Winrod Vineyards

Pre Vineyard Development
Aerial Photo 07-09-1993
Outline of Existing Vineyard Blocks Shown in RED

Legend

- Vineyard
- Winrod

Winrod

Google Earth

Image U.S. Geological Survey

N

500 ft

Winrod Vineyards

07-1993 Aerial
Existing Vineyards Outlined in RED
Proposed Vineyards Outlined in GREEN

Legend

- Section Lines
- Vineyard Blocks
- Winrod

VINEYARD SITE PLAN

SCALE: 1" = 60'

SOIL TYPE LEGEND:

NAPA COUNTY SOILS:
101 - AIKEN LOAM, 15% TO 30% SLOPES
139 - FORWARD SILT LOAM, 5% TO 30% SLOPES
140 - FORWARD SILT LOAM, 12% TO 57% SLOPES
156 - KIDD LOAM, 30% TO 75% SLOPES

SLOPE SECTIONS:

VINEYARD BLOCK	SECTION LABEL	% SLOPE
1	A-A	9%
	B-B	16%
	BLOCK AVG	13%
3	F-F	20%
	G-G	24%
	H-H	11%
	I-I	10%
	J-J	9%

SYMBOL LEGEND:

AREA WITHIN PROJECT WITH SLOPES OVER 30% (20,072± SQUARE FEET / 0.5± ACRES)

EDGE OF PROPOSED VINEYARD AVENUE

PROPOSED VINEYARD LAYOUT & VINEROW DIRECTION

PREPARED UNDER THE DIRECTION OF

BARTELT ENGINEERING
CIVIL ENGINEERING | LAND PLANNING

WINROD VINEYARDS
VINEYARD SITE PLAN

Google Earth
Image U.S. Geological Survey

600 ft

N

Winrod Vineyards

Post Vineyard Development
Aerial Photo 06-2003
Outline of Vineyard Blocks Shown in RED

Legend
- Vineyard
- Winrod

Winrod

Google Earth
Image USDA Farm Service Agency

N

600 ft

Winrod Vineyards

Post Vineyard Development
Aerial Photo 12-2007
Outline of Vineyard Blocks Shown in RED

Legend
- Vineyard
- Winrod

Winrod

Google Earth

N

600 ft

Winrod Vineyards

Post Vineyard Development
Aerial Photo 07-2009
Outline of Vineyard Blocks Shown in RED

Legend
Vineyard
Winrod

Winrod

Google Earth
Image © 2021 Maxar Technologies

N

600 ft

BARTELT ENGINEERING

USLE LAYOUT & PRACTICE ALTERNATIVES
VINEYARD BLOCK "1"

A=(R)(K)(LS)(C)(P)

DESCRIPTION: Track I - Vineyard Development

USER: rp

SOIL TYPE(s):	**SOIL LOSS TOLERANCE (T)**	**SOIL EROSIVENESS (K)**
101 Aiken loam, 15 to 30% slopes	3	0.28
139 Forward silt loam, 5 to 39% slopes	3	0.43
140 Forward silt loam, 12 to 57% slopes	3	0.43

2-YR, 6-HR RAINFALL (INCHES): 2.41

RAINFALL (R): 120

EXISTING CONDITION: Based on the 07-1993 aerial with the proposed vineyard block overlaid, the following assumptions are made:
Section A1 appears to be partial tree canopy (75% cover) and assumed to have a moderate weed cover (40% W)
Section A2 appears to be outside of the tree canopy and assumed to have a higher percentage of weed ground cover (70% W)
Section B appears to be partial tree canopy (75% cover) and assumed to have a moderate weed cover (40% W)

PROPOSED COVER: Vine Row Alternating Tilled; achieve a minimum of 75% cover after three years with post emergent herbicide application in an 18" wide spray strip if necessary.

PROPOSED PRACTICE: Vine rows planted perpendicular to contour (up & down hill) with 4' x 7' spacing by mechanically farmed means.

SLOPE SECTION*:		**A_1-A_1**		**A_2-A_2**		**B_1-B_1**		**B_2-B_2**	
FACTOR:	**DESCRIPTION**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
R	Rainfall	120	120	120	120	120	120	120	120
	Soil Type	140		101		139		101	
K	Soil Erosiveness	0.43	0.43	0.28	0.28	0.43	0.43	0.28	0.28
Ls	Segment Length (FT)	**67**	**67**	**147**	**147**	**121**	**121**	**67**	**67**
S	Segment Gradient (%)	**13**	**13**	**8**	**8**	**19**	**19**	**10**	**10**
LSs	Section Calculated LS	2.96	2.96	1.32	1.32	4.45	4.45	1.96	1.96
	Cover	75% Canopy 40% Weeds	Vine Row Alternating Tilled	70% Weeds	Vine Row Alternating Tilled	75% Canopy 40% Weeds	Vine Row Alternating Tilled	75% Canopy 40% Weeds	Vine Row Alternating Tilled
	% Ground Cover	40	75	70	75	40	75	40	75
C	Cover	**0.130**	**0.039**	**0.067**	**0.039**	**0.130**	**0.039**	**0.130**	**0.039**
P	Practice	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
A *(Section)*	Soil loss, tons/acre	6.96	2.09	1.94	1.13	10.46	3.14	5.57	1.67
A *(Section)*	Soil loss, tons/acre	Existing: 8.89		Proposed: 3.21		Existing: 16.02		Proposed: 4.81	
T (Allowable)	Soil loss, tons/acre	3.00		3.00		3.00		3.00	

Notes: Existing practice was determined from field observations. P=1 was used for proposed practice, because it represents a conservative analysis; actual practice may vary throughout block. Ls is the horizontal length of the slope section/segment symbol on the erosion control plan. LSs is calculated based on the total section length (or the total of all segments). The slope sections used in this analysis were chosen to represent average conditions found within the vineyard blocks.

Interpretation of Results: The proposed vineyard development and runoff control measures are predicted to result in soil loss less than or equal to existing conditions.

*See Track I Vineyard Development and Erosion Control Plan for slope section locations.

BARTELT ENGINEERING

USLE LAYOUT & PRACTICE ALTERNATIVES
VINEYARD BLOCK "2"

A=(R)(K)(LS)(C)(P)

DESCRIPTION: Track I - Vineyard Development

USER: rp

SOIL TYPE(s):	**SOIL LOSS TOLERANCE (T)**	**SOIL EROSIVENESS (K)**
101 Aiken loam, 15 to 30% slopes	3	0.28
139 Forward silt loam, 5 to 39% slopes	3	0.43
140 Forward silt loam, 12 to 57% slopes	3	0.43

2-YR, 6-HR RAINFALL (INCHES): 2.41

RAINFALL (R): 120

EXISTING CONDITION: Based on the 07-1993 aerial with the proposed vineyard block overlaid, the following assumptions are made:
Section C1 appears to be partial tree canopy (75% cover) and assumed to have a moderate weed cover (40% W)
Section C2 appears to be primarily outside of the tree canopy and assumed to have a higher percentage of weed ground cover (70% W)
Section D appears to be partial tree canopy (75% cover) and assumed to have a moderate weed cover (40% W)

PROPOSED COVER: Vine Row Alternating Tilled; achieve a minimum of 75% cover after three years with post emergent herbicide application in an 18" wide spray strip if necessary.

PROPOSED PRACTICE: Vine rows planted perpendicular to contour (up & down hill) with 4' x 7' spacing by mechanically farmed means.

SLOPE SECTION*:		**C_1-C_1**		**C_2-C_2**		**D-D**	
FACTOR:	**DESCRIPTION**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
R	Rainfall	120	120	120	120	120	120
	Soil Type	101		101		101	
K	Soil Erosiveness	0.28	0.28	0.28	0.28	0.28	0.28
Ls	Segment Length (FT)	**106**	**106**	**164**	**164**	**150**	**150**
S	Segment Gradient (%)	**19**	**19**	**6**	**6**	**17**	**17**
LSs	Section Calculated LS	5.30	5.30	1.13	1.13	3.35	3.35
	Cover	75% Canopy 40% Weeds	Vine Row Alternating Tilled	70% Weeds	Vine Row Alternating Tilled	75% Canopy 40% Weeds	Vine Row Alternating Tilled
	% Ground Cover	40	75	70	75	40	75
C	Cover	**0.130**	**0.039**	**0.067**	**0.039**	**0.130**	**0.039**
P	Practice	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
A *(Section)*	Soil loss, tons/acre	8.10	2.43	1.65	0.96	14.62	4.38
A *(Section)*	Soil loss, tons/acre	Existing: 9.75		Proposed: 3.39			
T (Allowable)	Soil loss, tons/acre	3.00		3.00		3.00	

Notes: Existing practice was determined from field observations. P=1 was used for proposed practice, because it represents a conservative analysis; actual practice may vary throughout block. Ls is the horizontal length of the slope section/segment symbol on the erosion control plan. LSs is calculated based on the total section length (or the total of all segments). The slope sections used in this analysis were chosen to represent average conditions found within the vineyard blocks.

Interpretation of Results: The proposed vineyard development and runoff control measures are predicted to result in soil loss less than or equal to existing conditions.

*See Track I Vineyard Development and Erosion Control Plan for slope section locations.

BARTELT ENGINEERING

USLE LAYOUT & PRACTICE ALTERNATIVES
VINEYARD BLOCK "2" CONTINUED

A=(R)(K)(LS)(C)(P)

DESCRIPTION: Track I - Vineyard Development

USER: rp

SOIL TYPE(s):	**SOIL LOSS TOLERANCE (T)**	**SOIL EROSIVENESS (K)**
101 Aiken loam, 15 to 30% slopes	3	0.28
139 Forward silt loam, 5 to 39% slopes	3	0.43
140 Forward silt loam, 12 to 57% slopes	3	0.43

2-YR, 6-HR RAINFALL (INCHES): 2.41

RAINFALL (R): 120

EXISTING CONDITION: Based on the 07-1993 aerial with the proposed vineyard block overlaid, the following assumptions are made:
Section E1 appears to be tree canopy (75% cover) and assumed to have a moderate weed cover (40% W)
Section E2 appears to be mostly tree canopy (75% cover) and assumed to have a moderate weed cover (40% W)
Section E3 appears to be mostly outside of the tree canopy and assumed to have a higher percentage of weed ground cover (70% W)

PROPOSED COVER: Vine Row Alternating Tilled; achieve a minimum of 75% cover after three years with post emergent herbicide application in an 18" wide spray strip if necessary.

PROPOSED PRACTICE: Vine rows planted perpendicular to contour (up & down hill) with 4' x 7' spacing by mechanically farmed means.

SLOPE SECTION*:		**E_1-E_1**		**E_2-E_2**		**E_2-E_2**	
FACTOR:	**DESCRIPTION**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
R	Rainfall	120	120	120	120	120	120
	Soil Type	139		101		101	
K	Soil Erosiveness	0.43	0.43	0.28	0.28	0.28	0.28
Ls	Segment Length (FT)	**102**	**102**	**100**	**100**	**340**	**340**
S	Segment Gradient (%)	**23**	**23**	**17**	**17**	**6**	**6**
LSs	Section Calculated LS	9.46	9.46	6.51	6.51	1.53	1.53
	Cover	75% Canopy 40% Weeds	Vine Row Alternating Tilled	75% Canopy 40% Weeds	Vine Row Alternating Tilled	70% Weeds	Vine Row Alternating Tilled
	% Ground Cover	40	75	40	75	70	75
C	Cover	**0.130**	**0.039**	**0.130**	**0.039**	**0.067**	**0.039**
P	Practice	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
A *(Section)*	Soil loss, tons/acre	12.05	3.62	9.96	2.99	1.58	0.92
A *(Section)*	Soil loss, tons/acre	Existing: 23.6			Proposed: 7.53		
T (Allowable)	Soil loss, tons/acre	3.00		3.00		3.00	

Notes: Existing practice was determined from field observations. P=1 was used for proposed practice, because it represents a conservative analysis; actual practice may vary throughout block. Ls is the horizontal length of the slope section/segment symbol on the erosion control plan. LSs is calculated based on the total section length (or the total of all segments). The slope sections used in this analysis were chosen to represent average conditions found within the vineyard blocks.

Interpretation of Results: The proposed vineyard development and runoff control measures are predicted to result in soil loss less than or equal to existing conditions.

*See Track I Vineyard Development and Erosion Control Plan for slope section locations.

BARTELT ENGINEERING

USLE LAYOUT & PRACTICE ALTERNATIVES
VINEYARD BLOCK "3"

A=(R)(K)(LS)(C)(P)

DESCRIPTION: Track I - Vineyard Development

USER: rp

SOIL TYPE(s):	**SOIL LOSS TOLERANCE (T)**	**SOIL EROSIVENESS (K)**
101 Aiken loam, 15 to 30% slopes	3	0.28
139 Forward silt loam, 5 to 39% slopes	3	0.43
140 Forward silt loam, 12 to 57% slopes	3	0.43

2-YR, 6-HR RAINFALL (INCHES): 2.41

RAINFALL (R): 120

EXISTING CONDITION: Based on the 07-1993 aerial with the proposed vineyard block overlayed, the following assumptions are made:
Sections F, G, H & I appear mostly to be tree canopy (75% cover) and assumed to have a moderate weed cover (70% W)

PROPOSED COVER: Vine Row Alternating Tilled; achieve a minimum of 75% cover after three years with post emergent herbicide application in an 18" wide spray strip if necessary.

PROPOSED PRACTICE: Vine rows planted perpendicular to contour (up & down hill) with 4' x 7' spacing by mechanically farmed means.

SLOPE SECTION*:		**F-F**		**G-G**		**H-H**		**I-I**	
FACTOR:	**DESCRIPTION**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
R	Rainfall	120	120	120	120	120	120	120	120
	Soil Type	139		139		139		139	
K	Soil Erosiveness	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Ls	Section Length (ft)	**247**	**247**	**168**	**168**	**612**	**612**	**346**	**346**
S	Section gradient (%)	**20**	**20**	**24**	**24**	**11**	**11**	**10**	**10**
LSs	Section Calculated LS	5.54	5.54	5.66	5.66	3.87	3.87	2.66	2.66
	Cover	75% Canopy 70% Weeds	Vine Row Alternating Tilled	75% Canopy 70% Weeds	Vine Row Alternating Tilled	75% Canopy 70% Weeds	Vine Row Alternating Tilled	75% Canopy 70% Weeds	Vine Row Alternating Tilled
	% Ground Cover	70	75	70	75	70	75	70	75
C	Cover	**0.0625**	**0.039**	**0.0625**	**0.039**	**0.0625**	**0.039**	**0.0625**	**0.039**
P	Practice	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
A *(Section)*	Soil loss, tons/acre	17.86	11.14	18.27	11.40	12.48	7.79	8.58	5.35
T (Allowable)	Soil loss, tons/acre	3.00		3.00		3.00		3.00	

Notes: Existing practice was determined from field observations. P=1 was used for proposed practice, because it represents a conservative analysis; actual practice may vary throughout block. Ls is the horizontal length of the slope section/segment symbol on the erosion control plan. LSs is calculated based on the total section length (or the total of all segments). The slope sections used in this analysis were chosen to represent average conditions found within the vineyard blocks.

Interpretation of Results: The proposed vineyard development and runoff control measures are predicted to result in soil loss less than or equal to existing conditions.

*See Track I Vineyard Development and Erosion Control Plan for slope section locations.

BARTELT ENGINEERING

USLE LAYOUT & PRACTICE ALTERNATIVES
VINEYARD BLOCK "3" CONTINUED

A=(R)(K)(LS)(C)(P)

DESCRIPTION: Track I - Vineyard Development

USER: rp

SOIL TYPE(s):	**SOIL LOSS TOLERANCE (T)**	**SOIL EROSIVENESS (K)**
101 Aiken loam, 15 to 30% slopes	3	0.28
139 Forward silt loam, 5 to 39% slopes	3	0.43
140 Forward silt loam, 12 to 57% slopes	3	0.43

2-YR, 6-HR RAINFALL (INCHES): 2.41

RAINFALL (R): 120

EXISTING CONDITION: Based on the 07-1993 aerial with the proposed vineyard block overlayed, the following assumptions are made:
Section J appears mostly to be tree canopy (75% cover) and assumed to have a moderate weed cover (70% W)

PROPOSED COVER: Vine Row Alternating Tilled; achieve a minimum of 75% cover after three years with post emergent herbicide application in an 18" wide spray strip if necessary.

PROPOSED PRACTICE: Vine rows planted perpendicular to contour (up & down hill) with 4' x 7' spacing by mechanically farmed means.

SLOPE SECTION*:		**J-J**	
FACTOR:	**DESCRIPTION**	**Existing**	**Proposed**
R	Rainfall	120	120
	Soil Type	139	
K	Soil Erosiveness	0.43	0.43
Ls	Section Length (ft)	**285**	**285**
S	Section gradient (%)	**9**	**9**
LSs	Section Calculated LS	2.01	2.01
	Cover	75% Canopy 70% Weeds	Vine Row Alternating Tilled
	% Ground Cover	70	75
C	Cover	**0.0625**	**0.039**
P	Practice	**1.00**	**1.00**
A *(Section)*	Soil loss, tons/acre	6.47	4.04
T (Allowable)	Soil loss, tons/acre	3.00	

Notes: Existing practice was determined from field observations. P=1 was used for proposed practice, because it represents a conservative analysis; actual practice may vary throughout block. Ls is the horizontal length of the slope section/segment symbol on the erosion control plan. LSs is calculated based on the total section length (or the total of all segments). The slope sections used in this analysis were chosen to represent average conditions found within the vineyard blocks.

Interpretation of Results: The proposed vineyard development and runoff control measures are predicted to result in soil loss less than or equal to existing conditions.

*See Track I Vineyard Development and Erosion Control Plan for slope section locations.

REFERENCES:

"Soil Survey of Napa County, California" by G. Lambert and J. Kashiwagi, Soil Conservation Service.

"The Universal Soil Loss Equation: Special Applications for Napa County" by USDA- Soil Conservation Service, May 1994.

BARTELT ENGINEERING

TABLE A-1: R FACTOR	
R Zone 1	**2-Year/6-Hour Precipitation (Inches)**
10	<0.7
10	0.7
10	0.8
15	0.9
15	1
20	1.1
25	1.2
30	1.3
35	1.4
40	1.5
45	1.6
50	1.7
60	1.8
65	1.9
75	2
85	2.1
90	2.2
100	2.3
110	2.4
120	2.5
130	2.6
145	2.7
155	2.8
165	2.9
180	3
195	3.1
205	3.2
220	3.3
235	3.4
250	3.5
265	3.6
285	3.7
300	3.8
315	3.9
335	4

Reference: Table A-1 "Guides for Erosion and Sediment Control in California", USDA-SCS, Davis CA, 1996, pg. A-3

BARTELT ENGINEERING

Table 10: C-Factor for Permanent Pasture, Range, Idle Land, or Grazed Woodland[1]

VEGETATIVE OVERHEAD CANOPY		Soil Surface Cover Percent Ground Cover (winter months)								
Type and Height[2]	**Percent Cover[3]**	**Type[4]** G=grass W=weed	**0%**	**20%**	**30%**	**40%**	**60%**	**70%**	**80%**	**95%**
No appreciable canopy	----	G	0.45	0.2	0.15	0.1	0.042	0.0275	0.013	0.003
		W	0.45	0.24	0.195	0.15	0.091	0.067	0.043	0.011
Tall grassy weeds or bushes with average drop fall height of less than 3 ft	25	G	0.36	0.17	0.13	0.09	0.038	0.0255	0.013	0.003
		W	0.36	0.2	0.165	0.13	0.083	0.062	0.041	0.011
	50	G	0.26	0.13	0.1	0.07	0.035	0.0235	0.012	0.003
		W	0.26	0.16	0.135	0.11	0.076	0.0575	0.039	0.011
	75	G	0.17	0.1	0.08	0.06	0.032	0.0215	0.011	0.003
		W	0.17	0.12	0.105	0.09	0.068	0.053	0.038	0.011
Appreciable brush or bushes with average drop fall height of 6.5 ft	25	G	0.4	0.18	0.135	0.09	0.04	0.0265	0.013	0.003
		W	0.4	0.22	0.18	0.14	0.087	0.0645	0.042	0.011
	50	G	0.34	0.16	0.12	0.08	0.038	0.025	0.012	0.003
		W	0.34	0.19	0.16	0.13	0.082	0.0615	0.041	0.011
	75	G	0.28	0.14	0.11	0.08	0.036	0.024	0.012	0.003
		W	0.28	0.17	0.145	0.12	0.078	0.059	0.04	0.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft.	25	G	0.42	0.19	0.145	0.1	0.041	0.027	0.013	0.003
		W	0.42	0.23	0.185	0.14	0.089	0.0655	0.042	0.011
	50	G	0.39	0.18	0.135	0.09	0.04	0.0265	0.013	0.003
		W	0.39	0.21	0.175	0.14	0.087	0.0645	0.042	0.011
	75	G	0.36	0.17	0.13	0.09	0.039	0.0255	0.012	0.003
		W	0.36	0.2	0.165	0.13	0.084	0.0625	0.041	0.011

[1] The listed C values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of the total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

[4] G: cover that surface is grass, grasslike plants, decaying compacted duff.
W: cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

Interpolated results

Reference: "Table 10: Predicting Rainfall Erosion Losses", *USDA Handbook No. 537.*

BARTELT ENGINEERING

TABLE 4: USLE "C" FACTORS FOR VINEYARDS

Vine Row Tilled

Stage of Development	% Raised Canopy [2]	% Ground Cover [3]					
		0	**20**	**40**	**60**	**80**	**95**
Clearing to 1 Year Old	0	1.00	0.44	0.22	0.092	0.029	0.007
1 - 3 Years Old	15	0.92	0.41	0.21	0.090	0.028	0.007
3+ Years Old	30	0.85	0.39	0.20	0.088	0.028	0.007

Vine Row Non-Tilled

Stage of Development	% Raised Canopy [2]	% Ground Cover [3]					
		0	**20**	**40**	**60**	**80**	**95**
Clearing to 1 Year Old	0	0.80	0.35	0.18	0.074	0.023	0.006
1 - 3 Years Old	15	0.74	0.33	0.17	0.072	0.022	0.006
3+ Years Old	30	0.68	0.31	0.16	0.070	0.022	0.006

Vine Row Alternating Tilled

Stage of Development	% Raised Canopy [2]	% Ground Cover [3]					
		0	**20**	**40**	**60**	**80**	**95**
Clearing to 1 Year Old	0	0.90	0.40	0.20	0.083	0.026	0.007
1 - 3 Years Old	15	0.83	0.37	0.19	0.081	0.025	0.007
3+ Years Old	30	0.77	0.35	0.18	0.079	0.025	0.007

[1] Continuous weed free tillage except as noted when vine row is non-tilled.

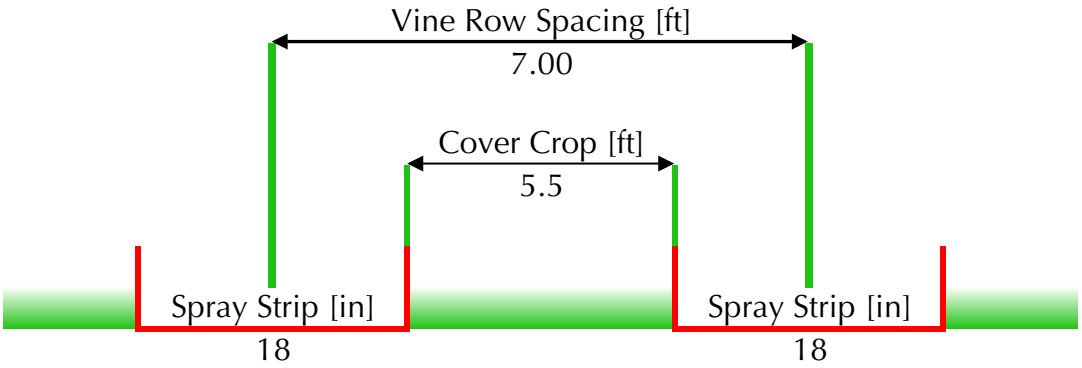
[2] Portion of total-area surface that would be hidden from view by canopy in a vertical projection - "a bird's-eye view".

[3] Percent ground cover over winter months.

Reference: United States Department of Agriculture (USDA) - Soil Conservation Service. The Universal Soil Loss Equation USLE Special Applications for Napa County California. 1994.

BARTELT ENGINEERING

SPRAY STRIP EXHIBIT



Percent Cover Crop =

79%	Maximum
75%	Proposed

NOAA Atlas 14, Volume 6, Version 2
Location name: Calistoga, California, USA*
Latitude: 38.5992°, Longitude: -122.6236°
Elevation: 439.73 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point 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	0.161 (0.143–0.182)	0.195 (0.173–0.221)	0.239 (0.211–0.273)	0.275 (0.241–0.317)	0.323 (0.273–0.387)	0.360 (0.296–0.442)	0.397 (0.318–0.501)	0.436 (0.338–0.568)	0.488 (0.361–0.666)	0.528 (0.375–0.749)
10-min	0.230 (0.205–0.261)	0.279 (0.248–0.317)	0.342 (0.303–0.391)	0.394 (0.345–0.454)	0.463 (0.391–0.554)	0.516 (0.425–0.633)	0.570 (0.456–0.719)	0.625 (0.484–0.814)	0.699 (0.517–0.954)	0.756 (0.538–1.07)
15-min	0.278 (0.247–0.316)	0.337 (0.300–0.384)	0.414 (0.367–0.473)	0.476 (0.418–0.549)	0.560 (0.472–0.671)	0.624 (0.514–0.765)	0.689 (0.551–0.869)	0.755 (0.586–0.984)	0.845 (0.625–1.15)	0.915 (0.650–1.30)
30-min	0.406 (0.361–0.461)	0.492 (0.437–0.560)	0.604 (0.535–0.690)	0.695 (0.609–0.801)	0.817 (0.689–0.979)	0.911 (0.750–1.12)	1.00 (0.805–1.27)	1.10 (0.855–1.44)	1.23 (0.912–1.68)	1.34 (0.949–1.90)
60-min	0.585 (0.520–0.664)	0.709 (0.630–0.807)	0.870 (0.770–0.993)	1.00 (0.878–1.15)	1.18 (0.993–1.41)	1.31 (1.08–1.61)	1.45 (1.16–1.83)	1.59 (1.23–2.07)	1.78 (1.31–2.43)	1.92 (1.37–2.73)
2-hr	0.899 (0.799–1.02)	1.08 (0.958–1.23)	1.31 (1.16–1.49)	1.49 (1.31–1.72)	1.73 (1.46–2.07)	1.91 (1.57–2.34)	2.09 (1.67–2.63)	2.27 (1.76–2.95)	2.50 (1.85–3.42)	2.68 (1.91–3.81)
3-hr	1.16 (1.03–1.31)	1.39 (1.23–1.58)	1.68 (1.48–1.91)	1.91 (1.67–2.19)	2.20 (1.86–2.64)	2.42 (2.00–2.97)	2.64 (2.11–3.33)	2.86 (2.21–3.72)	3.14 (2.32–4.28)	3.35 (2.38–4.75)
6-hr	1.75 (1.56–1.99)	2.12 (1.88–2.41)	2.57 (2.28–2.93)	2.92 (2.56–3.37)	3.37 (2.85–4.04)	3.70 (3.05–4.54)	4.02 (3.22–5.07)	4.33 (3.36–5.65)	4.74 (3.50–6.47)	5.03 (3.58–7.15)
12-hr	2.48 (2.20–2.81)	3.12 (2.77–3.55)	3.90 (3.45–4.45)	4.49 (3.94–5.18)	5.24 (4.42–6.28)	5.78 (4.76–7.09)	6.29 (5.04–7.94)	6.79 (5.26–8.84)	7.41 (5.48–10.1)	7.86 (5.59–11.2)
24-hr	3.41 (3.07–3.88)	4.49 (4.03–5.11)	5.80 (5.19–6.61)	6.79 (6.04–7.79)	8.04 (6.96–9.48)	8.93 (7.59–10.7)	9.78 (8.15–12.0)	10.6 (8.62–13.3)	11.6 (9.14–15.1)	12.4 (9.44–16.6)
2-day	4.52 (4.06–5.14)	5.90 (5.30–6.71)	7.64 (6.84–8.71)	9.01 (8.01–10.3)	10.8 (9.33–12.7)	12.1 (10.3–14.5)	13.4 (11.2–16.4)	14.7 (11.9–18.4)	16.3 (12.8–21.2)	17.6 (13.4–23.5)
3-day	5.31 (4.77–6.03)	6.86 (6.16–7.80)	8.87 (7.94–10.1)	10.5 (9.32–12.0)	12.6 (10.9–14.9)	14.3 (12.1–17.1)	15.9 (13.2–19.5)	17.6 (14.3–22.0)	19.8 (15.6–25.7)	21.5 (16.4–28.8)
4-day	5.94 (5.34–6.75)	7.65 (6.87–8.70)	9.88 (8.85–11.3)	11.7 (10.4–13.4)	14.1 (12.2–16.7)	16.0 (13.6–19.2)	17.9 (14.9–21.9)	19.8 (16.1–24.9)	22.5 (17.6–29.2)	24.5 (18.7–32.8)
7-day	7.34 (6.59–8.33)	9.41 (8.45–10.7)	12.1 (10.9–13.8)	14.4 (12.8–16.5)	17.4 (15.0–20.5)	19.7 (16.8–23.6)	22.1 (18.4–27.0)	24.5 (19.9–30.7)	27.8 (21.9–36.2)	30.4 (23.2–40.7)
10-day	8.34 (7.50–9.47)	10.7 (9.61–12.2)	13.8 (12.3–15.7)	16.3 (14.5–18.6)	19.6 (16.9–23.1)	22.1 (18.8–26.5)	24.7 (20.6–30.2)	27.3 (22.2–34.2)	30.8 (24.2–40.0)	33.5 (25.6–44.8)
20-day	11.0 (9.93–12.5)	14.2 (12.8–16.2)	18.2 (16.3–20.7)	21.2 (18.9–24.4)	25.2 (21.8–29.7)	28.1 (23.9–33.7)	30.9 (25.7–37.8)	33.6 (27.4–42.2)	37.2 (29.2–48.3)	39.8 (30.4–53.3)
30-day	13.4 (12.0–15.2)	17.2 (15.4–19.5)	21.8 (19.5–24.9)	25.3 (22.5–29.1)	29.8 (25.8–35.1)	32.9 (28.0–39.5)	35.9 (29.9–44.0)	38.8 (31.6–48.7)	42.4 (33.3–55.1)	45.1 (34.4–60.3)
45-day	16.4 (14.8–18.7)	21.0 (18.9–23.9)	26.5 (23.7–30.2)	30.5 (27.1–35.0)	35.5 (30.7–41.8)	38.9 (33.1–46.7)	42.1 (35.1–51.6)	45.1 (36.7–56.6)	48.8 (38.4–63.4)	51.5 (39.3–68.8)
60-day	19.5 (17.5–22.2)	24.8 (22.3–28.2)	31.0 (27.8–35.3)	35.5 (31.6–40.7)	40.9 (35.4–48.3)	44.6 (38.0–53.6)	48.0 (40.0–58.8)	51.2 (41.7–64.2)	55.0 (43.2–71.5)	57.7 (44.0–77.2)

[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.

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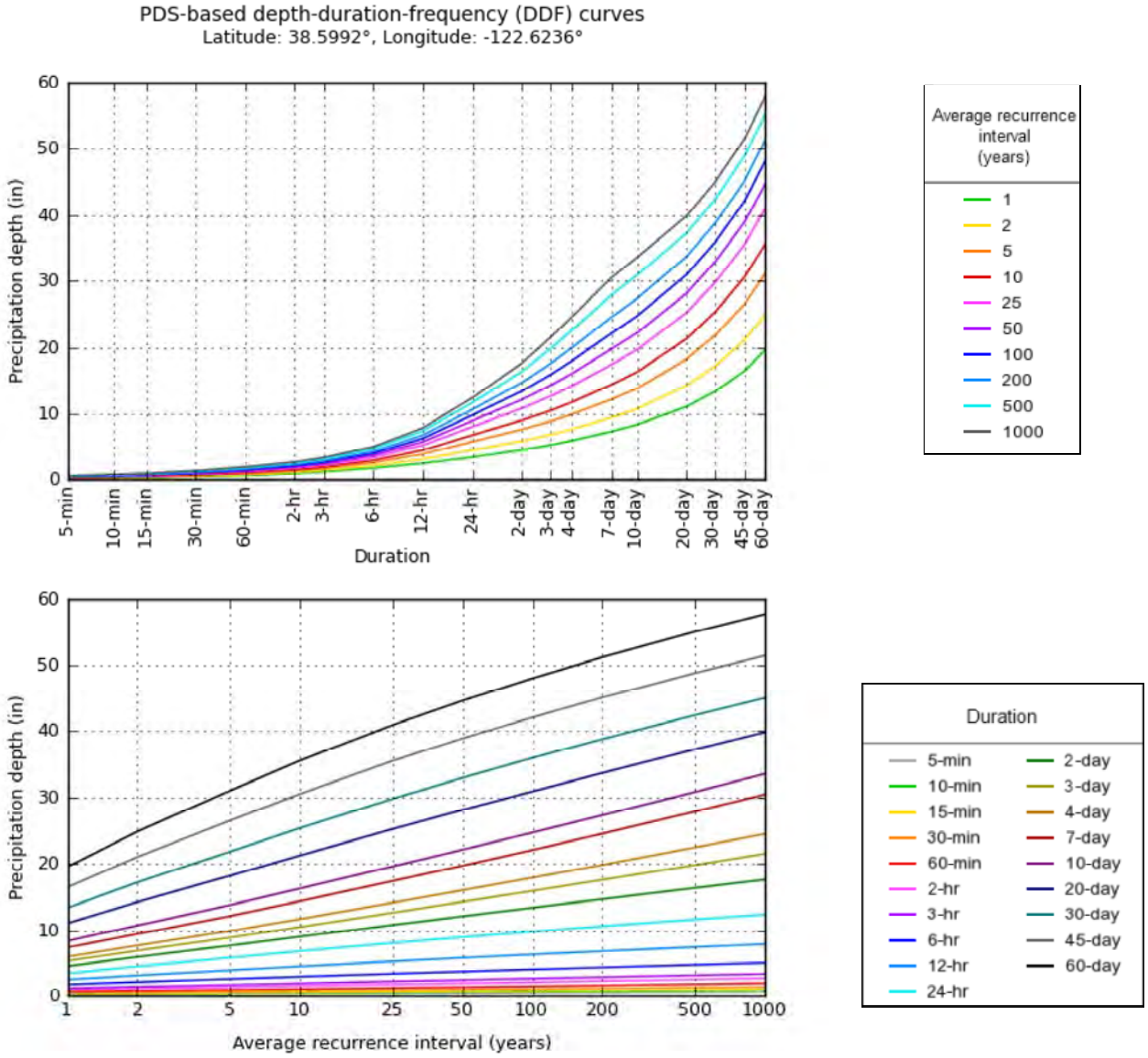
PF graphical



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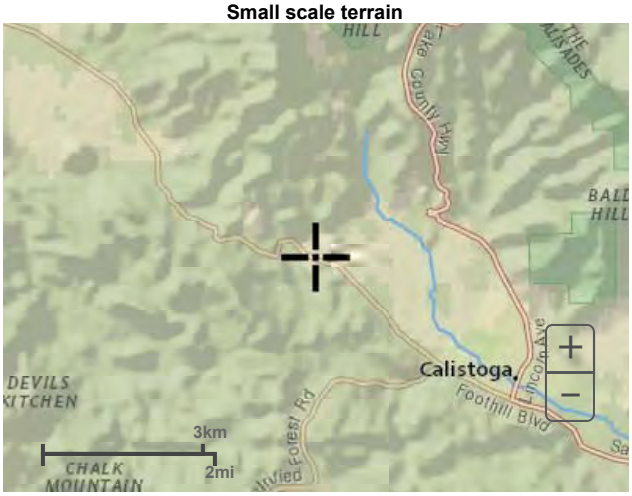
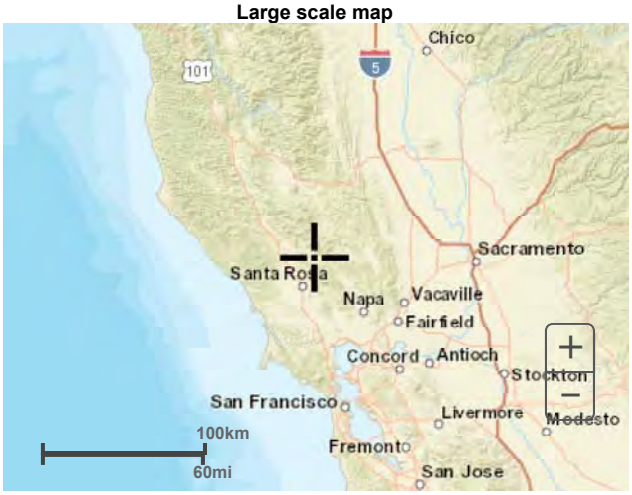
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map



Large scale aerial

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Napa County, California, and Sonoma County, California

Winrod Vineyards

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

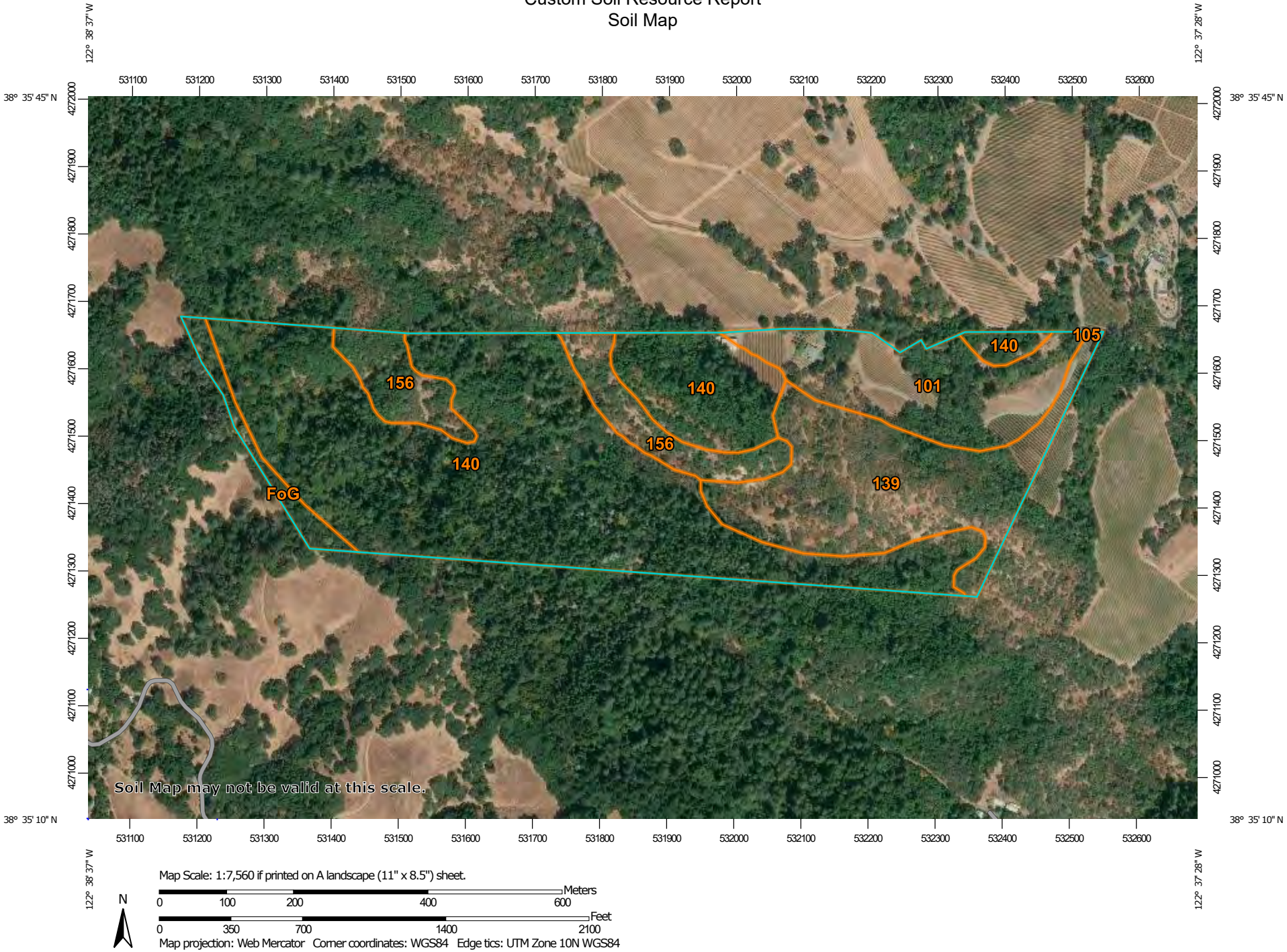
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,560 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 350, 700, 1400, 2100

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 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:
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 13, May 29, 2020

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 14, May 29, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 31, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
101	Aiken loam, 15 to 30 percent slopes	13.6	13.0%
105	Bale clay loam, 2 to 5 percent slopes	0.1	0.0%
139	Forward silt loam, 5 to 39 percent slopes, MLRA 15	20.1	19.1%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	59.8	56.9%
156	Kidd loam, 30 to 75 percent slopes	9.2	8.7%
Subtotals for Soil Survey Area		**102.8**	**97.7%**
Totals for Area of Interest		**105.2**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FoG	Forward silt loam, 12 to 57 percent slopes, MLRA 15	2.4	2.3%
Subtotals for Soil Survey Area		**2.4**	**2.3%**
Totals for Area of Interest		**105.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They

generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Napa County, California

101—Aiken loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: hdk1
Elevation: 300 to 3,000 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 54 to 55 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Aiken and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aiken

Setting

Landform: Hillsides
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from volcanic rock

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 14 inches: clay loam
H3 - 14 to 44 inches: clay
H4 - 44 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

105—Bale clay loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hdk5
Elevation: 20 to 400 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 220 to 270 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Bale and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bale

Setting

Landform: Terraces, flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from rhyolite and/or alluvium derived from igneous rock

Typical profile

H1 - 0 to 24 inches: clay loam
H2 - 24 to 60 inches: stratified gravelly sandy loam to loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

139—Forward silt loam, 5 to 39 percent slopes, MLRA 15

Map Unit Setting

National map unit symbol: 2xc9x
Elevation: 110 to 2,080 feet
Mean annual precipitation: 27 to 45 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 281 to 344 days
Farmland classification: Not prime farmland

Map Unit Composition

Forward and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Forward

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Rhyolitic residuum weathered from volcanic rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 6 inches: silt loam
BA - 6 to 12 inches: silt loam
Bw1 - 12 to 19 inches: silt loam
Bw2 - 19 to 28 inches: silt loam
Bw3 - 28 to 37 inches: gravelly silt loam
Cr - 37 to 51 inches: bedrock

Properties and qualities

Slope: 5 to 39 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Kidd
Percent of map unit: 5 percent

Aiken
Percent of map unit: 5 percent

Boomer
Percent of map unit: 3 percent

Sobrante
Percent of map unit: 2 percent

140—Forward silt loam, 12 to 57 percent slopes, MLRA 15

Map Unit Setting
National map unit symbol: 2xc9y
Elevation: 310 to 2,370 feet
Mean annual precipitation: 33 to 56 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 338 days
Farmland classification: Not prime farmland

Map Unit Composition
Forward and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Forward

Setting
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Rhyolitic residuum weathered from volcanic rock

Typical profile
Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 6 inches: silt loam
BA - 6 to 12 inches: silt loam
Bw1 - 12 to 19 inches: silt loam
Bw2 - 19 to 28 inches: silt loam
Bw3 - 28 to 37 inches: gravelly silt loam
Cr - 37 to 51 inches: bedrock

Properties and qualities

Slope: 12 to 57 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Aiken

Percent of map unit: 5 percent

Boomer

Percent of map unit: 5 percent

Kidd

Percent of map unit: 3 percent

Sobrante

Percent of map unit: 2 percent

156—Kidd loam, 30 to 75 percent slopes

Map Unit Setting

National map unit symbol: hdlt
Elevation: 500 to 4,300 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Kidd and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidd

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from rhyolite

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 75 percent
Depth to restrictive feature: 14 to 18 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: VERY SHALLOW ROCKY (R015XD127CA)
Hydric soil rating: No

Sonoma County, California

FoG—Forward silt loam, 12 to 57 percent slopes, MLRA 15

Map Unit Setting

National map unit symbol: 2xc9y
Elevation: 310 to 2,370 feet
Mean annual precipitation: 33 to 56 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 338 days
Farmland classification: Not prime farmland

Map Unit Composition

Forward and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Forward

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Rhyolitic residuum weathered from volcanic rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 6 inches: silt loam
BA - 6 to 12 inches: silt loam
Bw1 - 12 to 19 inches: silt loam
Bw2 - 19 to 28 inches: silt loam
Bw3 - 28 to 37 inches: gravelly silt loam
Cr - 37 to 51 inches: bedrock

Properties and qualities

Slope: 12 to 57 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Boomer
Percent of map unit: 5 percent

Aiken
Percent of map unit: 5 percent

Kidd
Percent of map unit: 3 percent

Sobrante
Percent of map unit: 2 percent

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Erosion Factors

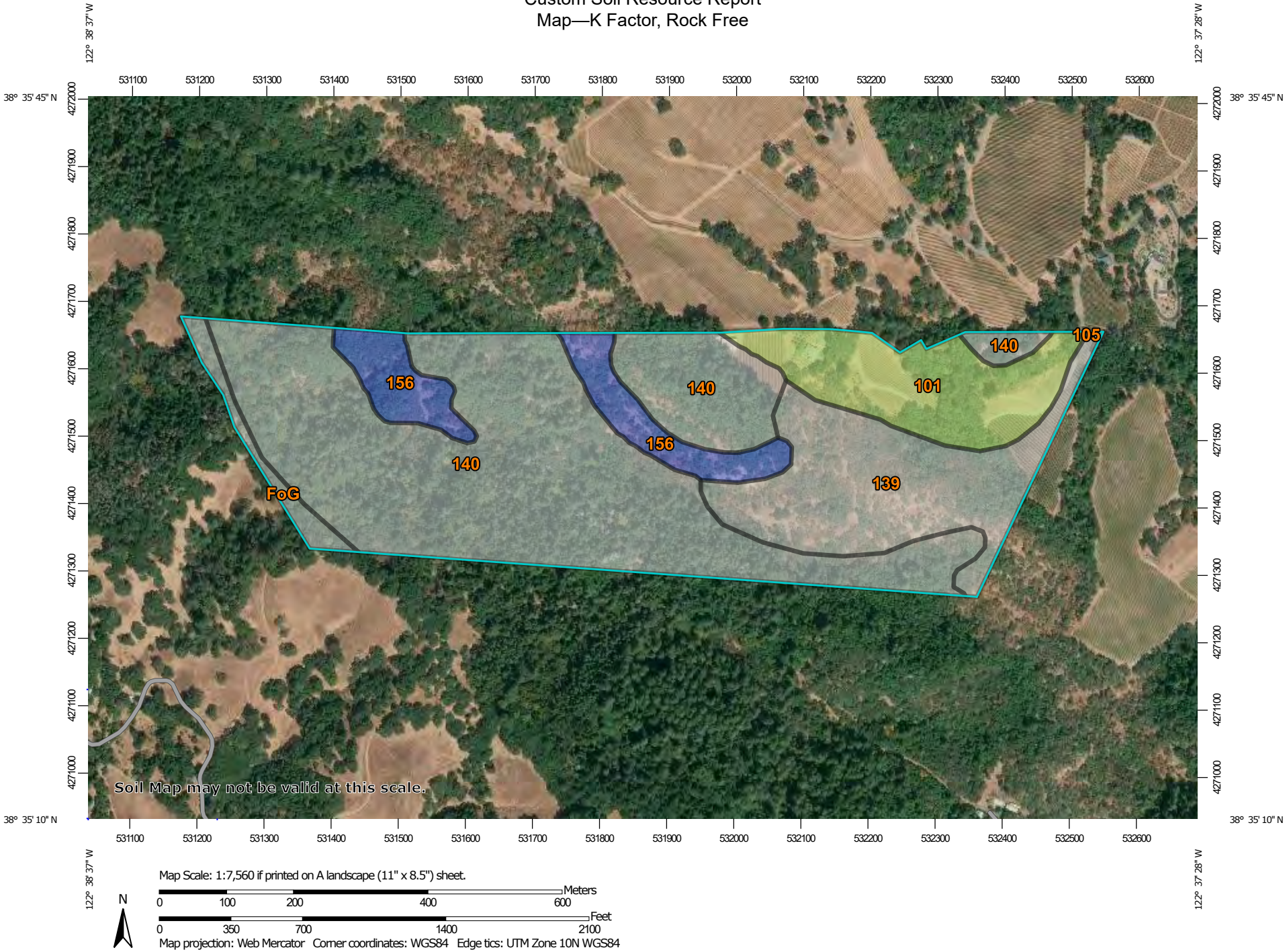
Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

K Factor, Rock Free

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 Kf (rock free)" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Map—K Factor, Rock Free



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Lines

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Points

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
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 scales ranging from 1:20,000 to 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:
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 13, May 29, 2020

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 14, May 29, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 31, 2017

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.

Table—K Factor, Rock Free

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
101	Aiken loam, 15 to 30 percent slopes	.24	13.6	13.0%
105	Bale clay loam, 2 to 5 percent slopes	.20	0.1	0.0%
139	Forward silt loam, 5 to 39 percent slopes, MLRA 15		20.1	19.1%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15		59.8	56.9%
156	Kidd loam, 30 to 75 percent slopes	.49	9.2	8.7%
Subtotals for Soil Survey Area			**102.8**	**97.7%**
Totals for Area of Interest			**105.2**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FoG	Forward silt loam, 12 to 57 percent slopes, MLRA 15		2.4	2.3%
Subtotals for Soil Survey Area			**2.4**	**2.3%**
Totals for Area of Interest			**105.2**	**100.0%**

Rating Options—K Factor, Rock Free

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

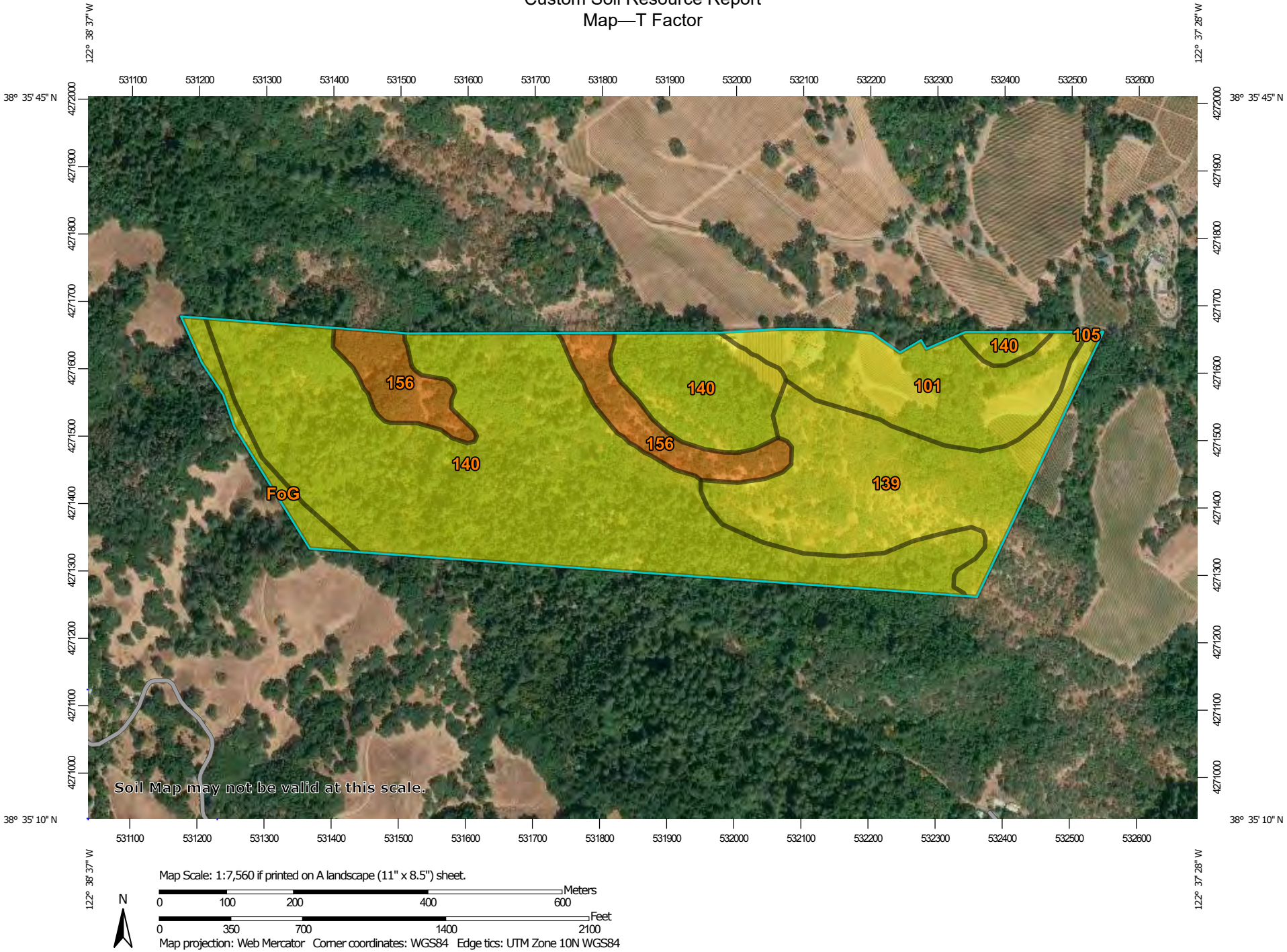
Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

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.

Custom Soil Resource Report
Map—T Factor



Map Scale: 1:7,560 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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
- 1
- 2
- 3
- 4
- 5
- Not rated or not available

Soil Rating Lines
- 1
- 2
- 3
- 4
- 5
- Not rated or not available

Soil Rating Points
- 1
- 2
- 3
- 4
- 5
- 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 scales ranging from 1:20,000 to 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:
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 13, May 29, 2020

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 14, May 29, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 31, 2017

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.

Table—T Factor

Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
101	Aiken loam, 15 to 30 percent slopes	3	13.6	13.0%
105	Bale clay loam, 2 to 5 percent slopes	5	0.1	0.0%
139	Forward silt loam, 5 to 39 percent slopes, MLRA 15	3	20.1	19.1%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	3	59.8	56.9%
156	Kidd loam, 30 to 75 percent slopes	2	9.2	8.7%
Subtotals for Soil Survey Area			**102.8**	**97.7%**
Totals for Area of Interest			**105.2**	**100.0%**

Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
FoG	Forward silt loam, 12 to 57 percent slopes, MLRA 15	3	2.4	2.3%
Subtotals for Soil Survey Area			**2.4**	**2.3%**
Totals for Area of Interest			**105.2**	**100.0%**

Rating Options—T Factor

Units of Measure: tons per acre per year

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

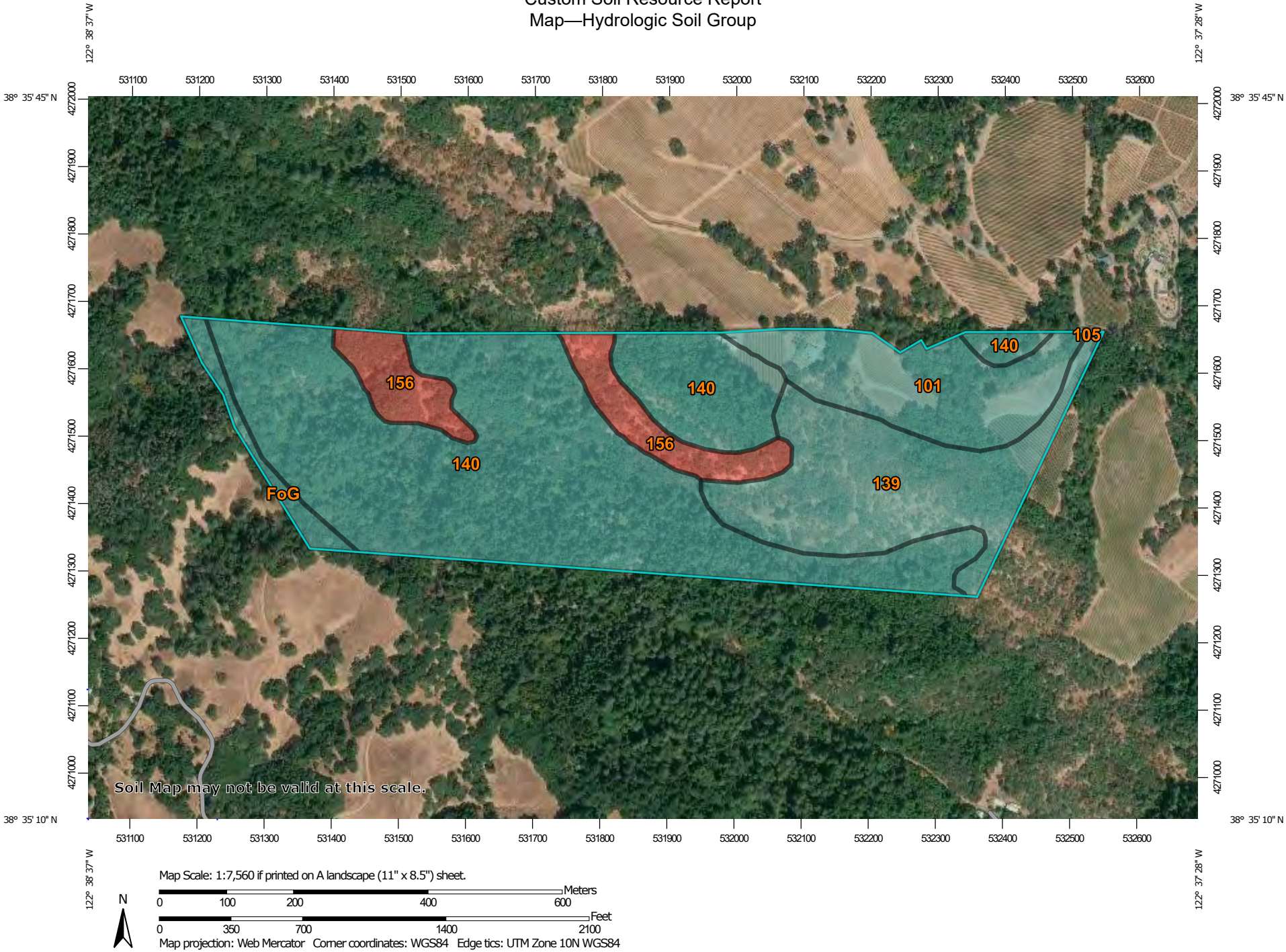
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:7,560 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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 scales ranging from 1:20,000 to 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:
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 13, May 29, 2020

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 14, May 29, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 31, 2017

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
101	Aiken loam, 15 to 30 percent slopes	C	13.6	13.0%
105	Bale clay loam, 2 to 5 percent slopes	B	0.1	0.0%
139	Forward silt loam, 5 to 39 percent slopes, MLRA 15	C	20.1	19.1%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	C	59.8	56.9%
156	Kidd loam, 30 to 75 percent slopes	D	9.2	8.7%
Subtotals for Soil Survey Area			**102.8**	**97.7%**
Totals for Area of Interest			**105.2**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FoG	Forward silt loam, 12 to 57 percent slopes, MLRA 15	C	2.4	2.3%
Subtotals for Soil Survey Area			**2.4**	**2.3%**
Totals for Area of Interest			**105.2**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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