“G”

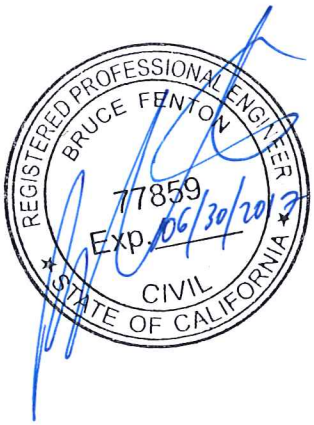
Water Study

Napa Vault Storage P14-00296-UP & P15-00298-TM
Planning Commission Hearing July 20, 2016

TIER 1
WATER AVAILABILITY ANALYSIS

NAPA VAULT
1055 SOSCOL FERRY ROAD
NAPA, CALIFORNIA

APN 057-170-018



PROPERTY OWNER:

Storage Tech LLC.
2783 Napa Valley Corporate Drive
Napa, CA 94558

Project# 4114028.0
December 18, 2015

I. Executive Summary

These calculations demonstrate that the proposed water use on the project parcel is less than the estimated groundwater recharge rate. The existing and proposed water use for the Napa Vault (APN: 057-170-018) are as follows:

Usage Type	Existing Usage [af/yr]	Proposed Usage [af/yr]
Winery		
Process Water	8.95	0.00
Employees, Guests and Visitors	0.46	0.00
Storage Condominium Facility		
Facility water	0.00	0.20
Landscaping	0.00	0.43
Totals (Acre-ft per Year)	**9.41**	**0.63**

The existing use estimates are taken from the attached 2009 Bartelt Engineering Water Availability Analysis for the Suscol Creek Winery.

Facility water use was calculated based on wastewater flow information for a similar facility provided by the client. The projected flow is based on an analysis of the supplied water usage per storage unit.

Sample Facility Water Usage: 18,000 gallons/year excluding landscaping

Facility Size Comparison: 71 units (sample facility)
130 units (proposed facility)

Yearly Water Usage per Unit: Gallons per year per unit = 18,000 gpy /71 units
= 254 gpy/ unit

Total Proposed Flow: 254 gpy/unit x 2.0 (safety factor) = 508 gpy/unit
508 gpy/unit x 130 units = 66,040 gpy/325,851 gal/af
= 0.20 af/yr

Landscape water use was taken from the attached Landscape Water Use Calculations.

Groundwater recharge in this area has been estimated using the methods outlined in the attached Annual Groundwater Recharge Rate Report. It is estimated that the recharge rate is 0.19 acre-feet per acre per year, which equates to 1.95 acre-feet per year for the project parcel.

BARTELT
engineering

February 6, 2009
#07-19

Hillary Gitelman, Director
Napa County Conservation, Development
and Planning Department
1195 Third Street, Room 210
Napa, CA 94559

RECEIVED
APR 23 2009
DEPT. OF
ENVIRONMENTAL MANAGEMENT

Re: Phase One Water Availability Analysis for the Suscol Creek Winery Use Permit Modification and Tentative Map, 1055 Soscol Ferry Road, Napa County, California, APN 057-170-018

Dear Ms. Gitelman:

As required by the County of Napa Public Works Department, and the Interim Policy approved by the Planning Commission on March 6, 1991, this letter outlines a Phase One Water Availability Analysis for the proposed Suscol Creek Winery Use Permit Modification and Tentative Map application.

As outlined in the Interim Policy a reconnaissance level report for this site has been prepared with the following items being pertinent to the study:

Site Plan

A USGS site map showing the site and approximate property line locations is attached. Information regarding the locations of the existing wells and proposed structures is shown on the enclosed Conceptual Site Plan prepared by Bartelt Engineering, dated January 2009. Information regarding the location of the existing wells on adjacent properties was unavailable at the time this report was prepared.

Project Description

It is our understanding that two new winery buildings will be constructed and that the proposed winery will be a full crushing facility with a production of 600,000 gallons of wine per year. The staff will consist of 25 full-time employees and 10 seasonal (harvest) employees. Tours and tastings will be allowed at the winery by appointment only with an average of 100 visitors per week and 25 visitors on a peak day. Private promotional tastings and marketing events are scheduled several times per year with a maximum of 20 guest in attendance.

civil engineering
land planning
1303 jefferson street, 200 B
napa, california 94559
(707) 258-1301
(707) 258-2926 fax

Projected Water Consumption

The total water requirements for the existing and proposed uses on the parcel are calculated below using quantities provided in the staff report from County of Napa Public Works Department and the onsite wastewater disposal feasibility study for the proposed Suscol Creek Winery prepared by Bartelt Engineering dated January 2009.

Current Water Use Using Napa County Interim Policy

Vacant Parcel	0.00 acre-feet/year
Total	0.00 acre-feet/year

Projected Water Use Calculations Using the Bartelt Engineering Wastewater Disposal Feasibility Study and Napa County Interim Policy

Peak Winery Process Wastewater Flow =

$$\frac{600{,}000 \text{ gal wine per year (1.5 gal water per 1 gal wine)}}{60 \text{ days of crush per year}} = 15{,}000 \text{ gpd}$$

Average Winery Process Wastewater Flow =

$$\frac{600{,}000 \text{ gal wine per year (5 gal water per 1 gal wine)}}{365 \text{ days per year}} = 8{,}219 \text{ gpd}$$

To calculate annual water use, conservatively assume peak water use for 16 weeks and average water use for 36 weeks.

Annual Winery Process Water Use =

$$\frac{15{,}000 \text{ gpd (6days/wk)(16wks/yr)} + 8{,}219 \text{ gpd (5days/wk)(36wks/yr)}}{325{,}851 \text{ gal per acre-foot}} = 8.95 \text{ ac-ft/yr}$$

All plumbing fixtures within the proposed winery facility shall be low-flow, water-saving fixtures per the Uniform Plumbing Code as adopted by the Napa County Building Department.

Peak Winery Sanitary Wastewater Flow =

25 full-time employees (15.0 gpd per employee) + 10 seasonal (harvest) employees (15.0 gpd per employee) + 25 visitors (3 gpd per visitor) + 20 guests (5.0 gpd per guest) = 700 gpd.

Average Winery Sanitary Wastewater Flow = 70% (700 gpd) = 490 gpd

Annual Winery Sanitary Water Use =

$$\frac{650\ \text{gpd}\,(6\ \text{days/wk})(16\ \text{wks/yr}) + 490\ \text{gpd}\,(5\ \text{days/wk})(36\ \text{wks/yr})}{325{,}851\ \text{gal per acre-foot}} = 0.46\ \text{ac-ft/yr}$$

Total Projected Water Use = annual winery process wastewater flow + annual winery sanitary wastewater flow.

Total Projected Water Use = 8.95 ac-ft/year + 0.46 ac-ft/year

Total = 9.41 acre-feet/year

Irrigation water for this site will be supplied from the recycled process water used in the winery.

Acceptable Threshold Water Use
(Calculated using Napa County Interim Policy for water usage in valley floor areas)

1.0 acre-feet/acre of site - valley floor

The following calculation assumes that the entire 10.32 acre parcel lies in an area designated as valley floor.

Acceptable water use = 10.32 acres x 1.0 acre-feet/year = 10.32 acre-feet/year

The above analysis shows that the projected water usage will be more than the current water usage but less than to the acceptable threshold water usage for the subject parcel.

Existing Water Source and Storage Capacity

According to the Property Owner, the onsite wells are capable of producing approximately 45 gallons per minute and 100 gallons per minute. Well water will be used to satisfy domestic, winery, and fire protection requirements. Ground water will be pumped from the existing well into new onsite storage tanks per County of Napa and/or California Department of Forestry Standards (size and quantity of tanks to be determined at a later date).

Summary and Conclusions

The water use requirements for the proposed Suscol Creek Winery development at 1055 Soscol Ferry Road are projected to be less than the acceptable threshold water usage level in accordance with the Interim Water Availability Policy; therefore, a Phase Two and/or Phase Three Analysis should not be required. The above information and the attached plans should assist you in processing the subject Use Permit Modification and Tentative Map. If you have any questions regarding the information provided, please feel free to call me.

Sincerely,

Paul N. Bartelt, P.E.
Principal Engineer

PNB:sd

Enclosures

cc: Mike Fennell
Tom Carey, Dickenson, Peatman & Fogarty

Parcel Location Factors

The allowable allotment of water is based on the location of your parcel. There are 3 different location classifications. Valley floor areas include all locations that are within the Napa Valley, Pope Valley and Carneros Region, except for areas specified as groundwater deficient areas. Groundwater deficient areas are areas that have been determined by the public works department as having a history of problems with groundwater. All other areas are classified as Mountain Areas. Please circle your location classification below (Public Works can assist you in determining your classification if necessary):

Valley Floor	1.0 acre feet per acre per year
Mountain Areas	0.5 acre feet per acre per year
MST Groundwater Deficient Area	0.3 acre feet per acre per year

Assessors Parcel Number(s)	Parcel Size (A)	Parcel Location Factor (B)	Allowable Water Allotment (A) X (B)
057-170-018	**10.32 acres**	**1.0 acre foot/acre/year**	**10.32 acre feet/year**

Step #3:

Using the guidelines in Attachment A, tabulate the existing and projected future water usage on the parcel(s) in acre-feet per year (af/yr). Transfer the information from the guidelines to the table below.

EXISTING USE:		**PROPOSED USE:**	
Residential	-0- af/yr	Residential	-0- af/yr
Farm Labor Dwelling	-0- af/yr	Farm Labor Dwelling	-0- af/yr
Winery	-0- af/yr	Winery	9.41 af/yr
Commercial	-0- af/yr	Commercial	-0- af/yr
Vineyard*	-0- af/yr	Vineyard*	-0- af/yr
Other Agriculture	-0- af/yr	Other Agriculture	-0- af/yr
Landscaping	-0- af/yr	Landscaping	-0- af/yr
Other Usage (List Separately):		Other Usage (List Separately):	
_____	_____ af/yr	_____	_____ af/yr
_____	_____ af/yr	_____	_____ af/yr
_____	_____ af/yr	_____	_____ af/yr
TOTAL:	-0- af/yr	**TOTAL:**	9.41 af/yr
TOTAL:	-0- gallons**	**TOTAL:**	3,065,976 gallons**

*Water use for vineyards should be no lower than 0.2 AF—unless irrigation records are available that show otherwise.

**To determine your existing and proposed total water use in gallons, multiply the totals (in acre- feet) by 325,821 gal/AF.

Is the proposed use less than the existing usage ( ) Yes (X) No ( ) Equal

Landscape Water Use Calculations Revised 12-17-15

Project Type Commercial

Napa Vault

0.45 ETo allowance

Applicant to use drop down menus in cells that indicate a selection to describe each hydrozone.
Where "INPUT" is shown, applicant to enter project specific information.
Please note that embedded formulas will reflect as 'false' or as an error until selections are completed.

1 Maximum Annual Water Allowance (MAWA)

INPUT the total square footage of landscape = 18,251 S.F.
INPUT the Hist. ETo for the area = 40.30

MAWA = **27,434** cu ft / yr

2 Estimated Annual Water Use (EAWU)

		Plant Type	Water Use
Hydrozone # 1	Plant Factor = 0.2	*Shrubs / Groundcover*	*Low*
INPUT Square Foot Area of Hydrozone = 1,336			
Hydrozone Irrigation Efficiency = 0.90	*Point Source Drip*		
EAWU = 992 cu ft / yr			
Hydrozone # 2	Plant Factor = 0.2	*Shrubs / Groundcover*	*Low*
INPUT square footage of hydrozone = 14,875			
Hydrozone Irrigation Efficiency = 0.90	*Point Source Drip*		
EAWU = 11,042 cu ft / yr			
Hydrozone # 3	Plant Factor = 0.5	*Trees / Mulch*	*Moderate*
INPUT square footage of hydrozone = 2,040			
Hydrozone Irrigation Efficiency = 0.90	*Point Source Drip*		
EAWU = 3,786 cu ft / yr			
Hydrozone # 4	Plant Factor = 0.2	*Shrubs / Groundcover*	*Low*
INPUT square footage of hydrozone = 0			
Hydrozone Irrigation Efficiency = 0.90	*Point Source Drip*		
EAWU = 0 cu ft / yr			
Hydrozone # 5	Plant Factor = 0.2	*Shrubs / Groundcover*	*Low*
INPUT square footage of hydrozone = 0			
Hydrozone Irrigation Efficiency = 0.90	*Point Source Drip*		
EAWU = 0 cu ft / yr			
Hydrozone # 6	Plant Factor = 0.5	*Trees / Mulch*	*Moderate*
INPUT square footage of hydrozone = 0			
Hydrozone Irrigation Efficiency = 0.90	*Point Source Drip*		
EAWU = 0 cu ft / yr			

SubTotal EAWU = 15,820 cu ft / yr
Input Irrigation System Operation Factor 0.85
Total EAWU = **18,612** / 43560 cf/acft = 0.43 acft/yr
MAWA - EAWU = **8,822** cu ft / yr
(this number must be positive)

PERCENTAGE OF WATER SAVED RELATIVE TO MAX. ALLOWED = 32%

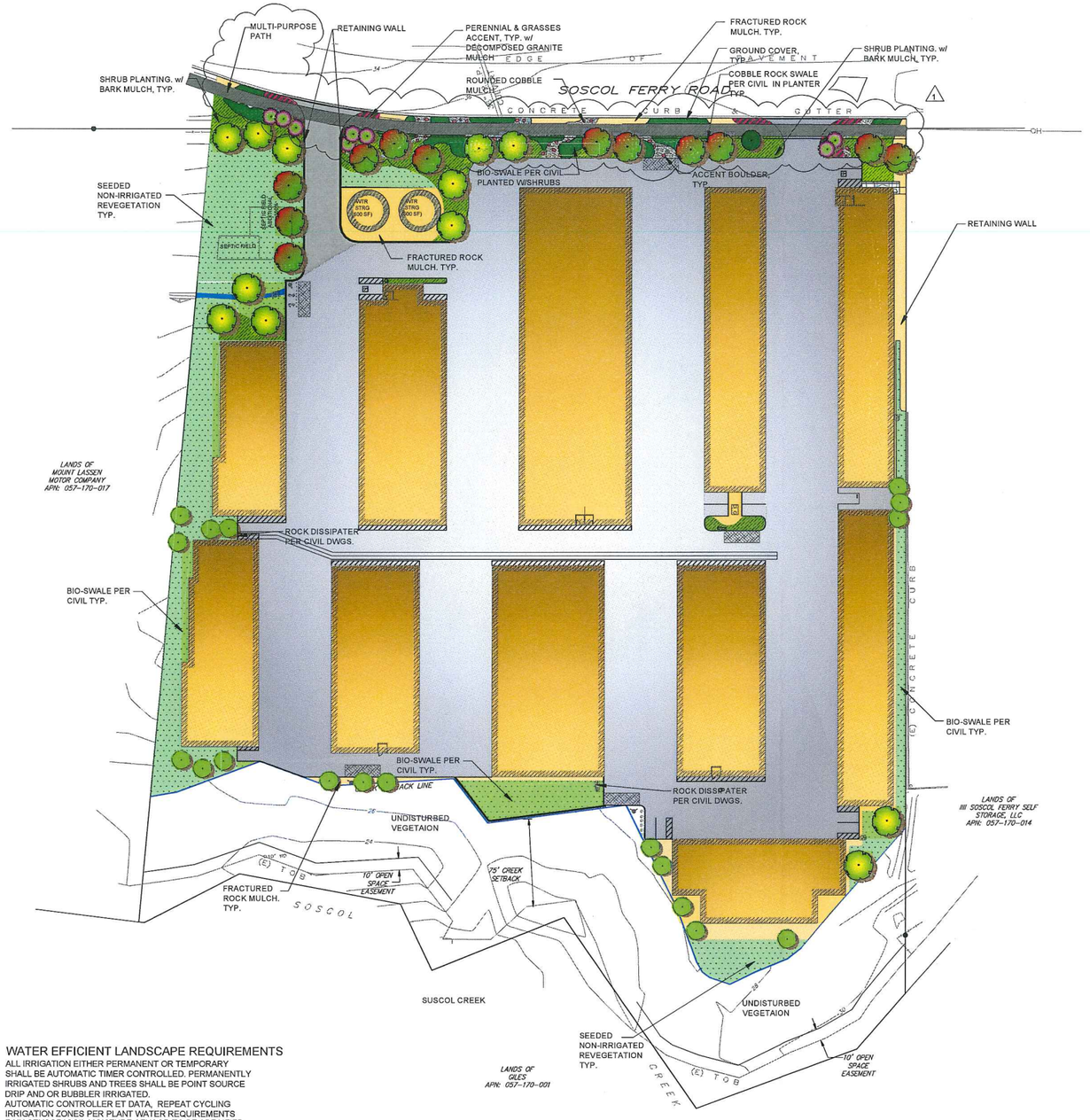
* Trees are not required to be listed as a separate hydrozone if understory is planted with plants of an equal or higher plant factor, and foot area is already included in calculations.

NAPA VAULT HYDROZONE INFORMATION TABLE REVISED 12-17-15

Please complete the hydrozone table(s) for each hydrozone. Use as many tables as necessary to provide the square footage of landscape area per hydrozone.

Hydrozone*	Zone or Valve	Irrigation Method**	Area (Sq. Ft.)	% of Landscape Area
LW Shrubs Med. Density	**1**	**Drip**	**1,336**	**29%**
LW Shrubs Low Density	**2**	**Drip/Bubbler**	**14,875**	**61%**
LW Trees	**3**	**Bubbler**	**2040**	**10%**
VLW Seeded areas.	**No irrigation**	**N/A**	**N/A**	
VLW Rock Areas	**No irrigation**	**N/A**	**N/A**	
	Total		**18,251 sq.ft.**	**100%**

Hydrozone *
HW = High Water Use Plants
MW = Moderate Water Use Plants
LW = Low Water Use Plants
VLW= Very Low Water Us –Non Irrigated
Trees are assumed a 40 s.f. area for watering each.



1 REVISION
ADDED MULTI-PURPOSE PATH 12-17-15

LEGEND:

- EVERGREEN TREE
- DECIDUOUS TREE
- COLUMNAR DECIDUOUS TREE
- FLW. ACCENT TREE
- EXISTING TREE
- GROUND COVER
- PERENNIALS & GRASSES
- SHRUB AREA
- NON-IRRIGATED SEEDED NATIVE GRASS & WILD FLOWERS

PLANT LIST: WATER REGIME LISTED IS PER WUCOLS REGION 1

CA NATIVE "N"	BOTANICAL NAME	COMMON NAME	SIZE		WATER REGIME	MATURE HABIT /ZONE H X W
	LARGE TREES					
N	PLATANUS A. 'COLUMBIA'	SYCAMORE	15 GAL.	1.25" CAL.	L	60' X 50'
N	QUERCUS AGRIFOLIA	COAST LIVE OAK	15 GAL.	1.25" CAL.	L	50' X 40'
	ACCENT TREES					
	LAGERSTROMIA	CRAPE MYRTLE	15 GAL.		L	20' X 12'
	SHRUBS					
N	BACCHARIS CENTENNAL	COYOTE BRUSH	5 GAL.		L	3' X 5'
N	RHAMNUS 'SAN BRUNO'	COFFEE BERRY	5 GAL.		L	4' X 6'
N	SALVIA CLEVELAND 'WINEFRED GILMAN'	SALVIA	5 GAL.		L	4' X 4'
N	CEANOTHUS 'CENTENNIAL'	CALIFORNIA LILAC	5 GAL.		L	1' X 4'
N	RIBES SANGUINEUM	PINK CURRANT	5 GAL.		L	5' X 5'
	GROUNDCOVER					
N	MAHONIA REPENS	CREEPING MAHONIA	5 GAL.		L	3' X 3'
	PERENNIALS					
N	ERIGONUM 'GRANDE RUBESCENS'	BUCKWHEAT	1 GAL.		L	1' X 3'
N	ACHILLEA 'MOONSHINE'	YARROW	1 GAL.		L	3' X 3'
N	NEPATA	CATMINT	1 GAL.		L	3' X 2'
N	VERBENA	VERBENA	1 GAL.		L	1.5' X 1.5'
N	ZAUSCHNERIA CALIFORNICA	CA. FUSCHIA	1 GAL.		L	2' X 1'
	GRASSES					
N	MUHLENBERGIA R. 'NASHVILLE'	PURPLE MUHLY	1 GAL.		M	2' X 2'

LANDSCAPE CALCULATIONS

TOTAL SITE AREA: 10.23 ACRES
SUSCOL FERRY STREET FRONTAGE LANDSCAPE REQUIRED 20' WIDE
25' PROVIDED (INCLUDING PATH)
STREET FRONTAGE TREES REQUIRED 1/30 LF. (593 L.F.) = 20
STREET FRONTAGE TREES PROVIDED: 20
PARKING SPACES PROVIDED = 13
PARKING AREA TREES REQUIRED 1/3 SPACES = 5
PARKING AREA TREES PROVIDED = 6

WATER EFFICIENT LANDSCAPE REQUIREMENTS

ALL IRRIGATION EITHER PERMANENT OR TEMPORARY
SHALL BE AUTOMATIC TIMER CONTROLLED. PERMANENTLY
IRRIGATED SHRUBS AND TREES SHALL BE POINT SOURCE
DRIP AND OR BUBBLER IRRIGATED.
AUTOMATIC CONTROLLER ET DATA, REPEAT CYCLING
IRRIGATION ZONES PER PLANT WATER REQUIREMENTS
RAIN SENSOR/ SOIL MOISTURE SENSOR TO BE SPECIFIED
SLOPES LESS THAN 5' IN HEIGHT
SOIL AMENDMENTS TO BE INCORPORATED
PLANTER SURFACE AREAS TO BE MULCHED
WATER USAGE TO MEET STATE WATER EFFICIENT LANDSCAPE STANDARD
CALIFORNIA NATIVE AND DROUGHT TOLERANT PLANTS SPECIFIED

THESE PLANS COMPLY WITH THE CRITERIA OF THE CALIFORNIA MODEL WATER EFFICIENT LANDSCAPE ORDINANCE (WELO) AND I HAVE APPLIED THEM ACCORDINGLY FOR THE EFFICIENT USE OF WATER IN THE LANDSCAPE AND IRRIGATION DESIGN INTENT. PLANS SHALL MEET THE MAWA PER STATE ORDINANCE IN FINAL DESIGN.

BARBARA M. HATCH, RLA ASLA

GreenDesign
Landscape Architects, Inc.
1464 Popinjay Dr.
Reno, NV. 89509
(775) 829-1364
bhatch00@charter.net

This conceptual design is based upon a preliminary review of entitlement requirements and an unverified and possibly incomplete site and/or building information, and is intended merely to assist in exploring how the project might be developed.

1" =40'
0 20 40 80 200 NORTH

REVISED 8-28-15

Conceptual Landscape Plan

1055 Suscol Ferry Rd.
Napa Valley, CA

WARE MALCOMB

SNR15-0009-00
03.27.2015

SHEET 1

ANNUAL GROUNDWATER RECHARGE RATE

NAPA VAULT
1055 SOSCOL FERRY ROAD
NAPA, CA 94558

APN 057-170-018

PROPERTY OWNER:

Storage Tech, LLC
2783 Napa Valley Corporate Drive
Napa, CA 94558

Project# 4114028.0

December 4, 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 Napa Vault property. The property is located at 1055 Soscol Ferry Road in Napa, parcel number 057-170-018. The parcel is 10.31 acres and has slopes ranging from 0 - 11%. The parcel has been divided into two areas, impervious, and pervious grassland with shrubs.

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 22 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 grass and shrub 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 Napa Vault property has an annual rainfall of 22 inches per year, equating to 0.8 million cubic feet per year for the entire site.

Total evapotranspiration volume lost to grass and shrub areas on-site is 0.1 million cubic feet per year. The stormwater runoff from the site totals 0.6 million cubic feet per year. The total average evapotranspiration and runoff from the site is 0.7 million cubic feet per year.

The average annual groundwater recharge is 80,000 cubic feet per year for the 10.31 acre site. This equates an annual groundwater recharge rate of 0.19 acre-feet per acre per year.

RSA+

Napa Vault

Groundwater Recharge Rate

Site Description	Hydrologic Soil Group	Area (ac)	Total Annual Rainfall (in/yr)	Total Rainfall (ft^3/yr)
Impervious Area	B/D	7.15	22	570,999
Grass and Shrubs	B/D	3.16	22	252,358
Total		**10.31**	**22**	**823,357**

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
Grass and Shrubs	1.03	1.53	2.93	3.53	1.64	1.17	11.83	0.8	9.46	108,560
Total										**108,560**

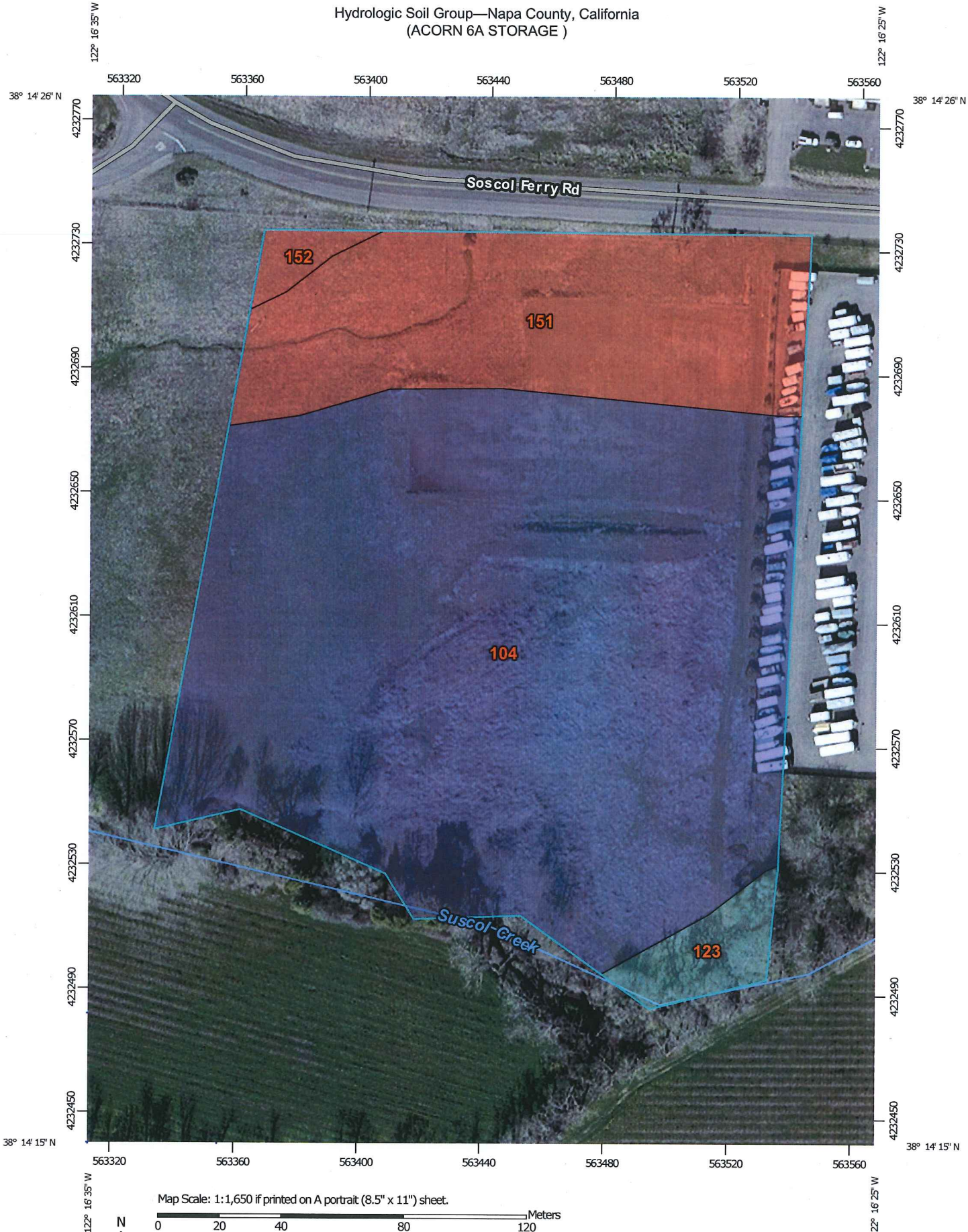
Runoff

Site	Run-Off Coefficient (C)	Total Runoff (ft^3/yr)
Impervious Area	0.90	513,899
Grass and Shrubs	0.46	116,084
Total		**629,984**

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	570,999	0	513,899	513,899	57,100	0.18
Grass and Shrubs	252,358	108,560	116,084	224,644	27,713	0.20
Total	**823,357**	**108,560**	**629,984**	**738,543**	**84,813**	**0.19**

Hydrologic Soil Group—Napa County, California
(ACORN 6A STORAGE)



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

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

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

Soils

Soil Rating Polygons
- 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 5, Nov 25, 2013

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

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

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

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**
104	Bale clay loam, 0 to 2 percent slopes	B	7.6	73.3%
123	Coombs gravelly loam, 2 to 5 percent slopes	C	0.3	2.9%
151	Hambright-Rock outcrop complex, 2 to 30 percent slopes	D	2.3	22.6%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	D	0.1	1.2%
Totals for Area of Interest			**10.4**	**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

NAPA VAULT
GROUND WATER RECHARGE EXHIBIT

SITE DESCRIPTION	AREA (AC.)
IMPERVIOUS AREAS	7.15
PERVIOUS AREAS	3.16

GRAPHIC SCALE

100 0 100 200

(IN FEET)
1 inch = 100 FT

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

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DEC 2, 2015 4114028.0 Exh-GW Recharge.dwg

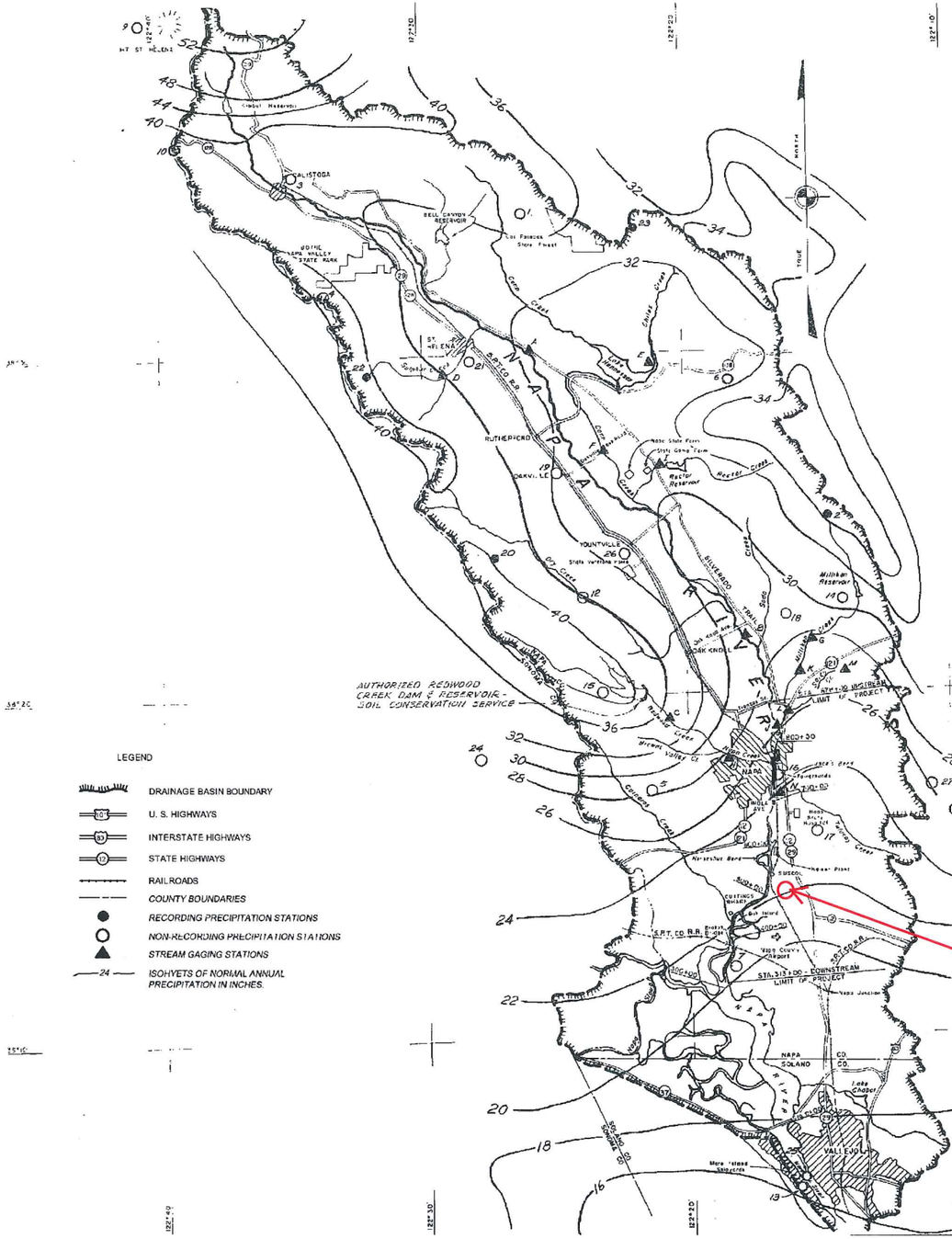
WATERSHED TYPES AND FACTORS

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%	0.20 **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	**0.10 – 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

Total C = 0.20+0.10+0.06+0.10 = 0.46



LEGEND

- DRAINAGE BASIN BOUNDARY
- U. S. HIGHWAYS
- INTERSTATE HIGHWAYS
- STATE HIGHWAYS
- RAILROADS
- COUNTY BOUNDARIES
- RECORDING PRECIPITATION STATIONS
- NON-RECORDING PRECIPITATION STATIONS
- STREAM GAGING STATIONS
- 24 — ISOHYETS OF NORMAL ANNUAL PRECIPITATION IN INCHES.

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**

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-