

Soil Loss Analysis
Proposed New Vineyard Development
Chen Vineyards
1260 Shady Brook Kane
Napa, CA 94588
052-190-013
November 13, 2023



The following analysis evaluates a 1.3-acre vineyard planting proposal on the referenced, approximately 41.8-acre parcel, to determine the proposal's potential to increase soil loss and sediment delivery from the site. This analysis, prepared by David Steiner, CPESC, CPSWQ, at the request of and in consultation with Mike Muelrath of Applied Civil Engineering, has adapted the Universal Soil Loss Equation (USLE) protocol developed by the Napa RCD, with guidance from the NRCS (SCS) Field Office Technical Guide, to requirements of the Napa County Engineering Division. Specifications of the Erosion Control Plan are also designed to assure adherence to the USDA soil loss tolerance "T." The transects modeled were drawn on the accompanying maps, provided by Applied Civil Engineering. The accompanying Excel spreadsheet¹ incorporates USLE principles and formulas, as follows:

- The "R" value is derived from the median value of the predicted range of 2-year/6-hour storms for this site, according to NOAA Atlas 14. A printout of the NOAA Atlas 14 table for the site accompanies this analysis.
- The "K" (soil erosivity) and "T" (soil loss tolerance) values were taken from the Napa County Web Soil Survey.
- The "LS" value is calculated per algorithms based on USDA empirical data, using plotted slope lengths and gradients, over six representative transects through the proposed vineyard areas.
- Pre-project "C": Cover values were assigned based on a site inspection on November 9, 2023, and examination of aerial photographic imagery (Google Earth and the Napa County GIS).
 - Block 1
 - Segment 1: 25% Low Brush; 70% cover: 60G, 40W
 $C = .038 \times .6 + .083 \times .4 = .056$
 - Segment 2: 25% Trees; 60% Cover: 50G, 50W
 $C = .089 \times .5 + .040 \times .5 = .0645$
 - Block 2: 0 Canopy; 50% Cover: 80G, 20W
 $C = .071 \times .8 + .121 \times .2 = .081$

¹ This Excel format segments modeled transects according to the most complex variable or USLE factor describing conditions along the transect. For example, a transect with five different types or levels of canopy or vegetative cover—but with uniform slope throughout—would nonetheless be assigned five separate slope entries (even though they were all the same), as the transect's segmentation (for all factors) would be based on cover, its most complex variable.

- Post-project “C” values are assigned based on the specifications of the current proposal, i.e., 75% cover with non-tilled management ($C = .034$). Specifications for cover maintenance on vineyard avenues are the same as those within vineyard blocks; supplementary practices such as annual applications of seed and straw mulch, per specifications in the Erosion Control Plan, may be necessary to compensate for ground disturbance related to tractor and equipment traffic.
- Pre- and post-project “P” values are assigned the default maximum (1.00), indicating proposed row direction up- and down-hill, that is, no “practice” reduction in soil loss.

Conclusion: With the assumption that the specified cover levels will be maintained, calculations predict that the net soil loss in each of the vineyard blocks will exceed neither pre-project levels nor the USDA soil loss tolerance. (Please see accompanying Excel printouts.)

Chen
Pre-Project USLE, preliminary
2-yr/6-hr storm, inches 1.63
November 7, 2023

Transect Identification		Chen Block 1, pre-Plan				
Acres		0.5	acres			
Total Slope Length		170	feet			
Number of Segments		2	segments			
		1	2	3	4	5
R	47.78	47.78	47.78	47.78	47.78	
Factor (F)	0.35	0.65	0.00	0.00	0.00	
Slope Length	170	170				
Slope %	20.0	22.4				
LS	4.53	5.26	0.00	0.00	0.00	
K	0.10	0.10				
C	0.056	0.065				
P	1.00	1.00	1.00	1.00	1.00	
T	1.00	1.00				1.00
(F) (LS) (K) (C)	0.008887	0.0221	0.0000	0.0000	0.0000	0.0310
A = (R) (F) (LS) (K) (C) (P)	0.42	1.05	0.00	0.00	0.00	1.48
						0.74

tons/acre/year
tons/year

Transect Identification		Chen Block 2, pre-Plan				
Acres		0.7	acres			
Total Slope Length		140	feet			
Number of Segments		1	segment			
		1	2	3	4	5
R	47.78	47.78	47.78	47.78	47.78	
Factor (F)	1.00	0.00	0.00	0.00	0.00	
Slope Length	140					
Slope %	21.4					
LS	4.50	0.00	0.00	0.00	0.00	
K	0.10					
C	0.081					
P	1.00	1.00	1.00	1.00	1.00	
T	1.00					1.00
(F) (LS) (K) (C)	0.036448	0.0000	0.0000	0.0000	0.0000	0.0364
A = (R) (F) (LS) (K) (C) (P)	1.74	0.00	0.00	0.00	0.00	1.74
						1.22

tons/acre/year
tons/year

Chen
Post-Project USLE, preliminary
2-yr/6-hr storm, inches 1.63
November 7, 2023

Transect Identification		Chen Block 1, post-Plan				
Acres		0.5	acres			
Total Slope Length		170	feet			
Number of Segments		2	segments			
		1	2	3	4	5
R	47.78	47.78	47.78	47.78	47.78	
Factor (F)	0.35	0.65	0.00	0.00	0.00	
Slope Length	170	170				
Slope %	20.0	22.4				
LS	4.53	5.26	0.00	0.00	0.00	
K	0.10	0.10				
C	0.034	0.034				75NT
P	1.00	1.00	1.00			
T	1.00	1.00				1.00
(F) (LS) (K) (C)	0.005396	0.0116	0.0000	0.0000	0.0000	0.0170
A = (R) (F) (LS) (K) (C) (P)	0.26	0.56	0.00	0.00	0.00	0.81
						0.41

tons/acre/year
tons/year

Transect Identification		Chen Block 2, post-Plan				
Acres		0.7	acres			
Total Slope Length		140	feet			
Number of Segments		1	segment			
		1	2	3	4	5
R	47.78	47.78	47.78	47.78	47.78	
Factor (F)	1.00	0.00	0.00	0.00	0.00	
Slope Length	140					
Slope %	21.4					
LS	4.50	0.00	0.00	0.00	0.00	
K	0.10					
C	0.034					75NT
P	1.00	1.00	1.00			
T	1.00					1.00
(F) (LS) (K) (C)	0.015299	0.0000	0.0000	0.0000	0.0000	0.0153
A = (R) (F) (LS) (K) (C) (P)	0.73	0.00	0.00	0.00	0.00	0.73
						0.51

tons/acre/year
tons/year



NOAA's National Weather Service

Hydrometeorological Design Studies Center

Precipitation Frequency Data Server (PFDS)

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NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type:

Precipitation depth

Units:

English

Time series type:

Partial duration

Select location

1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude:

Submit

b) By station (list of CA stations):

Select station

c) By address

1260 Shadybrook Ln, Napa, CA, 9455

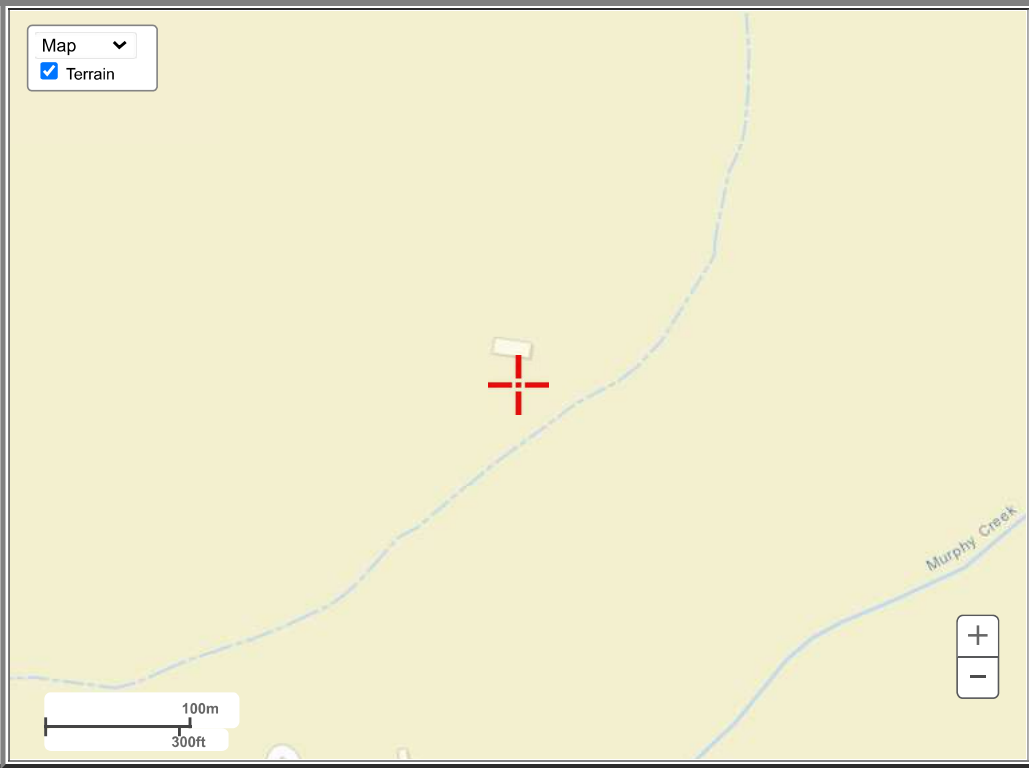
X

Q

2) Use map:

Map

☒ Terrain



100m

300ft

+

-

a) Select location

Move crosshair or double click

b) Click on station icon

☐ Show stations on map

Location information:

Name: Napa, California, USA*

Latitude: 38.3014°

Longitude: -122.2150°

Elevation: 843 ft **

* Source: ESRI Maps

** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES
WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular

PF graphical

Supplementary information

Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.125 (0.112-0.142)	0.160 (0.142-0.181)	0.205 (0.182-0.234)	0.244 (0.214-0.280)	0.296 (0.250-0.354)	0.338 (0.279-0.414)	0.381 (0.305-0.480)	0.426 (0.331-0.554)	0.490 (0.363-0.668)	0.541 (0.385-0.767)
10-min	0.179 (0.160-0.204)	0.229 (0.204-0.260)	0.294 (0.261-0.335)	0.349 (0.307-0.401)	0.425 (0.359-0.508)	0.484 (0.399-0.593)	0.546 (0.438-0.688)	0.611 (0.475-0.795)	0.702 (0.520-0.957)	0.775 (0.552-1.10)
15-min	0.217 (0.193-0.246)	0.277 (0.246-0.314)	0.356 (0.316-0.406)	0.422 (0.371-0.485)	0.514 (0.434-0.614)	0.586 (0.483-0.717)	0.660 (0.529-0.832)	0.739 (0.574-0.961)	0.849 (0.629-1.16)	0.937 (0.668-1.33)
30-min	0.311 (0.277-0.352)	0.396 (0.352-0.450)	0.509 (0.452-0.580)	0.604 (0.531-0.695)	0.735 (0.621-0.878)	0.838 (0.691-1.03)	0.945 (0.758-1.19)	1.06 (0.821-1.38)	1.22 (0.900-1.66)	1.34 (0.955-1.90)
60-min	0.449 (0.400-0.509)	0.572 (0.509-0.650)	0.736 (0.653-0.839)	0.873 (0.767-1.00)	1.06 (0.898-1.27)	1.21 (0.999-1.48)	1.37 (1.10-1.72)	1.53 (1.19-1.99)	1.76 (1.30-2.39)	1.94 (1.38-2.75)
2-hr	0.684 (0.609-0.776)	0.858 (0.763-0.974)	1.09 (0.964-1.24)	1.27 (1.12-1.46)	1.53 (1.29-1.83)	1.73 (1.43-2.12)	1.93 (1.55-2.43)	2.14 (1.66-2.79)	2.44 (1.80-3.32)	2.67 (1.90-3.78)
3-hr	0.875 (0.780-0.992)	1.09 (0.974-1.24)	1.38 (1.22-1.57)	1.61 (1.42-1.86)	1.93 (1.63-2.31)	2.17 (1.79-2.66)	2.42 (1.94-3.05)	2.68 (2.08-3.48)	3.03 (2.24-4.13)	3.30 (2.35-4.68)

6-hr	1.30 (1.15-1.47)	1.63 (1.45-1.85)	2.06 (1.83-2.35)	2.41 (2.12-2.77)	2.88 (2.43-3.44)	3.23 (2.66-3.96)	3.59 (2.88-4.52)	3.95 (3.07-5.14)	4.44 (3.29-6.05)	4.82 (3.43-6.83)
12-hr	1.76 (1.56-1.99)	2.30 (2.04-2.61)	2.98 (2.64-3.40)	3.53 (3.10-4.06)	4.25 (3.59-5.08)	4.79 (3.95-5.87)	5.33 (4.27-6.71)	5.87 (4.56-7.63)	6.59 (4.88-8.98)	7.14 (5.08-10.1)
24-hr	2.36 (2.13-2.68)	3.23 (2.90-3.66)	4.31 (3.87-4.90)	5.17 (4.61-5.92)	6.28 (5.45-7.40)	7.11 (6.06-8.52)	7.93 (6.62-9.69)	8.75 (7.14-10.9)	9.82 (7.74-12.7)	10.6 (8.13-14.2)
2-day	3.05 (2.75-3.46)	4.15 (3.73-4.70)	5.52 (4.95-6.28)	6.60 (5.88-7.56)	8.02 (6.95-9.43)	9.07 (7.73-10.9)	10.1 (8.44-12.3)	11.1 (9.09-13.9)	12.5 (9.85-16.2)	13.5 (10.4-18.0)
3-day	3.59 (3.23-4.07)	4.84 (4.36-5.50)	6.42 (5.76-7.30)	7.65 (6.82-8.76)	9.27 (8.04-10.9)	10.5 (8.92-12.5)	11.7 (9.73-14.2)	12.8 (10.5-16.0)	14.4 (11.3-18.6)	15.6 (11.9-20.7)
4-day	4.02 (3.62-4.56)	5.43 (4.88-6.16)	7.18 (6.44-8.16)	8.55 (7.62-9.79)	10.3 (8.96-12.2)	11.7 (9.94-14.0)	12.9 (10.8-15.8)	14.2 (11.6-17.8)	15.9 (12.6-20.6)	17.2 (13.2-22.9)
7-day	4.97 (4.47-5.63)	6.81 (6.13-7.73)	9.06 (8.13-10.3)	10.8 (9.61-12.3)	13.0 (11.3-15.3)	14.6 (12.4-17.4)	16.1 (13.4-19.7)	17.6 (14.4-22.0)	19.5 (15.4-25.3)	20.9 (16.0-27.9)
10-day	5.61 (5.05-6.36)	7.74 (6.96-8.79)	10.3 (9.25-11.7)	12.3 (10.9-14.0)	14.7 (12.7-17.3)	16.4 (14.0-19.7)	18.1 (15.1-22.1)	19.7 (16.1-24.7)	21.8 (17.2-28.2)	23.3 (17.8-31.0)
20-day	7.42 (6.68-8.41)	10.1 (9.12-11.5)	13.4 (12.0-15.2)	15.8 (14.1-18.1)	18.8 (16.3-22.1)	20.9 (17.8-25.0)	22.9 (19.1-28.0)	24.8 (20.3-31.0)	27.2 (21.5-35.2)	29.0 (22.2-38.6)
30-day	9.00 (8.10-10.2)	12.1 (10.9-13.7)	15.8 (14.2-17.9)	18.5 (16.5-21.2)	21.9 (19.0-25.8)	24.3 (20.7-29.0)	26.5 (22.1-32.4)	28.6 (23.4-35.8)	31.3 (24.7-40.5)	33.3 (25.5-44.3)
45-day	11.2 (10.1-12.7)	14.6 (13.2-16.6)	18.7 (16.8-21.3)	21.8 (19.4-24.9)	25.6 (22.2-30.1)	28.2 (24.0-33.7)	30.7 (25.6-37.4)	33.0 (27.0-41.3)	36.0 (28.4-46.6)	38.2 (29.2-50.8)
60-day	13.5 (12.2-15.3)	17.3 (15.5-19.6)	21.7 (19.5-24.7)	25.0 (22.3-28.6)	29.1 (25.2-34.2)	32.0 (27.2-38.3)	34.7 (29.0-42.3)	37.3 (30.4-46.6)	40.5 (31.9-52.5)	42.9 (32.8-57.2)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

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K Factor, Whole Soil

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Advanced Options

Aggregation Method Dominant Condition

Component Percent Cutoff

Tie-break Rule

☐ Lower

☒ Higher

Layer Options (Horizon Aggregation Method)

☒ Surface Layer (Not applicable)

☐ Depth Range (Weighted Average)

Top Depth

Bottom Depth

☐ Inches

☐ Centimeters

☐ All Layers (Weighted Average)

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T Factor

Wind Erodibility Group

Wind Erodibility Index

Soil Health Properties

Soil Physical Properties

Soil Qualities and Features

Water Features

Map — K Factor, Whole Soil

Scale (not to scale)

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

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Map surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of map not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Summary by Map Unit — Napa County, California (CA055)				
Summary by Map Unit — Napa County, California (CA055)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15		4.1	5.1%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	.10	76.3	93.9%
178	Sobranite loam, 5 to 30 percent slopes	.32	0.8	1.0%
Totals for Area of Interest			81.2	100.0%

Description — K Factor, Whole Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by

	water.
	"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.
	Factor K does not apply to organic horizons and is not reported for those layers.
	Rating Options — K Factor, Whole Soil
	Aggregation Method: Dominant Condition
	Component Percent Cutoff: <i>None Specified</i>
	Tie-break Rule: Higher
	Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)



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Soil Erosion Factors

K Factor, Rock Free

K Factor, Whole Soil

T Factor

View Description View Rating

View Options

Map ☒

Table ☒

Description of Rating ☒

Rating Options ☒ Detailed Description

Advanced Options

Aggregation Method Dominant Condition ▼

Component Percent Cutoff

Tie-break Rule ☒ Lower ☐ Higher

Interpret Nulls as Zero ☐ Yes ☒ No

View Description View Rating

Wind Erodibility Group

Wind Erodibility Index

Soil Health Properties

Soil Physical Properties

Soil Qualities and Features

Water Features

Map — T Factor

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

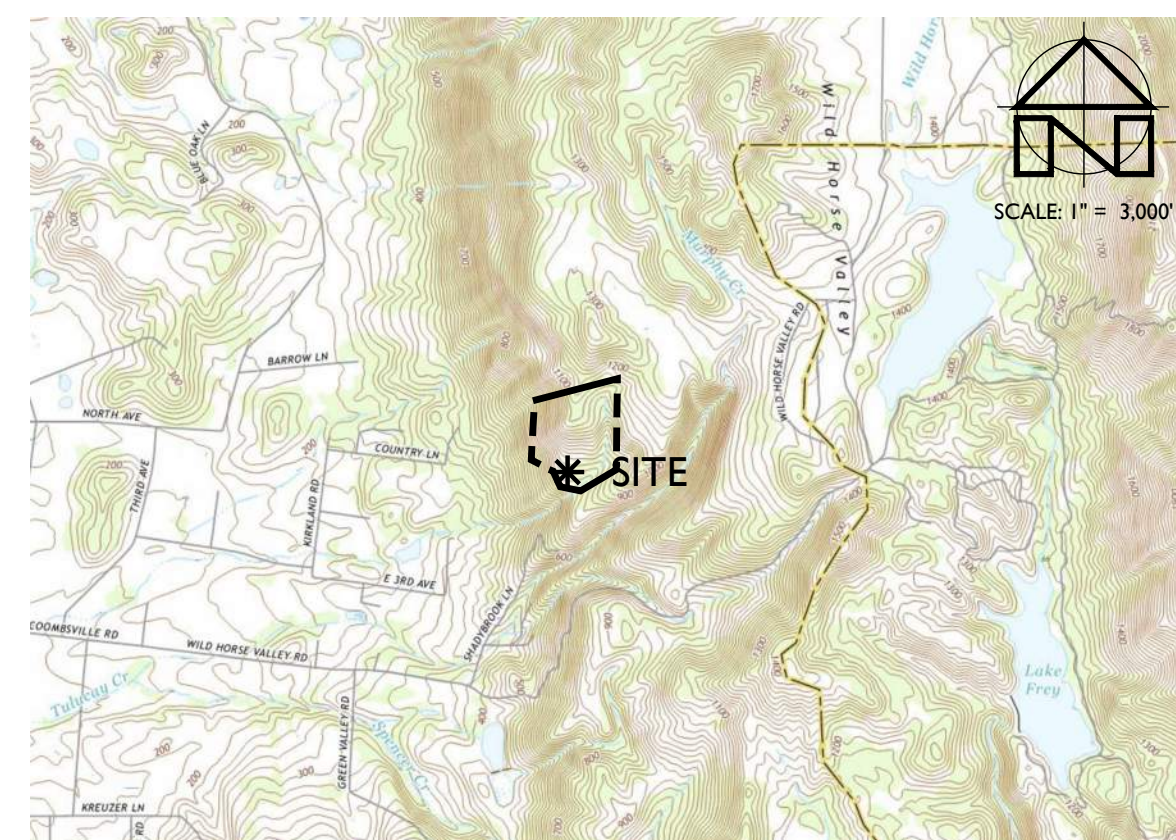
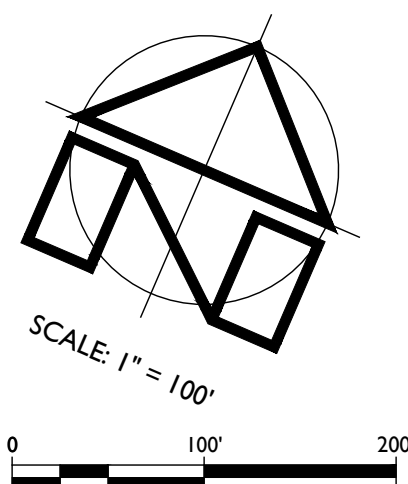
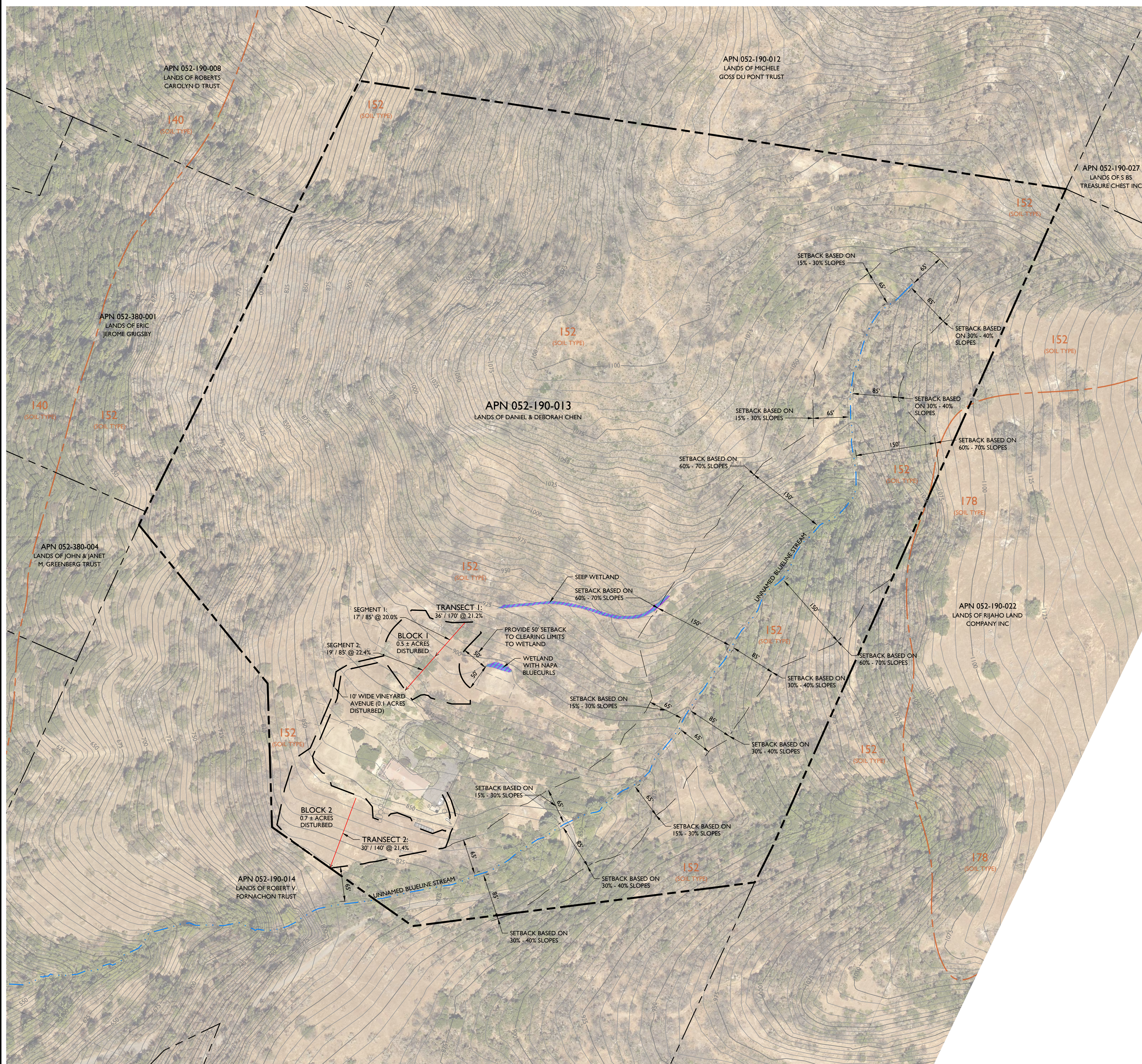
You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Map surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of map not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Tables — T Factor — Summary By Map Unit				
Summary by Map Unit — Napa County, California (CA055)				
Summary by Map Unit — Napa County, California (CA055)				
Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	3	4.1	5.1%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	1	76.3	93.9%
178	Sobrante loam, 5 to 30 percent slopes	2	0.8	1.0%
Totals for Area of Interest			81.2	100.0%
Description — T Factor				
The T factor is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.				

	Rating Options — T Factor Units of Measure: tons per acre per year Aggregation Method: Dominant Condition Component Percent Cutoff: <i>None Specified</i> Tie-break Rule: Lower Interpret Nulls as Zero: No
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UNIVERSAL SOIL LOSS EQUATION EXHIBIT



LOCATION MAP

SCALE: 1" = 3,000'

PROJECT INFORMATION:

PROPERTY OWNER & APPLICANT:
DANIEL & DEBORAH CHEN
1453 DRAKE AVENUE
BURLINGAME, CA 94010

SITE ADDRESS:
1260 SHADYBROOK LANE
NAPA, CA 94558

ASSESSOR'S PARCEL NUMBER:
052-190-013

PARCEL SIZE:
41.8 ± ACRES

ZONING:
AGRICULTURAL WATERSHED (AW)

FLOOD HAZARD NOTE:

ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) MAP NUMBER 06055C0550E, EFFECTIVE SEPTEMBER 26, 2008, THE PROJECT SITE IS NOT LOCATED IN A SPECIAL FLOOD HAZARD AREA.

NOTES:

1. FADED BACKGROUND REPRESENTS EXISTING TOPOGRAPHIC FEATURES. TOPOGRAPHIC INFORMATION WAS TAKEN FROM THE NAPA COUNTY GEOGRAPHIC INFORMATION SYSTEM DATABASE. APPLIED CIVIL ENGINEERING INCORPORATED ASSUMES NO LIABILITY REGARDING THE ACCURACY OR COMPLETENESS OF THE TOPOGRAPHIC INFORMATION.
2. AERIAL PHOTOGRAPHS WERE OBTAINED FROM THE NAPA COUNTY GEOGRAPHIC INFORMATION SYSTEM DATABASE, TAKEN APRIL TO JUNE 2018 AND MAY NOT REPRESENT CURRENT CONDITIONS.
3. THE PROPERTY LINES SHOWN ON THESE PLANS DO NOT REPRESENT A BOUNDARY SURVEY. THEY ARE APPROXIMATE AND ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

LEGEND:

	APPROXIMATE PROPERTY LINE - PRIMARY
	APPROXIMATE PROPERTY LINE - ADJACENT
	SOIL TYPE BOUNDARY
	BLUELINE STREAM
	LIMIT OF DISTURBED AREA
	USLE TRANSECT / SEGMENTS

SOIL TYPE LEGEND

152 HAMBRIGHT ROCK-OUTCROP COMPLEX, 30 TO 75 PERCENT SLOPES

SOIL TYPE BOUNDARIES SHOWN ON THIS MAP ARE BASED ON THE NAPA COUNTY GEOGRAPHIC INFORMATION SYSTEM DATA.

