EXHIBIT D

HYDROLOGIC ANALYSIS
PHILLIPS-KELHAM TRUST VINEYARD PARTNERS
PROPOSED NEW VINEYARD DEVELOPMENT AND RE-PLANT
ST. HELENA HIGHWAY
YOUNTVILLE, CA
APN 027-490-006
Revised September 17, 2019

The following analysis evaluates a proposed, approximately 13.8-acre vineyard development, located southwest of State Highway 29, north of the Town of Yountville, California, to determine the proposal's potential effects on runoff and/or peak storm flow. This analysis was prepared by David Steiner, CPESC, CPSWQ, at the request of, and in consultation with, Mr. Mike Muelrath, PE, of Applied Civil Engineering. The analysis employs the basic methodology of USDA Technical Release 55, as modeled in Version 1.00.10 of WinTR55 "Small Watershed Hydrology", a Windows-based application. The reader's attention is drawn to accompanying printouts of the analysis—both pre-project and post-project—including storm data, curve number analyses, times of concentration, and summaries of hydrograph peaks and peak times. The accompanying maps were drawn on an aerial/topographic base map provided by Applied Civil Engineering.

It would be possible to draw a single watershed encompassing the entire, proposed development. However, this hypothetical watershed—comprising the over 300-acre drainage of the blueline stream passing through the property—might be large enough to "buffer" or mask the hydrologic impacts of the relatively small proposal. To minimize this potential, this analysis is based on smaller, discrete drainage basins, deliberately drawn to isolate the project's components in their more immediate hydrologic context. The intent of this approach is to optimize the integrity of the pre-project vs. post-project comparisons.

Most of the project is encompassed by an approximately 32.4 acre watershed that drains to an unnamed blueline stream that flows northward to the Napa River, across an alluvial plain dominated by vineyards, west of Highway 29. This watershed (**AB**) is divided into two sub-watersheds, **A** and **B**. The former drains directly into the blueline stream; the latter drains to an existing, .7-acre pond, whose overflow also drains, via an 18-inch pipe and wooden flume, into the blueline stream, at a point designated the watershed's **Outlet.** The stream reach between the outfall of **Watershed A** and the **Outlet** (the outfall of **Watershed B**) is designated **Reach AB**. Please note that, for the reasons explained above, the drainage to the entire right bank of the blueline stream has been deleted and ignored—a step that limits the validity of the assumed, in-stream hydraulics and total flow. The analysis overlooks these anomalies, as they are the same under pre- and post-project conditions. The far western corner of the project's Block 1 is part of the small (4.9-acre) **Watershed C,** whose **Outlet** has been plotted on neighboring vineyard property, north of the site.

The data for the modeled **24-hour storms** of 2, 5, 10, 25, 50, and 100-year return intervals were taken from the median of each event's range of likely depths, as per NOAA Atlas 14. A printout of the NOAA website's database page also accompanies this analysis. Peak flow calculations for this location were derived from these values, using the appropriate "CA-1" distribution curve, implicit in the recent (2013) updates of the Atlas.

The watersheds include riparian areas, mixed woodland, savannah, grassland, existing vineyards, and small areas of rock outcrop with little or no topsoil or vegetation. Residences with landscaping and outbuildings, with access via asphalt driveways, complete the area's land use picture. Pre- and post-project runoff curve numbers (**CN**) are assigned based on hydrologic soil group (**HSG**), land use, and hydrologic condition. Estimates of land use, cover, and hydrologic condition were based on examination of Google Earth imagery and evaluations made during field visits on November 27, 2018, February 11, 2019 and August 19, 2019. HSG designations are derived from the USDA Web Soil Survey.

- Under pre-project conditions, the majority of both watersheds is characterized as "Woods", in good hydrologic condition. (**HSG "D", CN 77**)
- The land use of the large "bowl" in Sub-watershed "A" and the ridge separating Sub-watersheds "A" and "B" is characterized, in pre-project conditions, as "Woods-grass combination", in "good" hydrologic condition. The same designation is applied to an area overlapping the north-eastern property line in the western corner of the proposed Block 1. (**HSG "D", CN 79**)
- The small, existing (non-tilled) vineyard at the eastern corner of the proposed Block 2, as well as a small area at the western corner of that same proposed block, and a somewhat larger meadow along the south side of proposed Block 1, are characterized as "Annual grass", good condition. This designation, applied in the analysis to both non-tilled vineyards and open grassland, was selected from a California-specific table found in the NRCS Engineering Field Handbook.[1] (**HSG "D", CN 81**)
- Existing, tilled vineyards on neighboring properties in Watersheds B and C, as well as the top of the dam impounding the pond at the outlet of Watershed B, are assigned the same curve numbers as "Annual grass" (vineyards), in "fair" hydrologic condition. However, limitations of the WinTR-55 application required use of the equivalent Curve Numbers of the "Open Space" land use designation. (**HSG "C", CN 79;** and **HSG "D", CN 84**)
- Developed residential and agricultural compounds are designated "Farmsteads." (**HSG "C", CN 82;** and **HSG "D", CN 86**)
- The asphalt driveway in Watershed B is designated "Paved road, open ditches." (**HSG "D", CN 93**)
- Post-project CN numbers, reflect reduced acreage of "Woods," and "Woods-grass combination", and commensurately increased acreage of non-tilled vineyard, entered into the application's User-defined field as "Annual grass", good condition.[2] (**HSG "D", CN 81**)
- Weighted Curve Numbers of all watersheds and sub-watersheds are increased by 1 point, under post-project conditions.

As the accompanying WinTR-55 printouts show, the initial modeling predicts small increases in post-project peak flows, for all storms modeled. Specifications in the Erosion Control Plan will address and eliminate those increases by extending Times of Concentration (Tc), as presented on the following pages:

[1] *Engineering Field Handbook, Part 650, Chapter 2, Supplement 1, USDA/NRCS, Oct 2008.*

[2] *WinTR-55 printouts of CN sheets are edited as pdf documents, to reflect actual land uses.*

Watershed AB:

- Post-project modeling predicts peak flow increases of .45 -.54 cfs (cubic feet per second) for the various return-interval storms.
- Manual entries to WinTR-55, extending the watershed's Tc by .101 hours, bring peak flows of all storms in post-project conditions to parity with those of pre-project conditions.
- The surface area of the existing pond at the bottom of Sub-watershed B is approximately .7 acres (x 43,450 sq ft/acre = 30,492 square feet).
- Post-project peak flow of the 100 year/24 hour storm of Sub-watershed B is 24.59 cfs.
- .101 hours (required Tc increase) x 3600 seconds/hour = 363.6 seconds.
- 363.6 seconds x 24.59 cfs = 8940.9 cubic feet required storage volume.
- 8940.9 cubic feet/30,492 square feet = .29 feet storage depth required in pond, to extend Tc and eliminate peak flow increase. (See detailed specifications in Erosion Control Plan.)

Sub-Watershed A:

- As Reach AB is a mapped blueline stream, into which Napa County guidelines forbid peak flow increases, Watershed A requires separate analysis, to develop specifications to prevent the predicted peak flow increase.
- Post-project modeling for Sub-Watershed A predicts peak flow increases in the range of from .14 cfs (2-year storm) to .16 cfs (100-year storm). To offset these increases, the ECP proposes to provide storage before the outlet into the blueline stream, to extend the time of concentration (Tc).
- Somewhat counter-intuitively, smaller storms require more Tc extension than larger storms to affect this end. This trend is explained by the fact that the smaller storms have lower flow rates (in cubic feet per second, for example). Larger storms, with higher flow rates, respond more quickly to Tc extensions.

- Manual entries to WinTR-55, extending the sub-watershed's Tc by .021 hours, bring peak flows of the **100-year storm** in post-project conditions to parity with those of pre-project conditions.
- The post-project peak flow of the 100-year/24-hour storm of Sub-Watershed A is 10.02 cfs.
- .021 hours x 3600 seconds/hour = 75.6 seconds.
- 75.6 seconds x 10.02 cfs = 767.5 cubic feet required storage volume.

- Manual entries to WinTR-55, extending the sub-watershed's Tc by .058 hours, bring peak flows of the **2-year storm** in post-project conditions to parity with those of pre-project conditions.
- The post-project peak flow of the 2-year/24-hour storm of Sub-Watershed A is 3.18 cfs.
- .058 hours x 3600 seconds/hour = 208.8 seconds.
- 208.8 seconds x 3.18 cfs = 664 cubic feet required storage volume.
- The required storage volume to offset to peak flow increases of all storms, up to and including the 100-year/24-hour storm is 767.5 cubic feet.

- Volume of keyed rock bench at outlet of Sub-Watershed A: 110' L x 10' W x 2.25' D = 2475 cubic feet. (See detailed specifications in Erosion Control Plan.)
- 2475 cubic feet x .33 (assumed void ratio in rock fill) = 816.8 cubic feet storage volume available (>767.5 cubic feet required).

Watershed C:

- Post project modeling predicts peak flow increase of .07 - .09 cfs for the various return-interval storms.
- Manual entries to WinTR-55, extending the Time of Concentration of Watershed C by .045 hours, will bring peak flows of all storms in post-project conditions to parity with those of pre-project conditions.
- The area of the basin draining to the lower (northeastern) boundary of Block 1, designated Sub-Watershed C-1, is 1.01 acres.
- Per a separate run of the WinTR-55 application, the post-project, 100-year peak flow of this sub-basin is 1.12 cfs. (Please see accompanying printouts of "Phillips-Kelham, SubWS C-1, post.w55").
- .045 hours (required Tc increase) x 3600 = 162 seconds.
- 162 seconds x 1.12 cfs = 181.4 cubic feet required storage volume.
- Volume of keyed rock bench at bottom of Block 1: 190' L x 7' W x 2' D = 2660 cubic feet. (See detailed specifications in Erosion Control Plan.)
- 2660 cubic feet x .33 (assumed void ratio in rock fill) = 877.8 cubic feet storage volume available (>181.4 cubic feet required).

The accompanying WinTR-55 printouts include post project runs with Time of Concentration sheets edited as pdf documents, with manual entries imposing Tc extensions as described above. Sub-Watersheds A and C-1 have been analyzed separately from the original, modeled Watersheds of which they are part (AB and C, respectively). Relevant sheets of the various WinTR-55 reports have been compiled as pdf documents and accompany this narrative. The analysis concludes that, with proper installation and maintenance of the retention structures and cover crops specified in the Erosion Control Plan, the proposal will not result in increases in peak flow/runoff.

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Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period					
	2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
Sub WS A	3.04	4.53	5.75	7.39	8.62	9.86
	12.17	12.16	12.16	12.16	12.16	12.16
Sub WS B	7.69	11.31	14.28	18.24	21.23	24.21
	12.12	12.12	12.13	12.13	12.13	12.13
REACHES						
Reach AB	3.04	4.53	5.75	7.39	8.62	9.86
	12.17	12.16	12.16	12.16	12.16	12.16
Down	3.04	4.53	5.75	7.39	8.62	9.86
	12.19	12.19	12.19	12.19	12.19	12.19
OUTLET	10.53	15.55	19.66	25.17	29.31	33.45

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Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

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Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	100	0.0700	0.040	4.00	7.00	6.944	0.004
					Time of Concentration		.192
Sub WS B							
SHEET	100	0.3700	0.240				0.066
SHALLOW	300	0.4160	0.050				0.008
SHALLOW	550	0.2910	0.050				0.018
CHANNEL	480	0.0940	0.045	8.00	12.00	7.843	0.017
CHANNEL	550	0.0600	0.012	1.00	2.83	15.278	0.010
					Time of Concentration		0.119

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Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Sub WS A	User defined urban (Click button or		D	.6	81
	Woods - grass combination	(good)	D	2.6	79
	Woods	(good)	D	6.7	77
	Total Area / Weighted Curve Number			9.9	78
Sub WS B	Open space; grass cover 50% to 75%	(fair)	D	.8	84
	Paved parking lots, roofs, driveways		D	.7	98
	Paved; open ditches (w/right-of-way)		D	.1	93
	User defined urban (Click button or		D	1.4	81
	Woods - grass combination	(good)	D	2.1	79
	Woods	(good)	D	16.9	77
	Farmsteads		D	.5	86
	Total Area / Weighted Curve Number			22.5	79

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Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Sub WS A	Vineyard ("Annual grass")	(good)	D	.6	81
	Woods - grass combination	(good)	D	2.6	79
	Woods	(good)	D	6.7	77
	Total Area / Weighted Curve Number			9.9	78
				===	==
Sub WS B	Vineyard ("Open space") 50% to 75%	(fair)	D	.8	84
	Paved parking lots, roofs, driveways		D	.7	98
	Paved; open ditches (w/right-of-way)		D	.1	93
	Vineyard ("Annual grass")	(good)	D	1.4	81
	Woods - grass combination	(good)	D	2.1	79
	Woods	(good)	D	16.9	77
	Farmsteads		D	.5	86
	Total Area / Weighted Curve Number			22.5	79
				====	==

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Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period					
	2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
Sub WS A	3.18 12.16	4.68 12.16	5.91 12.16	7.54 12.17	8.79 12.16	10.02 12.16
Sub WS B	8.01 12.13	11.66 12.12	14.64 12.12	18.62 12.13	21.61 12.12	24.59 12.12
REACHES						
Reach AB	3.18 12.16	4.68 12.16	5.91 12.16	7.54 12.17	8.79 12.16	10.02 12.16
Down	3.18 12.19	4.68 12.19	5.90 12.18	7.54 12.19	8.78 12.18	10.01 12.19
OUTLET	10.98	16.04	20.17	25.70	29.85	33.98

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Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

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Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	100	0.0700	0.040	4.00	7.00	6.944	0.004
					Time of Concentration		.192
Sub WS B							
SHEET	100	0.3700	0.240				0.066
SHALLOW	300	0.4160	0.050				0.008
SHALLOW	550	0.2910	0.050				0.018
CHANNEL	480	0.0940	0.045	8.00	12.00	7.843	0.017
CHANNEL	550	0.0600	0.012	1.00	2.83	15.278	0.010
					Time of Concentration		0.119

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Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Sub WS A	User defined urban (Click button or		D	5.5	81
	Woods - grass combination	(good)	D	.1	79
	Woods	(good)	D	4.3	77
	Total Area / Weighted Curve Number			9.9	79
Sub WS B	Open space; grass cover 50% to 75%	(fair)	D	.8	84
	Paved parking lots, roofs, driveways		D	.7	98
	Paved; open ditches (w/right-of-way)		D	.1	93
	User defined urban (Click button or		D	7.6	81
	Woods - grass combination	(good)	D	.3	79
	Woods	(good)	D	12.5	77
	Farmsteads		D	.5	86
	Total Area / Weighted Curve Number			22.5	80

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Post-Project WS AB
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Sub WS A	Vineyard ("Annual grass")	(good)	D	5.5	81
	Woods - grass combination	(good)	D	.1	79
	Woods	(good)	D	4.3	77
	Total Area / Weighted Curve Number			9.9	79
Sub WS B	Vineyard ("Open space") 50% to 75%	(fair)	D	.8	84
	Paved parking lots, roofs, driveways		D	.7	98
	Paved; open ditches (w/right-of-way)		D	.1	93
	Vineyard ("Annual grass")	(good)	D	7.6	81
	Woods - grass combination	(good)	D	.3	79
	Woods	(good)	D	12.5	77
	Farmsteads		D	.5	86
	Total Area / Weighted Curve Number			22.5	80

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Post-Project WS AB, trial
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
Sub WS A	3.18	4.68	5.91	7.54	8.79	10.02
	12.16	12.16	12.16	12.17	12.16	12.16
Sub WS B	7.36	10.73	13.48	17.15	19.91	22.66
	12.18	12.18	12.17	12.18	12.17	12.17
REACHES						
Reach AB	3.18	4.68	5.91	7.54	8.79	10.02
	12.16	12.16	12.16	12.17	12.16	12.16
Down	3.18	4.68	5.90	7.54	8.78	10.01
	12.19	12.19	12.18	12.19	12.18	12.19
OUTLET	10.53	15.39	19.36	24.67	28.66	32.64

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Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

original: WinTR55

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Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	100	0.0700	0.040	4.00	7.00	6.944	0.004
					Time of Concentration		0.192
Sub WS B							
SHEET	100	0.3700	0.240				0.066
SHALLOW	300	0.4160	0.050				0.008
SHALLOW	550	0.2910	0.050				0.018
CHANNEL	480	0.0940	0.045	8.00	12.00	7.843	0.017
CHANNEL	785	0.0010	0.012	1.00	2.83	1.964	0.111
					Time of Concentration		0.220

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manual entry

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Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	100	0.0700	0.040	4.00	7.00	6.944	0.004
					Time of Concentration		0.192
Sub WS B							
SHEET	100	0.3700	0.240				0.066
SHALLOW	300	0.4160	0.050				0.008
SHALLOW	550	0.2910	0.050				0.018
CHANNEL	480	0.0940	0.045	8.00	12.00	7.843	0.017
MANUAL ENTRY							0.111
					Time of Concentration		.220

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Post-Project WS AB, trial
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Sub WS A	User defined urban (Click button or		D	5.5	81
	Woods - grass combination	(good)	D	.1	79
	Woods	(good)	D	4.3	77
	Total Area / Weighted Curve Number			9.9	79
Sub WS B	Open space; grass cover 50% to 75%	(fair)	D	.8	84
	Paved parking lots, roofs, driveways		D	.7	98
	Paved; open ditches (w/right-of-way)		D	.1	93
	User defined urban (Click button or		D	7.6	81
	Woods - grass combination	(good)	D	.3	79
	Woods	(good)	D	12.5	77
	Farmsteads		D	.5	86
	Total Area / Weighted Curve Number			22.5	80

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Post-Project WS AB, trial
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Sub WS A	Vineyard ("Annual grass")	(good)	D	5.5	81
	Woods - grass combination	(good)	D	.1	79
	Woods	(good)	D	4.3	77
	Total Area / Weighted Curve Number			9.9	79
Sub WS B	Vineyard ("Open space")50% to 75%	(fair)	D	.8	84
	Paved parking lots, roofs, driveways		D	.7	98
	Paved; open ditches (w/right-of-way)		D	.1	93
	Vineyard ("Annual grass")	(good)	D	7.6	81
	Woods - grass combination	(good)	D	.3	79
	Woods	(good)	D	12.5	77
	Farmsteads		D	.5	86
	Total Area / Weighted Curve Number			22.5	80

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Phillips-Kelham Trust
Pre-Project WS C
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
WS C	1.61	2.39	3.03	3.89	4.54	5.19
	12.13	12.12	12.12	12.13	12.12	12.13
REACHES						
OUTLET	1.61	2.39	3.03	3.89	4.54	5.19

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Phillips-Kelham Trust
Pre-Project WS C
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

DAS

Phillips-Kelham Trust
Pre-Project WS C
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
WS C							
SHEET	100	0.2600	0.240				0.076
SHALLOW	420	0.1760	0.050				0.017
SHALLOW	675	0.2150	0.050				0.025
						Time of Concentration	0.118

DAS

Phillips-Kelham Trust
Pre-Project WS C
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
WS C	Open space; grass cover 50% to 75%	(fair)	C	.8	79
	Woods	(good)	D	3.6	77
	Farmsteads		C	.4	82
	Farmsteads		D	.1	86
	Total Area / Weighted Curve Number			4.9	78

DAS

Phillips-Kelham Trust
Post-Project WS C
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
WS C	1.68 12.12	2.47 12.12	3.11 12.12	3.98 12.13	4.63 12.12	5.28 12.12
REACHES						
OUTLET	1.68	2.47	3.11	3.98	4.63	5.28

DAS

Phillips-Kelham Trust
Post-Project WS C
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

DAS

Phillips-Kelham Trust
Post-Project WS C
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
WS C							
SHEET	100	0.2600	0.240				0.076
SHALLOW	420	0.1760	0.050				0.017
SHALLOW	675	0.2150	0.050				0.025
						Time of Concentration	0.118

original: WinTR55

DAS

Phillips-Kelham Trust
Post-Project WS C
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
WS C	Open space; grass cover 50% to 75%	(fair)	C	.8	79
	User defined urban (Click button or		D	.9	81
	Woods	(good)	D	2.7	77
	Farmsteads		C	.4	82
	Farmsteads		D	.1	86
	Total Area / Weighted Curve Number			4.9	79

edited pdf

DAS

Phillips-Kelham Trust
Post-Project WS C
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
WS C	Vineyard ("Open space") 50% to 75%	(fair)	C	.8	79
	Vineyard ("Annual grass")	(good)	D	.9	81
	Woods	(good)	D	2.7	77
	Farmsteads		C	.4	82
	Farmsteads		D	.1	86
	Total Area / Weighted Curve Number			4.9	79

DAS

Phillips-Kelham Trust
Post-Project WS C, Trial
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs)	(hr)	5-Yr (cfs)	(hr)	10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)	50-Yr (cfs)	(hr)	100-Yr (cfs)	(hr)
SUBAREAS												
WS C	1.61	12.15	2.37	12.15	2.99	12.15	3.83	12.15	4.45	12.14	5.08	12.15
REACHES												
OUTLET	1.61		2.37		2.99		3.83		4.45		5.08	

DAS

Phillips-Kelham Trust
Post-Project WS C, Trial
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

original: WinTR55
manual calc

DAS

Phillips-Kelham Trust
Post-Project WS C, Trial
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
WS C							
SHEET	100	0.2600	0.240				0.076
SHALLOW	1500	0.1760	0.050				0.062
SHALLOW	675	0.2150	0.050				0.025
						Time of Concentration	.163

edited pdf manually

DAS

Phillips-Kelham Trust
Post-Project WS C, Trial
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
WS C							
SHEET	100	0.2600	0.240				0.076
MANUAL ENTRY							0.062
SHALLOW	675	0.2150	0.050				0.025
					Time of Concentration		.163

original WinTR55

DAS

Phillips-Kelham Trust
Post-Project WS C, Trial
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
WS C	Open space; grass cover 50% to 75%	(fair)	C	.8	79
	User defined urban (Click button or		D	.9	81
	Woods	(good)	D	2.7	77
	Farmsteads		C	.4	82
	Farmsteads		D	.1	86
	Total Area / Weighted Curve Number			4.9	79

edited plot

DAS

Phillips-Kelham Trust
Post-Project WS C, Trial
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
WS C	Vineyard ("Open space")50% to 75%	(fair)	C	.8	79
	Vineyard ("Annual grass")	(good)	D	.9	81
	Woods	(good)	D	2.7	77
	Farmsteads		C	.4	82
	Farmsteads		D	.1	86
	Total Area / Weighted Curve Number			4.9	79

DAS

Phillips-Kelham Trust
Post-Project Sub WS C-1
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs)	(hr)	5-Yr (cfs)	(hr)	10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)	50-Yr (cfs)	(hr)	100-Yr (cfs)	(hr)
SUBAREAS												
SubWS C-1	0.37	12.12	0.53	12.12	0.67	12.12	0.85	12.12	0.99	12.11	1.12	12.11
REACHES												
OUTLET	0.37		0.53		0.67		0.85		0.99		1.12	

DAS

Phillips-Kelham Trust
Post-Project Sub WS C-1
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
3.99	5.08	5.95	7.1	7.96	8.82	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

DAS

Phillips-Kelham Trust
Post-Project Sub WS C-1
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SubWS C-1							
SHEET	100	0.2600	0.240				0.076
SHALLOW	390	0.1850	0.050				0.016
						Time of Concentration	0.1

DAS

Phillips-Kelham Trust
Post-Project Sub WS C-1
Napa County, California

Sub-Area Land Use and Curve Number Details

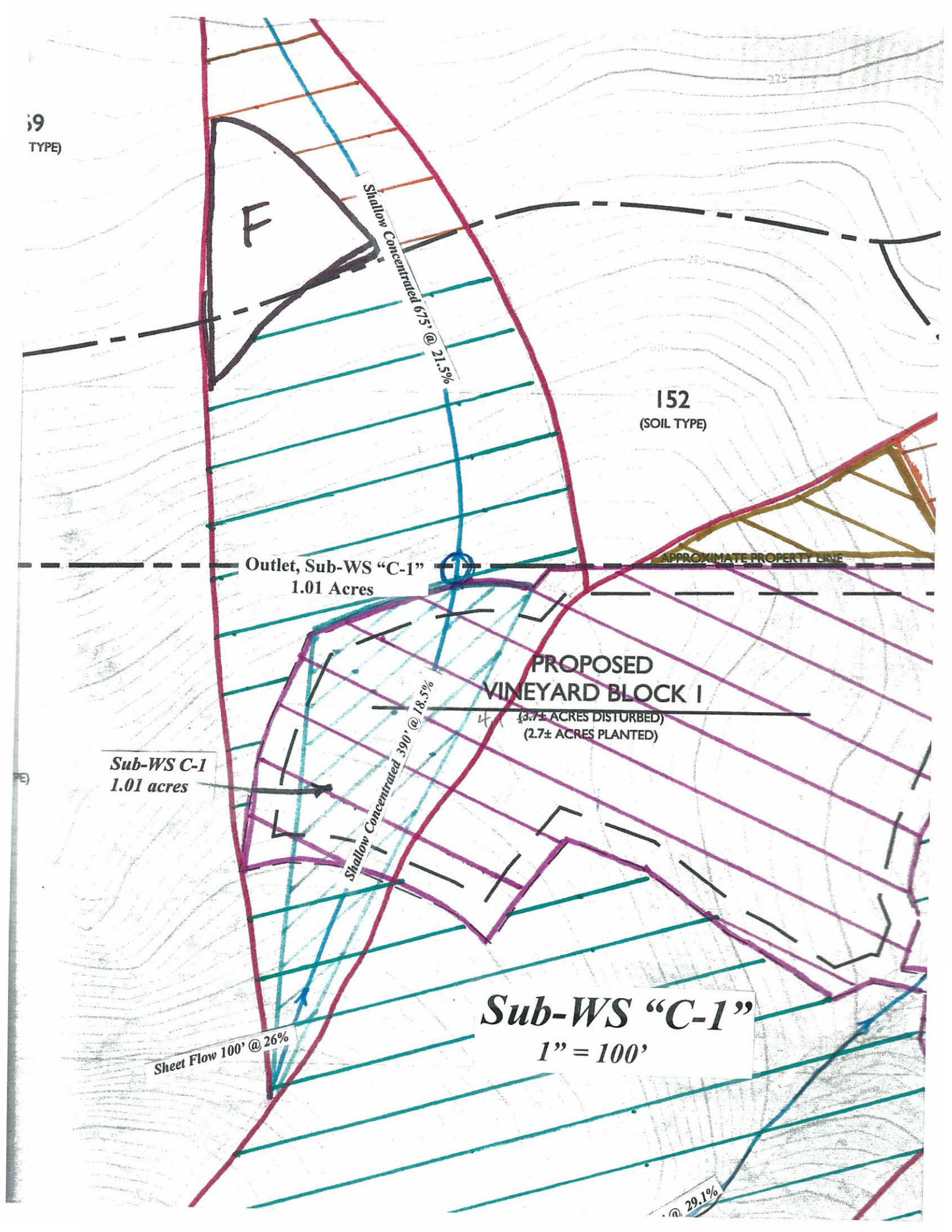
Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
SubWS C-1	User defined urban (Click button or	D	.79	81
	Woods (good)	D	.22	77
	Total Area / Weighted Curve Number		1.01	80

DAS

Phillips-Kelham Trust
Post-Project Sub WS C-1
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
SubWS C-1	Vineyard (annual grass) (good)	D	.79	81
	Woods (good)	D	.22	77
	Total Area / Weighted Curve Number		1.01	80


F
Shallow Concentrated 675' @ 21.5%
152
(SOIL TYPE)
APPROXIMATE PROPERTY LINE
Outlet, Sub-WS "C-1"
1.01 Acres
PROPOSED
VINEYARD BLOCK I
(3.7± ACRES DISTURBED)
(2.7± ACRES PLANTED)
Shallow Concentrated 390' @ 18.5%
Sub-WS C-1
1.01 acres
Sheet Flow 100' @ 26%
Sub-WS "C-1"
1" = 100'
@ 29.1%

DAS

Phillips-Kelham Trust
Post-Project WS A, w/Tc Increase for 2-year peak
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs)	(hr)	5-Yr (cfs)	(hr)	10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)	50-Yr (cfs)	(hr)	100-Yr (cfs)	(hr)
SUBAREAS												
Sub WS A	3.04	12.19	4.48	12.20	5.66	12.19	7.24	12.19	8.43	12.20	9.61	12.18
REACHES												
Reach AB	3.04	12.19	4.48	12.20	5.66	12.19	7.24	12.19	8.43	12.20	9.61	12.18
Down	3.04	12.22	4.48	12.22	5.66	12.23	7.24	12.22	8.42	12.21	9.61	12.22
OUTLET	3.04		4.48		5.66		7.24		8.42		9.61	

= pre-project

DAS

Phillips-Kelham Trust
Post-Project WS A, w/Tc Increase for 2-year peak
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	100	0.0700	0.040	4.00	7.00	6.944	0.004
CHANNEL	425	0.0100	0.050	4.00	7.00	2.035	0.058
					Time of Concentration		0.250

manual entry

-.192

.058 HR

required to offset 2-year peak flow increase of .14 cfs

DAS

Phillips-Kelham Trust
Post-Project WS A, Tc increased for 100 year peak
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
Sub WS A	3.13	4.60	5.81	7.43	8.65	9.87
	12.18	12.17	12.18	12.18	12.17	12.17
REACHES						
Reach AB	3.13	4.60	5.81	7.43	8.65	9.87
	12.18	12.17	12.18	12.18	12.17	12.17
Down	3.12	4.60	5.81	7.42	8.64	9.86
	12.20	12.20	12.20	12.20	12.20	12.20
OUTLET	3.12	4.60	5.81	7.42	8.64	9.86

= pre-project

DAS

Phillips-Kelham Trust
Post-Project WS A, Tc increased for 100 year peak
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	600	0.0700	0.040	4.00	7.00	6.667	0.025
					Time of Concentration		.213

to manual entry

-.192

.021 HR

required to offset 100 year peak flow increase of .16 cfs

DAS

Phillips-Kelham Trust
Pre-Project WS A
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
Sub WS A	3.04	4.53	5.75	7.39	8.62	9.86
	12.17	12.16	12.16	12.16	12.16	12.16
REACHES						
Reach AB	3.04	4.53	5.75	7.39	8.62	9.86
	12.17	12.16	12.16	12.16	12.16	12.16
Down	3.04	4.53	5.75	7.39	8.62	9.86
	12.19	12.19	12.19	12.19	12.19	12.19
OUTLET	3.04	4.53	5.75	7.39	8.62	9.86

DAS

Phillips-Kelham Trust
Post-Project WS A
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS						
Sub WS A	3.18	4.68	5.91	7.54	8.79	10.02
	12.16	12.16	12.16	12.17	12.16	12.16
REACHES						
Reach AB	3.18	4.68	5.91	7.54	8.79	10.02
	12.16	12.16	12.16	12.17	12.16	12.16
Down	3.18	4.68	5.90	7.54	8.78	10.01
	12.19	12.19	12.18	12.19	12.18	12.19
OUTLET	3.18	4.68	5.90	7.54	8.78	10.01

.14 cfs increase

Δ .16 cfs increase

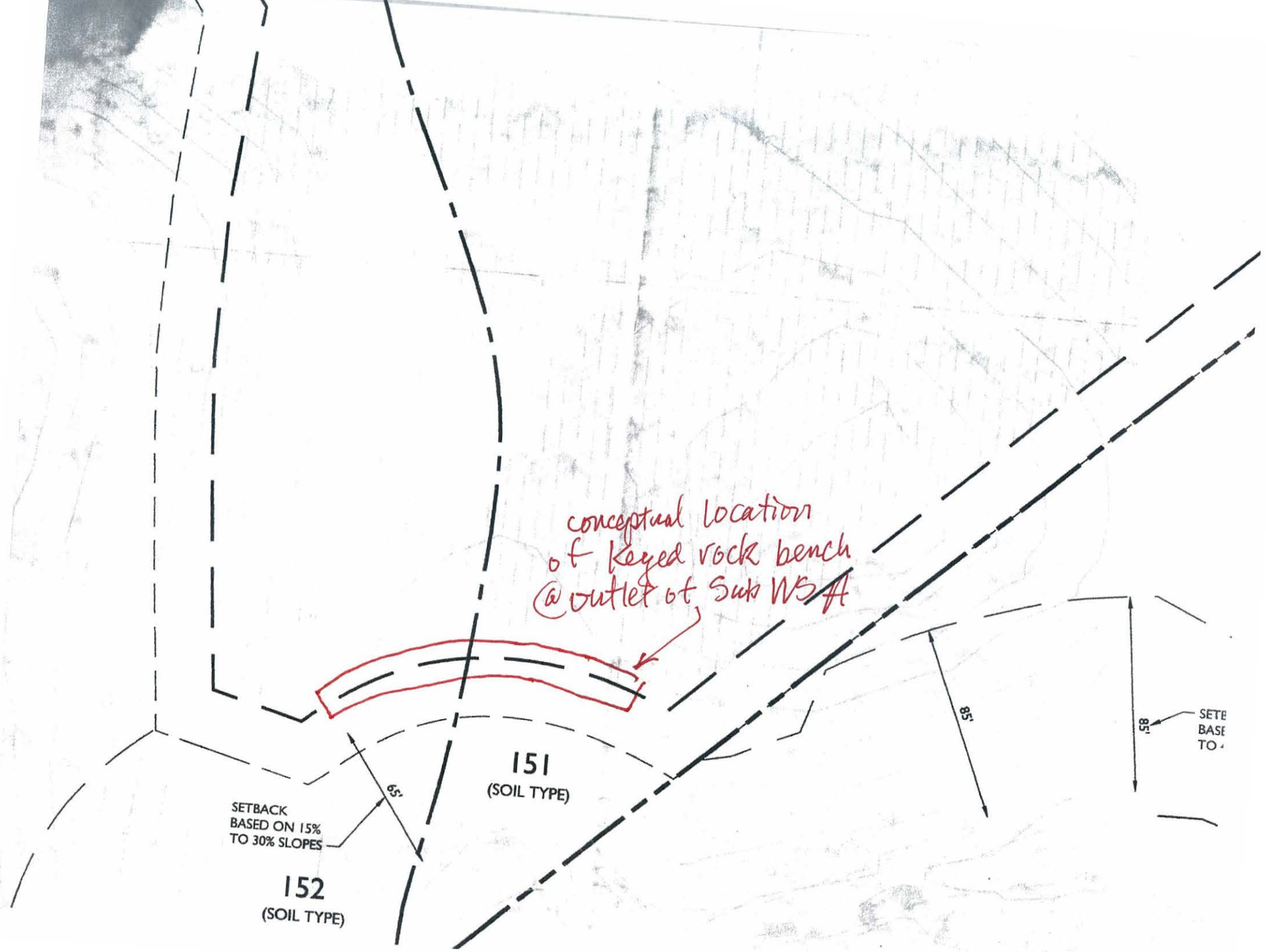
DAS

Phillips-Kelham Trust
Post-Project WS A
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Sub WS A							
SHEET	100	0.0500	0.240				0.148
SHALLOW	230	0.0870	0.050				0.013
SHALLOW	385	0.0620	0.050				0.027
CHANNEL	100	0.0700	0.040	4.00	7.00	6.944	0.004
					Time of Concentration		0.192

w/o Tc increase


conceptual location
of keyed rock bench
@outlet of Sub WS #1
151
(SOIL TYPE)
152
(SOIL TYPE)
SETBACK
BASED ON 15%
TO 30% SLOPES
65'
85'
85'

Land Use	Cover Treatment or Practice	Hydrologic 1/ Condition	Hydrologic Soil Group A	B	C	D
Orchards, deciduous		(See accompanying land-use description)				
Orchards, Evergreen		Poor	55	72	81	86
		Fair	42	64	76	82
		Good	33	58	72	79
Vineyards		(See accompanying land-use description)				
NON-CULTIVATED AGRICULTURAL LAND (Grassland, Woodland, Brushland)						
Annual grass		Poor	65	78	86	89
		Fair	49	69	79	84
		Good	38	61	75	81
Broadleaf chaparral		Poor	53	70	80	85
		Fair	40	63	75	81
		Good	31	57	71	78
Meadow		Poor	63	77	84	90
		Fair	58	70	78	84
		Good	30	58	72	78
Narrowleaf chaparral		Poor	70	82	88	90
		Fair	55	72	81	86
Open brush		Poor	61	76	84	88
		Fair	46	66	77	83
		Good	41	63	75	81

Exhibit 2.1-3

Close-seeded legumes or rotation meadow, contour - Close-seeded legumes or rotation meadow planted on the contour or in straight rows on land with 2 percent slopes or less.

Irrigated pasture - Irrigated land that is planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. For hydrologic purposes, dryland pasture is considered as annual grass.

Orchards, Deciduous - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds. Soil protection during the rainy season is dependent on ground cover. This ground cover may be annual grass or perennial grass cover crops with or without legumes, occasionally legumes alone.

Use curve numbers that apply to the land use or the kind and condition of cover during storm periods; for example, Annual grass curve numbers for annual grass or grass-legume cover. Where orchards are kept bare by disking or the use of herbicides, use Fallow curve numbers.

Because of management practices, ground cover in orchards is seldom continous. Only orchards untilled with more than 75 percent of the ground surface continuously protected by cover are in Good Hydrologic Condition, others are Fair or Poor.

Orchards, Evergreen - Land planted to evergreen trees which include citrus, avocado, and Christmas tree plantations. Soil protection is dependent on ground cover or litter. This ground cover may be annual grass or perennial grass cover crops with or without legumes alone; or the ground protection may be litter where tree canopy is sufficiently dense to produce an effective amount of fallen leaves.

Because of management practices, ground cover in orchards is seldom continous. Only untilled orchards with more than 75 percent of the ground surface continuously protected by litter or plant cover are in Good Hydrologic Condition, others are Fair or Poor.

Vineyards - Land planted to grapes. Soil protection during the rainy season is dependent on ground cover. This ground cover may be annual grass or perennial grass cover crops with or without legumes, occasionally legumes alone.

Use curve numbers that apply to the land use or the kind and condition of cover during the storm periods; for example, Annual grass curve numbers for annual grass or grass legume cover. Where vineyards are kept bare by disking or the use of herbicides, use Fallow curve numbers.

USDA United States Department of Agriculture Natural Resources Conservation Service

Web Soil Survey

A A A

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Area of Interest (AOI) | Soil Map | **Soil Data Explorer** | Download Soils Data | Shopping Cart (Free)

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Intro to Soils | Suitabilities and Limitations for Use | **Soil Properties and Qualities** | Ecological Site Assessment | Soil Reports

Search

Properties and Qualities Ratings

Open All | Close All

Soil Chemical Properties

Soil Erosion Factors

K Factor, Rock Free

K Factor, Whole Soil

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

Layer Options (Horizon Aggregation Method):
◉ Surface Layer (Not applicable)
○ Depth Range (Weighted Average)
Top Depth:
Bottom Depth:
○ Inches
◉ Centimeters
○ All Layers (Weighted Average)

View Description | View Rating

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. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were
design of map units and the level of detail shown in the resulting soil map are dependent on that map 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 contra
have been shown at a more detailed scale.

Tables — K Factor, Whole Soil — 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	Acres in AOI	Percent of AOI
104	Bale clay loam, 0 to 2 percent slopes	.20	107.4	36.5%
110	Boomer-Forward-Felta complex, 30 to 50 percent slopes	.28	4.7	1.6%
116	Clear Lake clay, drained, 0 to 2 percent slopes, MLRA 14	.17	0.1	0.0%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15		0.1	0.0%
151	Hambright-Rock outcrop complex, 2 to 30 percent slopes	.10	21.3	7.2%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	.10	92.0	31.3%
168	Perkins gravelly loam, 1 to 10 percent slopes, MLRA 14	.20	2.0	0.7%
169	Perkins gravelly loam, 5 to 9 percent slopes	.15	66.6	22.6%
Totals for Area of Interest			**294.2**	**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.

Rating Options — K Factor, Whole Soil

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

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

Search

Properties and Qualities Ratings

Open All | Close All

- Soil Chemical Properties
- **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

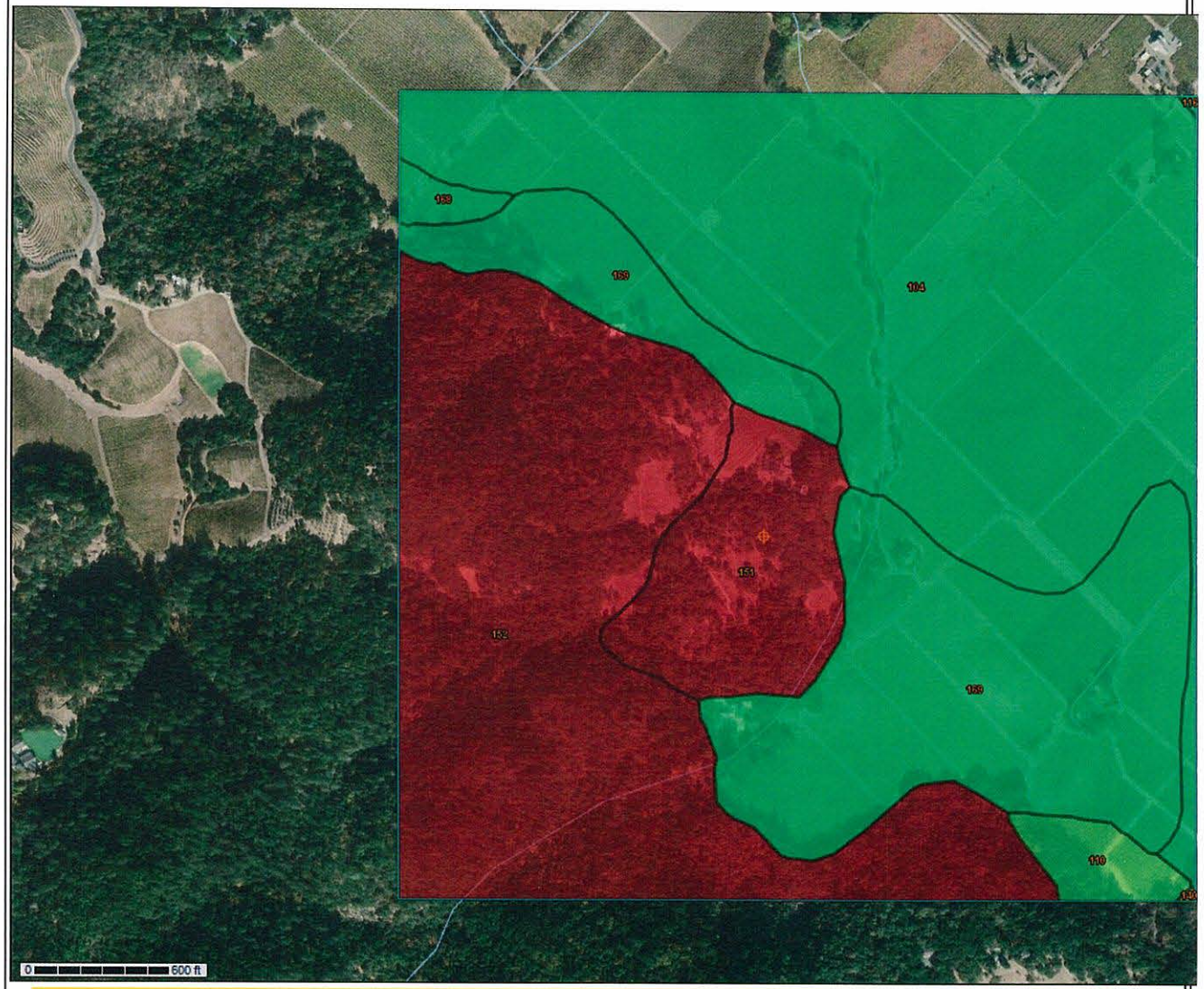
Interpret Nulls as Zero: ○ Yes ◉ No

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

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. Mapping of soils is done at a particular scale. The soil surveys tha design of map units and the level of detail shown in the resulting soil map are dependent on that map 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 sho 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)

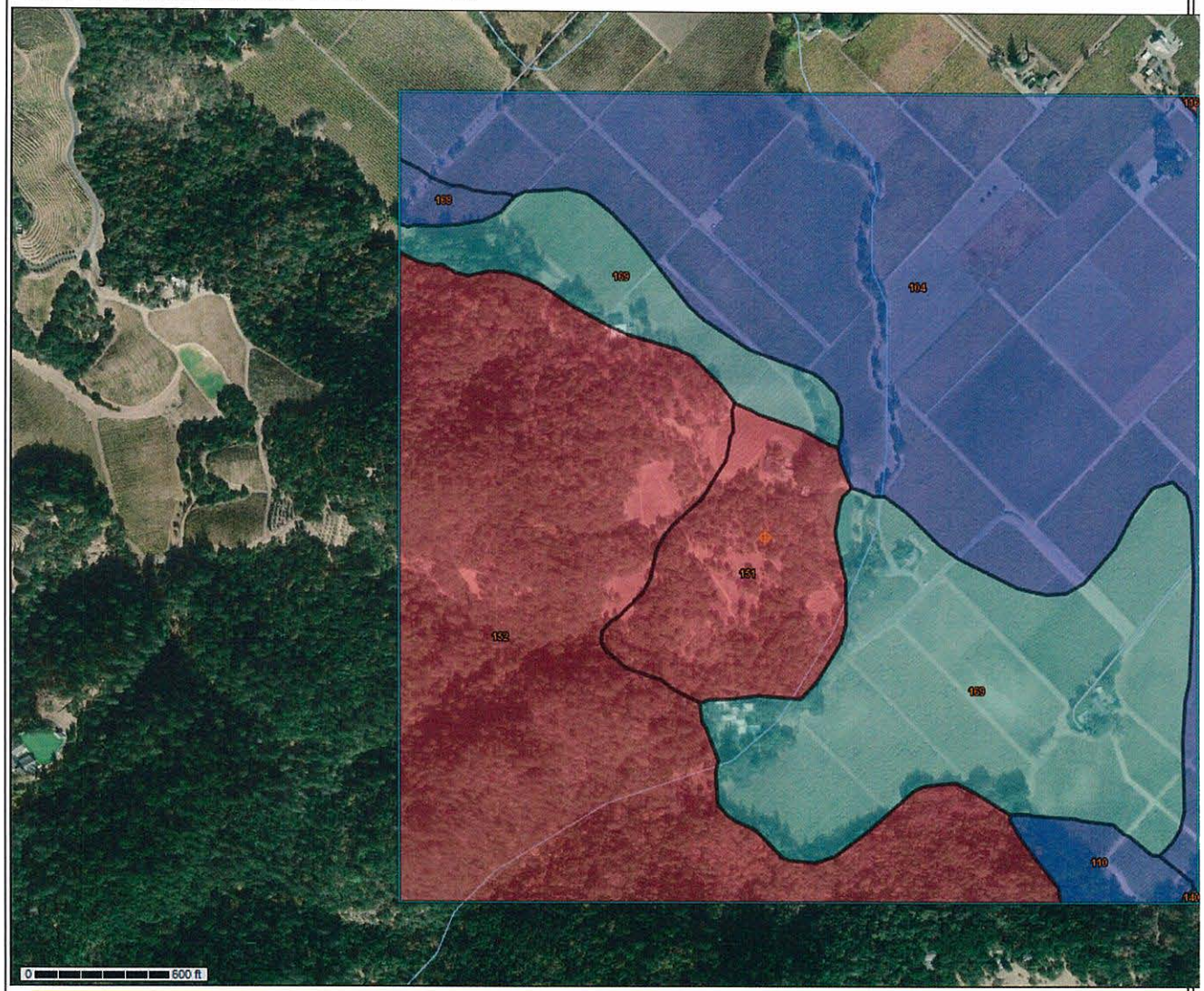
Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
104	Bale clay loam, 0 to 2 percent slopes	5	107.4	36.5%
110	Boomer-Forward-Felta complex, 30 to 50 percent slopes	4	4.7	1.6%
116	Clear Lake clay, drained, 0 to 2 percent slopes, MLRA 14	5	0.1	0.0%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	3	0.1	0.0%
151	Hambright-Rock outcrop complex, 2 to 30 percent slopes	1	21.3	7.2%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	1	92.0	31.3%
168	Perkins gravelly loam, 1 to 10 percent slopes, MLRA 14	5	2.0	0.7%
169	Perkins gravelly loam, 5 to 9 percent slopes	5	66.6	22.6%
Totals for Area of Interest			**294.2**	**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: *None Specified*
Tie-break Rule: Lower
Interpret Nulls as Zero: No



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Tables — Hydrologic Soil Group — 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	Acres in AOI	Percent of AOI
104	Bale clay loam, 0 to 2 percent slopes	B	107.4	36.5%
110	Boomer-Forward-Felta complex, 30 to 50 percent slopes	B	4.7	1.6%
116	Clear Lake clay, drained, 0 to 2 percent slopes, MLRA 14	D	0.1	0.0%
140	Forward silt loam, 12 to 57 percent slopes, MLRA 15	C	0.1	0.0%
151	Hambright-Rock outcrop complex, 2 to 30 percent slopes	D	21.3	7.2%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	D	92.0	31.3%
168	Perkins gravelly loam, 1 to 10 percent slopes, MLRA 14	B	2.0	0.7%
169	Perkins gravelly loam, 5 to 9 percent slopes	C	66.6	22.6%
Totals for Area of Interest			**294.2**	**100.0%**

Description — 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.

Rating Options — Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

 TRUST PARTNERS (PHILLIPS/KELHAM)

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

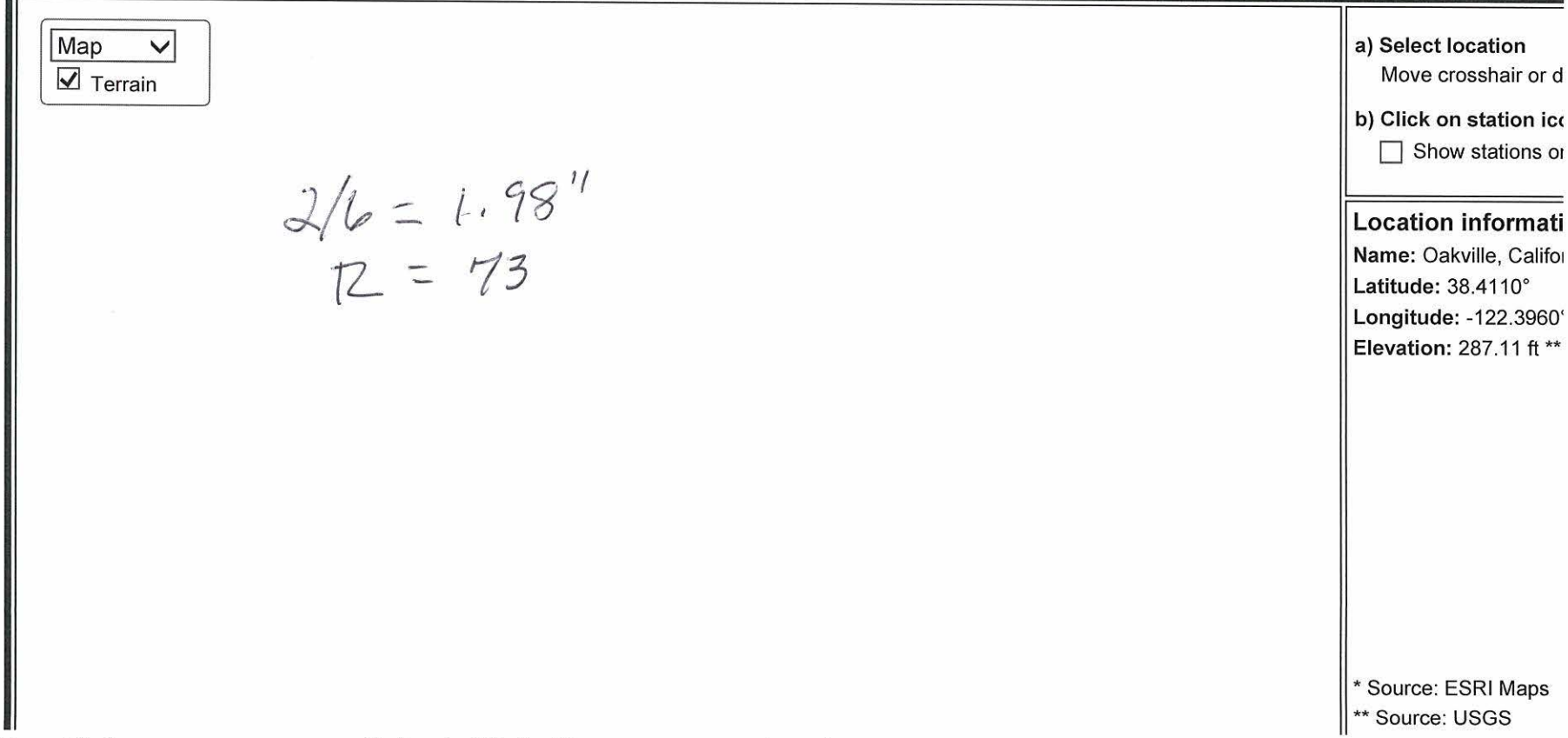
1) Manually:

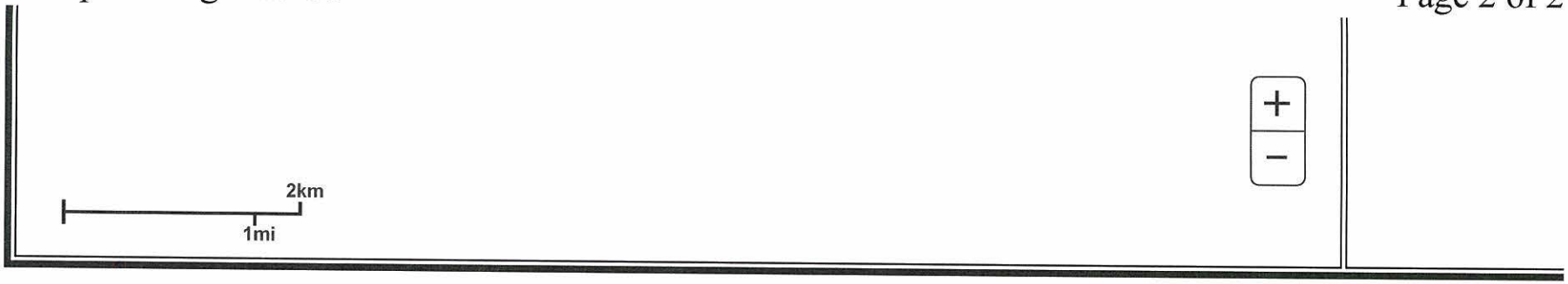
a) By location (decimal degrees, use "-" for S and W): Latitude: 38.411 Longitude: -122.396 Submit

b) By station (list of CA stations): Select station

c) By address Search

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://js.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):





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

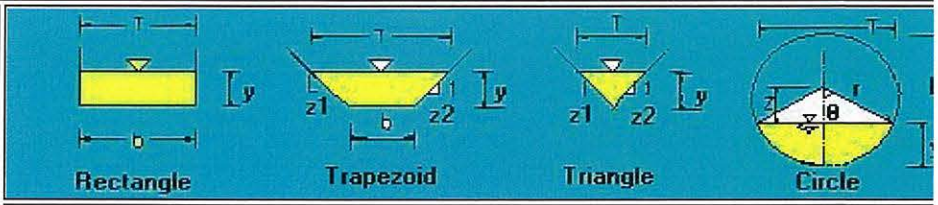
PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.144** (0.128-0.163)	**0.177** (0.157-0.201)	**0.220** (0.195-0.251)	**0.255** (0.224-0.294)	**0.303** (0.256-0.363)	**0.340** (0.280-0.417)	**0.377** (0.303-0.476)	**0.416** (0.323-0.542)	**0.469** (0.347-0.640)	**0.510** (0.363-0.72
10-min	**0.206** (0.183-0.234)	**0.253** (0.225-0.288)	**0.315** (0.279-0.360)	**0.366** (0.321-0.421)	**0.434** (0.367-0.520)	**0.487** (0.402-0.597)	**0.541** (0.434-0.682)	**0.597** (0.463-0.776)	**0.672** (0.498-0.917)	**0.731** (0.521-1.0
15-min	**0.249** (0.222-0.283)	**0.306** (0.272-0.348)	**0.381** (0.338-0.435)	**0.442** (0.388-0.509)	**0.525** (0.444-0.628)	**0.589** (0.486-0.722)	**0.654** (0.524-0.825)	**0.722** (0.560-0.939)	**0.813** (0.602-1.11)	**0.885** (0.630-1.2
30-min	**0.361** (0.322-0.410)	**0.444** (0.395-0.505)	**0.553** (0.490-0.631)	**0.641** (0.563-0.738)	**0.762** (0.643-0.911)	**0.854** (0.704-1.05)	**0.949** (0.760-1.20)	**1.05** (0.812-1.36)	**1.18** (0.873-1.61)	**1.28** (0.913-1.8
60-min	**0.534** (0.475-0.606)	**0.657** (0.584-0.747)	**0.817** (0.724-0.932)	**0.948** (0.832-1.09)	**1.13** (0.951-1.35)	**1.26** (1.04-1.55)	**1.40** (1.12-1.77)	**1.55** (1.20-2.01)	**1.74** (1.29-2.38)	**1.90** (1.35-2.69
2-hr	**0.823** (0.733-0.934)	**1.01** (0.898-1.15)	**1.25** (1.11-1.43)	**1.45** (1.27-1.67)	**1.71** (1.44-2.04)	**1.90** (1.57-2.33)	**2.10** (1.68-2.65)	**2.30** (1.79-3.00)	**2.57** (1.90-3.51)	**2.77** (1.98-3.93
3-hr	**1.06** (0.946-1.21)	**1.30** (1.16-1.48)	**1.61** (1.43-1.84)	**1.86** (1.63-2.14)	**2.19** (1.85-2.62)	**2.44** (2.01-2.99)	**2.69** (2.15-3.39)	**2.94** (2.28-3.82)	**3.27** (2.42-4.46)	**3.52** (2.50-4.99
6-hr	**1.61** (1.43-1.83)	**1.98** (1.76-2.25)	**2.45** (2.17-2.80)	**2.83** (2.48-3.25)	**3.32** (2.81-3.98)	**3.69** (3.05-4.53)	**4.06** (3.26-5.12)	**4.43** (3.44-5.77)	**4.92** (3.64-6.71)	**5.28** (3.76-7.49
12-hr	**2.27** (2.02-2.58)	**2.84** (2.52-3.23)	**3.57** (3.16-4.07)	**4.14** (3.64-4.77)	**4.90** (4.14-5.87)	**5.47** (4.51-6.71)	**6.04** (4.84-7.61)	**6.60** (5.13-8.59)	**7.35** (5.44-10.0)	**7.90** (5.63-11.2
24-hr	**3.13** (2.81-3.55)	**3.99** (3.58-4.53)	**5.08** (4.56-5.79)	**5.95** (5.30-6.82)	**7.10** (6.16-8.37)	**7.96** (6.78-9.54)	**8.82** (7.36-10.8)	**9.67** (7.89-12.1)	**10.8** (	

Reach AB WS≈270 acres

The open channel flow calculator

Select Channel Type: Trapezoid

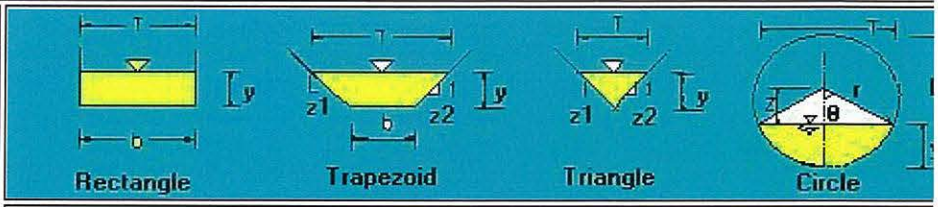


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .041 ft/ft 29'/700 @ 4.1%	Water depth(y): 1.2 ft	Bottom width(b) 5 ft
Flow velocity 7.6386 ft/s	LeftSlope (Z1): 2.5 to 1 (H:V	RightSlope (Z2): 2.5 to 1 (H:V
Flow discharge 73.3302 ft^3/s	Input n value .035 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 11.46 ft	Flow area 9.6 ft^2	Top width(T) 11 ft
Specific energy 2.11 ft	Froude number 1.44	Flow status Supercritical flow
Critical depth 1.47 ft	Critical slope 0.0187 ft/ft	Velocity head 0.91 ft

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .054 ft/ft	Water depth(y): 1 ft	Bottom W(b) 0 ft
Flow velocity 14.3881 ft/s	LeftSlope (Z1): 1 to 1 (H:V	RightSlope (Z2): 1 to 1 (H:V
Flow discharge 14.3881 ft^3/s	Input n value .012 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.83 ft	Flow area 1 ft^2	Top width(T) 2 ft
Specific energy 4.21 ft	Froude number 3.59	Flow status Supercritical flow
Critical depth 1.67 ft	Critical slope 0.0035 ft/ft	Velocity head 3.21 ft

1. TYPICAL VALUES OF MANNING CHARACTERISTIC ROUGHNESS

The table below presents the manning characteristic roughness for many common materials of construction for channels and natural formations of streams.

Characteristic Roughness	n ($m^{1/6}$)
Pipes and Flumes	
Brass pipe	0.010
Plastic, smooth	0.010
Steel, smooth	0.012
Concrete pipe, finished	0.012
Wood plank pipe or flume, planed	0.012
Wood plank pipe or flume, unplaned	0.013
Asphalt, smooth	0.013
Clay tile, smooth	0.013
Vitrified sewer pipe	0.013
Semicircular metal flumes, smooth	0.013
Cast-iron pipe	0.014
Concrete pipe, unfinished	0.015

Brick with cement mortar	0.015
Riveted steel pipe	0.017
Semicircular metal flumes, corrugated	0.028

Neutrium

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MANNING CHARACTERISTIC ROUGHNESS

SUMMARY

The Manning Characteristic Roughness is used to characterise the surfaces over which water can flow in streams, channels, ditches and flumes. This article presents a reference of roughness values for many common materials of construction for channels and natural formations of streams.

1. DEFINITIONS

nnn : Manning characteristic roughness

Phillips-Kelham Trust Vineyard Proposal
Runoff/Peak Flow Analysis
Pre-Project Conditions

Legend:

HSG, Land Use, Hydrologic Condition, Curve Number

D	Paved Roads	93
D	Farmsteads	86
C	Farmsteads	82
D	Woods-Grass Combination Good Condition	79
D	Woods, Good Condition	77
D	Vineyard ("Annual Grass") Good Condition	81
D	Vineyard ("Open Space") Fair Condition	84
C	Vineyard ("Open Space") Fair Condition	79
	Impervious Area (Pond)	98

Watershed Boundaries

Time of Concentration (Tc) Flowpaths, Stream Reach

Outlets (Points of Interest)

WATERSHED EXHIBIT

SCALE: 1" = 100'

APPLIED CIVIL ENGINEERING INCORPORATED
2074 West Lincoln Avenue
Napa, CA 94558
(707) 320-4968 (707) 320-2395 Fax
www.appliedcivil.com

TRUST VINEYARD PARTNERS

WATERSHED EXHIBIT
WATERSHED EXHIBIT

PREPARED UNDER THE DIRECTION OF:

REGISTERED PROFESSIONAL ENGINEER
MICHAEL R. PUTERBAUGH
NO. 67435
Exp. 12/31/2020
CIVIL
STATE OF CALIFORNIA
PRELIMINARY NOT FOR CONSTRUCTION

DRAWN BY: BT DRAFTING

CHECKED BY: MRM

DATE: JANUARY 2019

REVISIONS: BY:

JOB NUMBER: 18-110

FILE: 18-110EXH_WTSH@100SCL.DWG

ORIGINAL SIZE: 24" X 36"

SHEET NUMBER: 1 OF 1

Phillips-Kelham Trust Vineyard Proposal
Runoff/Peak Flow Analysis
Post-Project Conditions

Legend:

HSG, Land Use, Hydrologic Condition, Curve Number

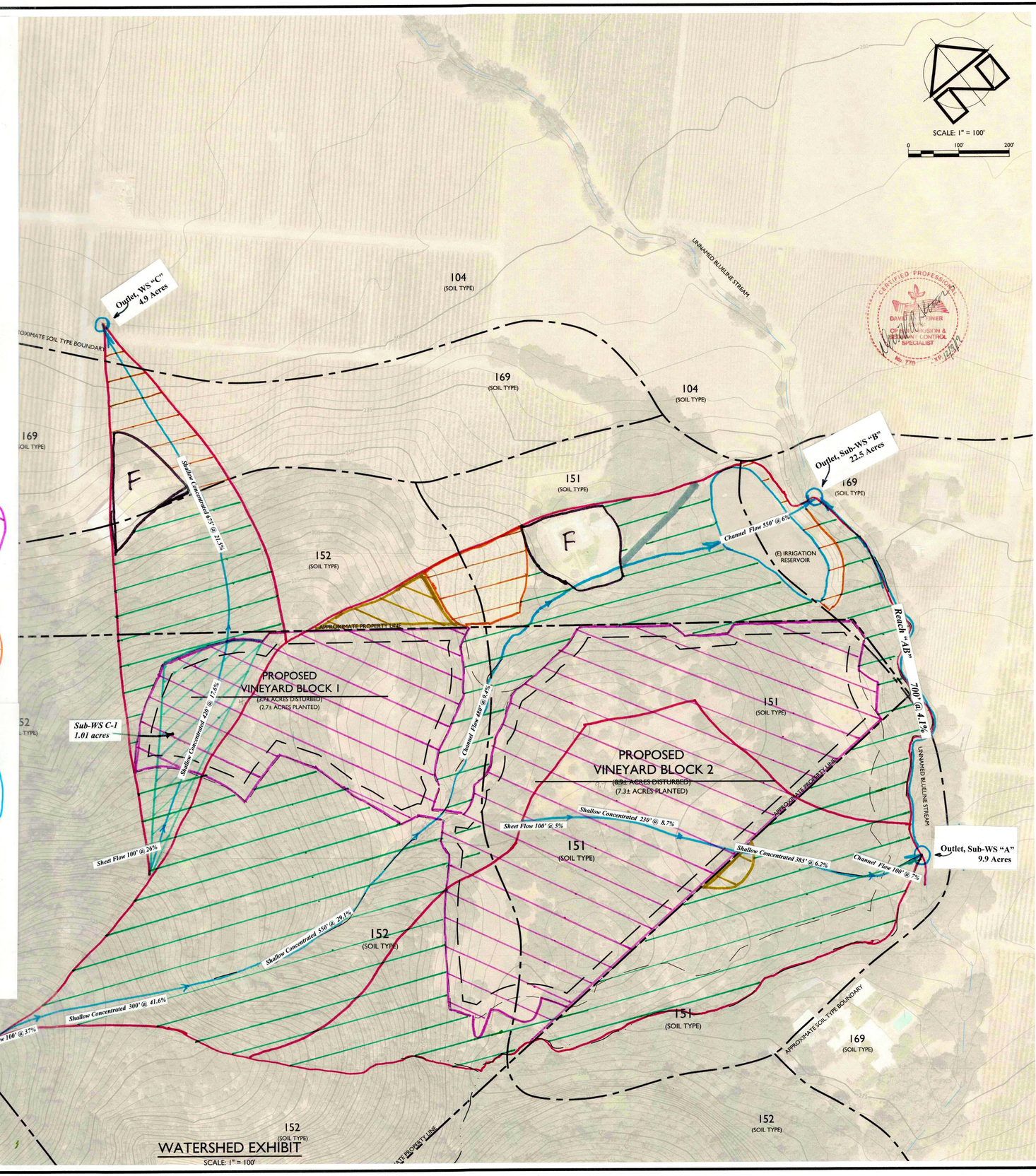
D	Paved Roads	93
D	Farmsteads	86
C	Farmsteads	82
D	Woods-Grass Combination Good Condition	79
D	Woods, Good Condition	77
D	Vineyard ("Annual Grass") Good Condition	81
D	Vineyard ("Open Space") Fair Condition	84
C	Vineyard ("Open Space") Fair Condition	79
	Impervious Area (Pond)	98

Watershed Boundaries

Time of Concentration (Tc) Flowpaths, Stream Reach

Outlets (Points of Interest)

Sub-Watershed C-1



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TRUST VINEYARD PARTNERS

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