

**Fulton Ranch Vineyard
268 Petrified Forest Road
Hydrology Analysis**

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INTRODUCTION

Fulton Ranch Vineyard seeks approval of approximately 3.83 net acres of proposed new vineyard. The project lies within five parcels APN 020-430-005, -006, -018, -019 & -027 totaling about 182.78 acres, located at 263 Petrified Forest Road, Calistoga.

This hydrology study is to determine the anticipated affect the proposed vineyard development project will have on local hydrology and runoff patterns in watersheds A thru J. Hydrologic modeling of existing and proposed conditions was performed using HydroCad, Urban Hydrology for Small Watersheds with the CA-1 rainfall distribution curve. Following is a summary of the data used to complete the hydrologic analysis and the results of this analysis.

RAINFALL DATA

Rainfall depths for the project site were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 6, Version 2, Precipitation Frequency Data for California, which uses the latitude and longitude of the Fulton Ranch Vineyard project are estimated to be 38.5701 N, -122.6132 W, based on information obtained from (NOAA) Atlas 14 site.

The following rainfall data from the NOAA website was used in the analysis:

2 year, 24 hour	5.18 inches
100 year, 24 hour	12.0 inches

Rainfall data for the interim storm events were interpolated as:

5 year, 24 hour	6.63 inches
10 year, 24 hour	7.78 inches
25 year, 24 hour	9.46 inches
50 year, 24 hour	10.7 inches

WATERSHED AREAS

The 10 project sites drain toward an unnamed stream and culverts. The points of interest for this analysis are points along culverts streams of natural ground. Watershed A is approximately ± 6.101 acres, B is ± 2.341 acres, C is ± 4.026 acres, D is ± 1.347 acres,

E is ±5.594 acres, F is ±4.758 acres, G is ±4.912 acres, H is ±0.410 acres, I is ±2.020 acres and J is ±2.822 acres and was delineated based on topographic data from the Napa County GIS Data Base (2002) and Tetra Tech (2018) data.

The maps, included in Appendix A, depict the watershed, the existing land uses, and the proposed vineyard project

PRE-PROJECT WATERSHED CONDITIONS

Soil Types

The United States Department of Agriculture Soil Conservation Service Soils Map for Napa County, August 1978, maps the following soil types within the watershed:

SCS #101, Aiken loam 15 to 30% slopes (Hydrologic Soil Group (HSG) C)

SCS #102, Aiken loam 30 to 50% slopes (Hydrologic Soil Group (HSG) C)

SCS #111, Boomer Forward felt complex 5 to 30% slopes (Hydrologic Soil Group (HSG) B)

SCS #140, Forward silt loam 12 to 57% slopes (Hydrologic Soil Group (HSG) C)

SCS #175, Rock outcrop (Hydrologic Soil Group (HSG) C)

Land Use

Land use within the subject watersheds was analyzed based on the 2016 aerial photograph obtained from the Napa County GIS website. Watershed A consists of 0.320 acres of grasslands with scattered brush, 5.748 acres of tree canopy, 0.033 acres of existing developed areas. Watershed B consists of 0.092 acres of grasslands with scattered brush, 2.249 acres of tree canopy. Watershed C consists of 4.026 acres of tree canopy. Watershed D consists of 0.016 acres of grasslands with scattered brush, 0.1.331 acres of tree canopy. Watershed E consists of 0.309 acres of grasslands with scattered brush, 5.256 acres of tree canopy, 0.028 acres of existing developed areas. Watershed F consists of 0.310 acres of vineyard, 4.447 acres of tree canopy. Watershed G consists of 4.912 acres of tree canopy. Watershed H consists of 0.376 acres of grasslands with scattered brush, 0.330 acres of tree canopy. Watershed I consists of 1.865 acres of grasslands with scattered brush, 0.155 acres of tree canopy. Watershed J consists of 2.031 acres of grasslands with scattered brush, .0.791 acres of tree canopy.

The grasslands and scatter brush areas are considered to be in a “good” condition, and the tree areas are considered to be in a “good” condition. A detailed breakdown of land use by area and hydrologic soil group is included in the HydroCad Reports, Appendix A.

Time of Concentration

The time of concentration represents the time it takes for rainfall in the most hydraulically remote portion of the watershed to reach the POI. The time of concentration is estimated assuming sheet flow up to 100 feet in the uppermost reaches of each watershed. A shallow concentrated flow regime is used to model the runoff down to a channel or a culvert if one exists, or to the POI. Roadside ditches and culverts are considered when modeling time of concentration. Channel flow data was determined by estimating a typical cross section of each segment of the channel based on available topography and field review. A detailed breakdown of the time of concentration parameters is included in the HydroCad reports, and is shown on the Drainage Area Maps.

POST PROJECT WATERSHED CONDITIONS

Soil Types

Land preparation for the proposed vineyard development does not alter the permeability of the mapped soil types. The post-project HSG remains the same as pre-project HSG.

Land Use

The proposed project will convert 4.608 acres of trees, .365 acres of brush and pasture grasses. Some development areas within the proposed vineyard areas will be relocated by avenues around the vineyard areas. The project proposes a no-till cover crop and spot spraying, which is considered a "good" hydrologic condition. Vineyard avenues/turnspaces will be maintained in a no-till cover or with a rock avenue and are modeled as part of the vineyard. All other areas within the watershed are assumed to remain unchanged including the access roads to the project area. A detailed breakdown of land uses by area and hydrologic soil group is included in the HydroCad Reports, Appendix A.

Time of Concentration

Time of concentration under post-project conditions will not increase in the watersheds the erosion control measures provided within the project area include. The time of concentration is estimated assuming sheet flow for 100 feet in the uppermost reaches of each watershed area, and shallow concentrated flow regime was used to model the runoff. Diversion ditches were added to help control the runoff rate to the projects POI. Mannings coefficients were selected to represent the respective surface conditions. A detailed breakdown of the time of concentration parameters is included in the HydroCad Reports, Appendix A and are shown on the Land Use Maps.

CALCULATED RUNOFF RATE

Using the rainfall data, watershed area, land use and time of concentration parameters described above and included in Appendix A, the following runoff rates were calculated:

HydroCad Calculated Peak Runoff Rate (cfs)

24 hr. storm event Project Condition	2 yr.		5 yr.		10 yr.		25 yr.		50 yr.		100 yr.	
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post
Watershed A	1.98	1.95	3.09	3.03	4.02	3.92	5.41	5.26	6.46	6.27	7.56	7.33
Watershed B	0.72	0.72	1.13	1.13	1.48	1.46	2.01	1.97	2.40	2.35	2.82	2.75
Watershed C	1.34	1.34	2.08	2.08	2.69	2.69	3.60	3.60	4.28	4.28	4.99	4.99
Watershed D	0.49	0.48	0.76	0.74	0.99	0.96	1.32	1.28	1.57	1.53	1.83	1.78
Watershed E	1.93	1.93	2.98	2.98	3.86	3.86	5.17	5.17	6.15	6.15	7.18	7.18
Watershed F, G	2.26	2.08	3.81	3.51	5.14	4.73	7.18	6.61	8.84	8.04	10.40	9.57
Watershed H	0.15	0.15	0.23	0.23	0.30	0.30	0.40	.040	0.48	0.48	0.56	0.56
Watershed I	0.75	0.75	1.16	1.16	1.50	1.50	2.00	2.00	2.38	2.38	2.78	2.78
Watershed J	1.01	1.01	1.56	1.56	2.02	2.02	2.71	2.71	3.22	3.22	3.76	3.76

CONCLUSION

The hydrologic analysis presented above and supporting information in the Appendix, demonstrate that the proposed vineyard development with appropriate mitigation measures will not increase the peak runoff rate in the affected watersheds.

