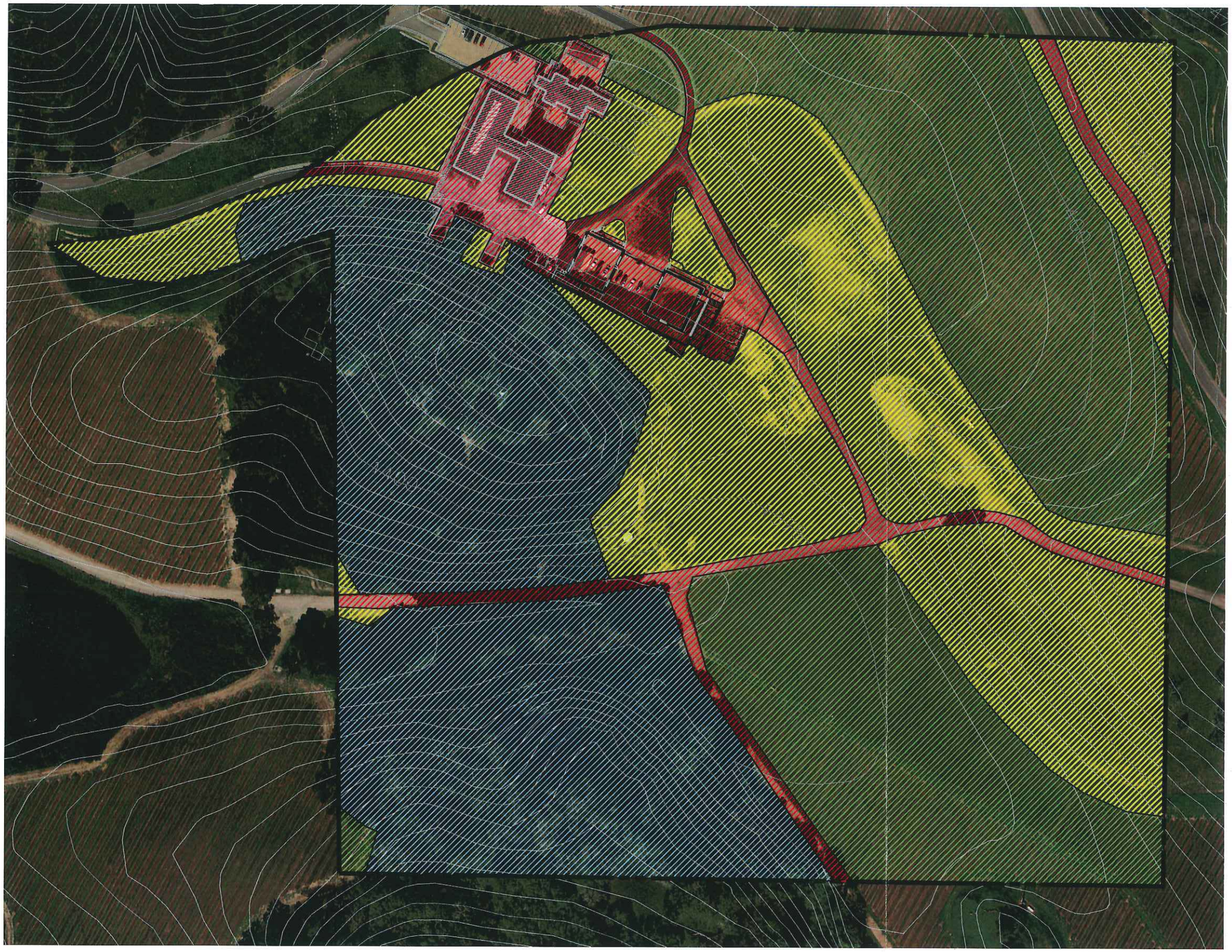
TABLE 1. Crop coefficients used in daily modeling of soil water processes in vineyards, oak trees and grasslands

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	$K_c = 0.5$		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.

KENZO WINERY
GROUNDWATER RECHARGE EXHIBIT



SITE DESCRIPTION	AREA (AC.)
IMPERVIOUS AREA	4.21
VINEYARD AREA	11.00
GRASS AND SHRUBS	10.30
COASTAL OAK TREES	10.62

GRAPHIC SCALE

150 0 150 300

(IN FEET)
1 inch = 150 FT

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