MH engineering Co.
16075 Vineyard Blvd. Morgan Hill, CA 95037 (408) 779-7381

Flood Study for

APN: 841-20-007, 048, 053, 064

For:
Erik Martin
Gilroy Rodeo
PO Box 1148
Gilroy, CA 95021

By:
MH Engineering Co.

February 22, 2019

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16075 Vineyard Blvd. Morgan Hill, CA 95037 (408) 779-7381

Feb 22, 2017 Job: 218058

Flood Plain Study for
APN 841-20-007, 048, 053, 064

Introduction

The purpose of this flood study is to present hydraulic and hydrologic information to demonstrate that the proposed development and surrounding properties within the flood plain are reasonably safe from increased flooding. The proposed development is located on 4 adjoining parcels located in a rural portion of Gilroy. See Exhibit A for the Vicinity Map. Currently the project area consists mostly of hayfields with some dirt roads, a pond, and the rodeo arena. Prior to the developments for the Gilroy Rodeo, the project area consisted of a dairy and ponds to capture the dairy runoff prior to entering Jones Creek. Jones Creek runs along the western portion of APN 841-20-064. The dairy was closed and the need for the ponds ceased. The pond areas were re-graded back to original conditions and the surplus of fill was used to create berms for the seating of the Gilroy Rodeo Arena. Flood Insurance Rate Maps (FIRMs) show that a portion of the proposed development lies in Zone A per FIRM 06085C0643H, effective May 18th, 2009. See attached Exhibit B. See Appendix B for the Gilroy Rodeo Work Map.

Watershed Study

The Flood Study included a watershed analysis for all portions of Jones Creek upstream of the project area. This included the watershed of Alamias Creek. Alamias and Jones Creek merge about 5,500 feet prior to the project area. A request was made to the Santa Clara Water District (SCVWD) for the peak flow of Jones Creek upstream of the project area. Currently the SCVWD has not found any information regarding the peak flow for Jones Creek.

The watershed study was conducted using HEC-HMS to model the flows and 2006 Lidar data from SCVWD to find the watershed limits and flow lengths. The watershed was divided into 3 sub-basins that covers 2.78 square miles. Each basin consists of mixed forest areas and grassland areas. The watershed analysis followed the procedures outlined in Chapter 4 of the Santa Clara County Drainage Manual 2007. The rainfall simulation used was based on the three-day December 1955 rainfall event from Figure D-1 of the County Drainage Manual. The mean annual precipitation (MAP) for the watershed area was determined from the County's property profile page and was found to be 19 inches. The 24-hour rainfall depth was calculated using the SCVWD's TDS equation (3-3) of the County Drainage Manual. The 24-hour rainfall depth was found to be 5.44 inches. The rainfall hyetograph was obtained by multiplying the MAP by the incremental rainfall distribution found in Figure D-1 of the County Drainage Manual. Each sub-basin was assigned a SCS Curve number based on the land cover and hydrologic soil group. The land cover was verified using aerial images and the hydrologic soil group data was obtained through the USGS web soil survey website. The curve numbers were taken from Table E-1 of the County Drainage Manual and then converted to antecedent moisture condition (AMC) II ½ using table E-2 of the County Drainage Manual. The SCS lag equation was then used to determine the basin lag time of each sub-basin. The watershed analysis data was entered into HEC-HMS to obtain the peak flow of Jones Creek for the 100-year storm event. The peak flow entering the project area from Jones creek was found to be 569.3 cfs. Please see Appendix A for watershed analysis calculations.

Flood Plain Study

The effects of the proposed grading have been evaluated using HEC-RAS computer modeling software. Jones Creek currently does not have a published flood profile from FEMA or SCVWD. A new model was created using the peak flow from the watershed analysis. Lidar data was obtained from the SCVWD website to model the pre-development cross sections of Jones Creek and field survey data was used to model the post development conditions. All the elevation information is based on the NAVD ’88 Datum.

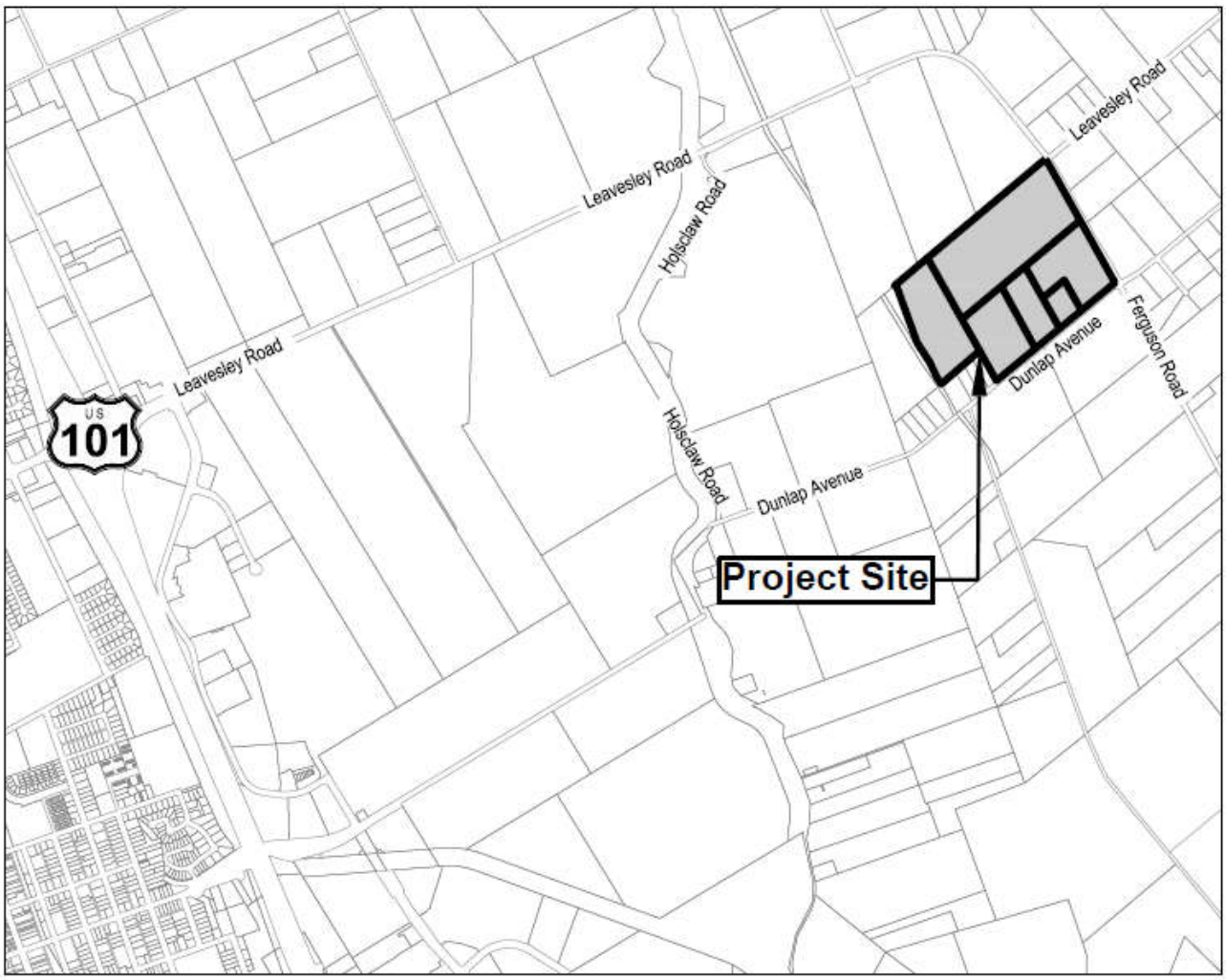
Prior to entering the project area, Jones Creek flows alongside of a large agricultural field with a 5-foot tall, 25-foot-wide berm along the west side of the creek. Once the Creek enters the project area, the flowline is now between two berms. The berm on the western side is now approximately 6 feet high and 20 feet wide. The berm along the project side is approximately 7 feet high and 20 feet wide. Once the creek leaves the project area the western berm continues until just before Dunlap Avenue with a height of 3 feet. The berm on the project side of the creek wraps around to the east and continues along the southern property line of APN 841-20-064.

The HEC-RAS model was used to determine if there was a change to the flood plain elevations after the proposed grading was completed. The model begins about 4,000 feet before the project area with creek cross sections every 500 feet. The approximately 1250 feet of creek that runs along the project area has cross sections every 50 feet. The model continues downstream approximately 4,000 feet with cross sections every 500 feet. Both the pre and post development models use the same plan model and the same flow data. The only difference between the models is the different geometry data in the project area.

Conclusion

The attached summary table, see Exhibit C, shows the results of the pre and post development models. The model shows that the elimination of the agricultural ponds and the addition of the berm for the arena seating has very little to no effect on the base flood plain elevation. The max elevation increase was 0.03 feet and the max elevation decrease was 0.01 feet.

Exhibit A



Vicinity Map

Exhibit B:

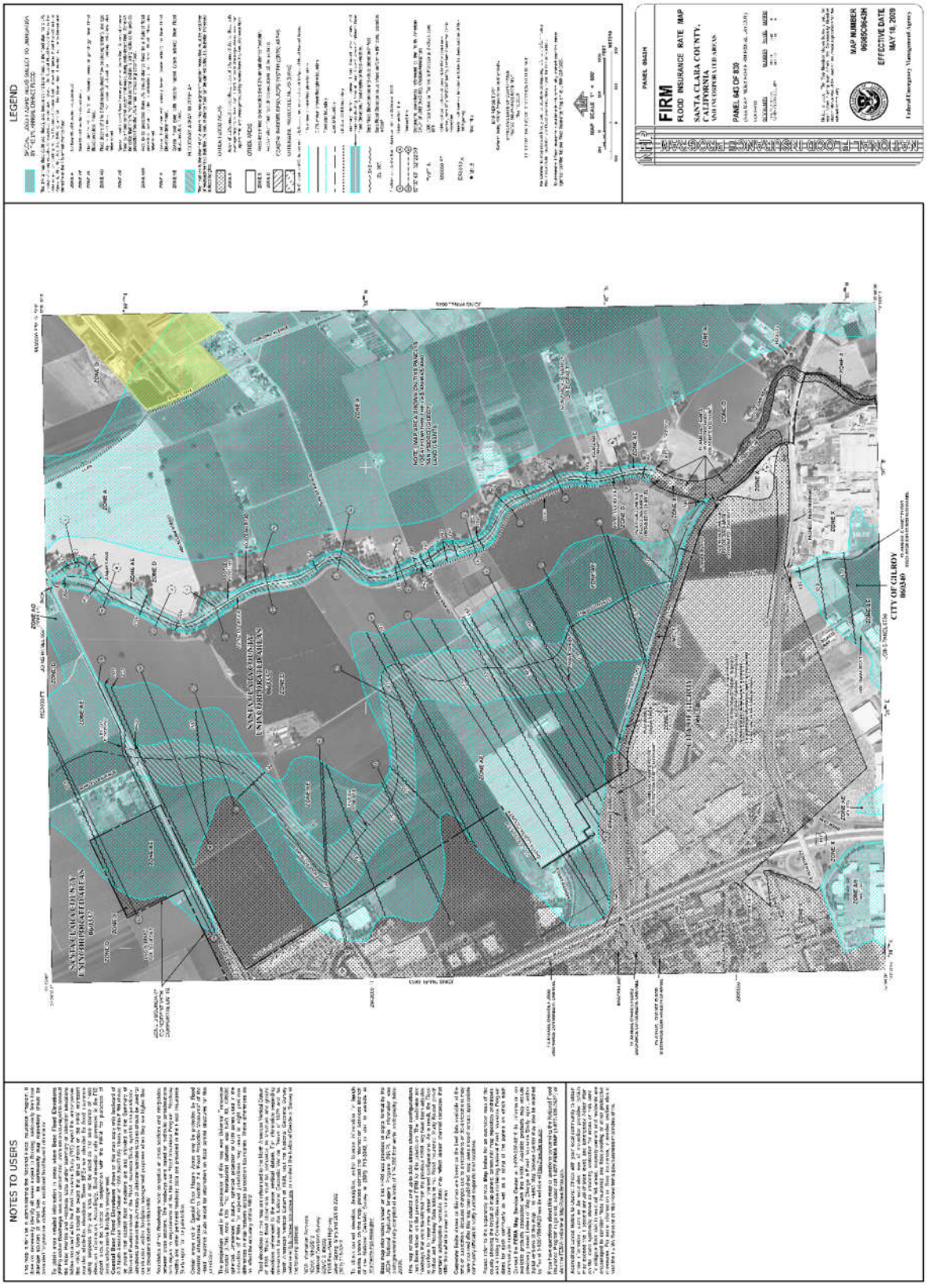

LEGEND
FIRM
FLOOD INSURANCE RATE MAP
SANTA CLARA COUNTY, CALIFORNIA
AND INCORPORATED AREAS
PANEL 642 OF 820
MAP NUMBER
06085C0642H
EFFECTIVE DATE
MAY 18, 2009
NOTES TO USERS
SANTA CLARA COUNTY UNINCORPORATED AREAS
CITY OF GILROY
060340

Exhibit C

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Delta	E.G. Elev	E.G. Slope	Vel Chnl	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	
Jones Creek	30	100 year AMC 2.5	Pre	604.6	221	225.47		225.7	0.003317	4.87	0.53
Jones Creek	30	100 year AMC 2.5	Post	604.6	221	225.47	0	225.70	0.003317	4.87	0.53
Jones Creek	29	100 year AMC 2.5	Pre	604.6	218	220.83		222.3	0.018322	9.85	1.23
Jones Creek	29	100 year AMC 2.5	Post	604.6	218	220.83	0	222.30	0.018322	9.85	1.23
Jones Creek	28	100 year AMC 2.5	Pre	604.6	214	217.39		218.08	0.007579	7.32	0.82
Jones Creek	28	100 year AMC 2.5	Post	604.6	214	217.39	0	218.08	0.007579	7.32	0.82
Jones Creek	27	100 year AMC 2.5	Pre	604.6	211	211.41		211.54	0.01277	2.9	0.8
Jones Creek	27	100 year AMC 2.5	Post	604.6	211	211.41	0	211.54	0.01277	2.9	0.8
Jones Creek	26	100 year AMC 2.5	Pre	604.6	209	209.78		209.81	0.001547	1.54	0.31
Jones Creek	26	100 year AMC 2.5	Post	604.6	209	209.78	0	209.81	0.001547	1.54	0.31
Jones Creek	25	100 year AMC 2.5	Pre	604.6	207	207.66		207.93	0.018307	4.19	1
Jones Creek	25	100 year AMC 2.5	Post	604.6	207	207.66	0	207.93	0.018307	4.19	1
Jones Creek	24	100 year AMC 2.5	Pre	604.6	205	207.22		207.23	0.000184	0.94	0.12
Jones Creek	24	100 year AMC 2.5	Post	604.6	205	207.22	0	207.23	0.000184	0.94	0.12
Jones Creek	23	100 year AMC 2.5	Pre	604.6	203	207.19		207.2	0.000028	0.59	0.05
Jones Creek	23	100 year AMC 2.5	Post	604.6	203	207.19	0	207.20	0.000028	0.59	0.05
Jones Creek	22	100 year AMC 2.5	Pre	569.3	201	207.19		207.19	0.000015	0.57	0.04
Jones Creek	22	100 year AMC 2.5	Post	569.3	201	207.18	-0.01	207.19	0.000019	0.64	0.05
Jones Creek	21	100 year AMC 2.5	Pre	569.3	201	206.68		207.14	0.00308	5.44	0.53

Jones Creek	21	100 year AMC 2.5	Post	569.3	201	206.68	0	207.14	0.003086	5.44	0.53
Jones Creek	20	100 year AMC 2.5	Pre	569.3	200	206.44		206.9	0.003038	5.45	0.52
Jones Creek	20	100 year AMC 2.5	Post	569.3	200	206.44	0	206.90	0.003045	5.45	0.52
Jones Creek	19	100 year AMC 2.5	Pre	569.3	200	206.25		206.63	0.002138	4.95	0.44
Jones Creek	19	100 year AMC 2.5	Post	569.3	200	206.24	-0.01	206.62	0.002144	4.96	0.44
Jones Creek	18	100 year AMC 2.5	Pre	569.3	200	205.73		206.26	0.003602	5.83	0.57
Jones Creek	18	100 year AMC 2.5	Post	569.3	200	205.72	-0.01	206.25	0.003622	5.84	0.57
Jones Creek	17	100 year AMC 2.5	Pre	569.3	199	205.51		206.02	0.003112	5.74	0.52
Jones Creek	17	100 year AMC 2.5	Post	569.3	199	205.5	-0.01	206.02	0.003132	5.75	0.52
Jones Creek	16	100 year AMC 2.5	Pre	569.3	199	205.24		205.71	0.002933	5.53	0.5
Jones Creek	16	100 year AMC 2.5	Post	569.3	199	205.27	0.03	205.70	0.002753	5.37	0.49
Jones Creek	15	100 year AMC 2.5	Pre	569.3	199	204.56		205.31	0.005097	6.95	0.66
Jones Creek	15	100 year AMC 2.5	Post	569.3	199	204.56	0	205.31	0.005097	6.95	0.66
Jones Creek	14	100 year AMC 2.5	Pre	569.3	198	204.27		204.85	0.003437	6.06	0.54
Jones Creek	14	100 year AMC 2.5	Post	569.3	198	204.27	0	204.85	0.003437	6.06	0.54
Jones Creek	13	100 year AMC 2.5	Pre	569.3	198	203.57		204.39	0.005624	7.28	0.68
Jones Creek	13	100 year AMC 2.5	Post	569.3	198	203.57	0	204.39	0.005624	7.28	0.68
Jones Creek	12	100 year AMC 2.5	Pre	569.3	198	203.58		203.97	0.001775	5.18	0.43
Jones Creek	12	100 year AMC 2.5	Post	569.3	198	203.58	0	203.97	0.001775	5.18	0.43
Jones Creek	11	100 year AMC 2.5	Pre	569.3	198	202.85		203.63	0.006137	7.1	0.73
Jones Creek	11	100 year AMC 2.5	Post	569.3	198	202.85	0	203.63	0.006137	7.1	0.73

Jones Creek	10	100 year AMC 2.5	Pre	569.3	198	201.62		202.76	0.012482	8.55	1.01
Jones Creek	10	100 year AMC 2.5	Post	569.3	198	201.62	0	202.76	0.012482	8.55	1.01
Jones Creek	9	100 year AMC 2.5	Pre	569.3	198	200		201.71	0.036514	10.49	1.62
Jones Creek	9	100 year AMC 2.5	Post	569.3	198	200	0	201.71	0.036514	10.49	1.62
Jones Creek	8	100 year AMC 2.5	Pre	569.3	197	199.73		199.78	0.00179	2.8	0.37
Jones Creek	8	100 year AMC 2.5	Post	569.3	197	199.73	0	199.52	0.001313	2.19	0.31
Jones Creek	7	100 year AMC 2.5	Pre	569.3	194	197.88		198.32	0.005409	6.35	0.68
Jones Creek	7	100 year AMC 2.5	Post	569.3	194	197.88	0	198.32	0.005409	6.35	0.68
Jones Creek	6	100 year AMC 2.5	Pre	569.3	193	195.89		195.92	0.00122	2.6	0.31
Jones Creek	6	100 year AMC 2.5	Post	569.3	193	195.89	0	195.92	0.00122	2.6	0.31
Jones Creek	5	100 year AMC 2.5	Pre	569.3	192	195.41		195.44	0.000785	2.2	0.26
Jones Creek	5	100 year AMC 2.5	Post	569.3	192	195.41	0	195.44	0.000785	2.2	0.26
Jones Creek	4	100 year AMC 2.5	Pre	569.3	191	195.12		195.14	0.000484	2.07	0.2
Jones Creek	4	100 year AMC 2.5	Post	569.3	191	195.12	0	195.14	0.000484	2.07	0.2
Jones Creek	3	100 year AMC 2.5	Pre	569.3	191	194.02		194.51	0.006441	5.7	0.73
Jones Creek	3	100 year AMC 2.5	Post	569.3	191	194.02	0	194.51	0.006441	5.7	0.73
Jones Creek	2	100 year AMC 2.5	Pre	569.3	189	192.66		192.83	0.001946	4	0.42
Jones Creek	2	100 year AMC 2.5	Post	569.3	189	192.66	0	192.83	0.001946	4	0.42
Jones Creek	1	100 year AMC 2.5	Pre	569.3	188	191.22		191.37	0.005139	3.64	0.6
Jones Creek	1	100 year AMC 2.5	Post	569.3	188	191.22	0	191.37	0.005139	3.64	0.6

Appendix A

Rainfall Depth Calculation

MAP = 19 in

	T (hr)	$A_{T,D}$	$B_{T,D}$
100 Year	24	0.814046	0.243391

$$x_{T,D} = A_{T,D} + (B_{T,D} MAP)$$

$X_{100\ year}$ = 5.4385 in

Sub Basin 1

CN Calculation

Hydrologic Soil Group	Area (sf)	Area (ac)	AMC II CN	AMC II 1/2 CN
Soil Type C	10073153	231.248	51	61
Soil Type D	43456962	997.635	76	83
Total	53530115	1228.882		
	Average CN value =		**71.30**	**78.86**

Basin Lag Calculation

$$t_{lag} = (0.862)\ 24 N \left(\frac{L L_c}{\sqrt{S}}\right)^{0.38}$$

N = 0.08
L = 1.738 mi
L_C = 0.9615 mi
S = 361.152 ft/mi

t_{lag} = 0.6570 hr
t_{lag} = 39.42 min

Initial Absorption

IA = 0.2*S S=1000/CN -10
S = 2.68
IA = 0.54 in

Sub Basin 2

CN Calculation

Hydrologic Soil Group	Area (sf)	Area (ac)	AMC II CN	AMC II 1/2 CN
Soil Type C	3640046	83.564	51	61
Soil Type D	16210664	372.146	70	78
Total	19850710	455.710		
	Average CN value =		**66.52**	**74.88**

Basin Lag Calculation

$$t_{lag} = (0.862)\ 24N\left(\frac{LL_c}{\sqrt{S}}\right)^{0.38}$$

N = 0.08
L = 1.4272 mi
L_C = 0.707 mi **t_{lag} = 0.6504 hr**
S = 138.871 ft/mi **t_{lag} = 39.03 min**

Initial Absorption

IA = 0.2*S S=1000/CN -10
S = 3.35
IA = 0.67 in

Sub Basin 3

CN Calculation

Hydrologic Soil Group	Area (sf)	Area (ac)	AMC II CN	AMC II 1/2 CN
Soil Type C	4223067	96.948	77	83
Total	4223067	96.948		
		CN value =	**77.00**	**83.00**

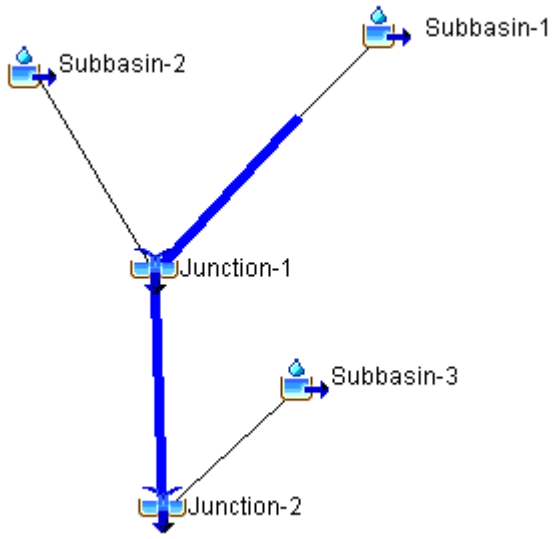
Basin Lag Calculation

$$t_{lag} = (0.862)\ 24N\left(\frac{LL_c}{\sqrt{S}}\right)^{0.38}$$

N = 0.08
L = 1.0234 mi
L_C = 0.5782 mi **t_{lag} = 0.7101 hr**
S = 30.099 ft/mi **t_{lag} = 42.60 min**

Initial Absorption

IA = 0.2*S S=1000/CN -10
S = 2.05
IA = 0.41 in



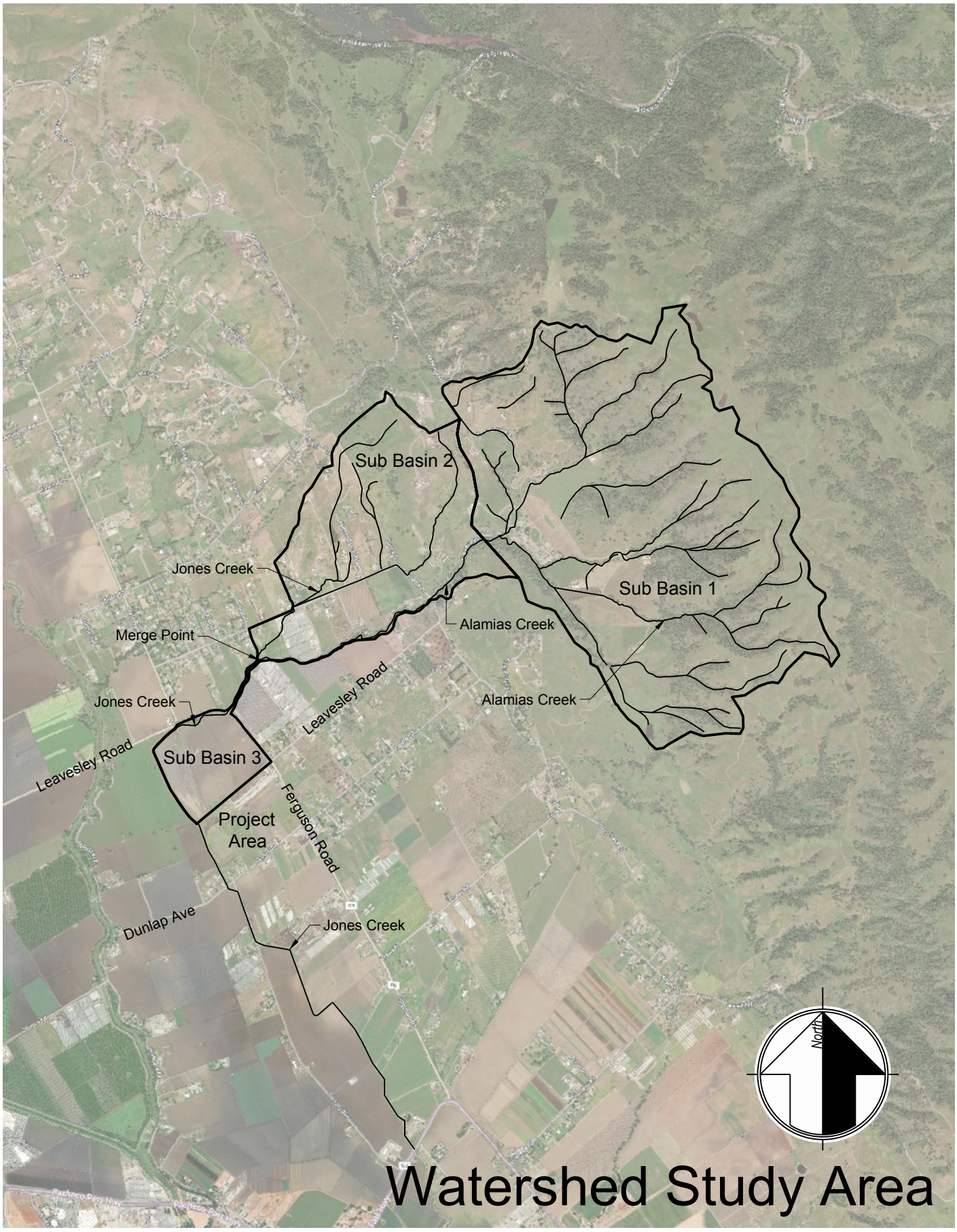
Project: 218058 AMC 2.5 Simulation Run: Run 1

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Existing
Meteorologic Model: Met 1
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN AC-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	2.63217	604.6	01Jan2000, 07:00	2.73
Junction-2	2.78365	569.3	01Jan2000, 07:30	2.70
Reach-1	1.92013	460.1	01Jan2000, 07:10	2.80
Reach-2	2.63217	540.3	01Jan2000, 07:35	2.67
Subbasin-1	1.92013	584.6	01Jan2000, 06:45	2.87
Subbasin-2	0.71204	179.6	01Jan2000, 06:45	2.54
Subbasin-3	0.15148	53.3	01Jan2000, 06:50	3.25



Watershed Study Area

Xrefs:

L:\Projects\Bill\218058 Gilroy Rodeo\dwg\218058 HEC-RAS Post.dwg - 2/21/2019 11:00 AM - Plotted 2/21/2019 11:01 AM by David Faria

MH engineering Co.
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037 (408) 779-7381

SCALE: 1" = 2000'	JOB #: 218058	SHEET
DRAWN BY: DF	DATE: 2/21/2019	1 of 1

02/22/2019 12:22pm
FOR PLANCHECK ONLY

REGISTERED PROFESSIONAL ENGINEER
WILLIAM J. McCLINTOCK
No. 24893
EXP 12-31-2019
STATE OF CALIFORNIA

FOR PLANCHECK ONLY
signature shall be provided upon approval

MH engineering Co.
16075 Vineyard Boulevard
Morgan Hill, CA 95037

Gilroy Rodeo - Work Map
APN's 841-20-007, 048, 053, 064

DATE:	2/22/2019		
SCALE:	1" = 150'	DRAWN BY:	DF
		CHECKED BY:	WJM

JOB NO.
218058

SHEET 1
OF 1

APPLICANT: Gilroy Rodeo ROAD: Dunlap Ave COUNTY FILE NO.: PLN18-11418