HAGERTY PROPERTY

TPM 3200-21144

Environ. Log No.:08-02-015

APN 105-800-63

Fallbrook, CA

CEQA-LEVEL DRAINAGE STUDY

April 2015

Prepared For:

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STATE OF CALIFORNIA

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1. INTRODUCTION

1.1 Purpose of Study

This study provides hydrologic analyses in support of Tentative Parcel Map 21144 (TPM) for the Hagerty property (APN 105-800-63) located at the southwest corner of East Fallbrook Street and McDonald Road in Fallbrook, California. This project consists of subdividing a single lot into four new parcels and one remainder parcel. The remainder parcel will retain an existing residence. This study evaluates offsite and onsite drainage patterns for both pre- and post-development conditions.

Onsite and offsite drainage patterns were analyzed for both existing and proposed conditions. This included determining floodplain limits traversing the site for both the existing drainageway on Parcel 4 and overflow spills discharging onto Parcels 1 and 2.

1.2 Scope

Hydrologic analyses were performed for APN 105-800-63 and contributing offsite areas, a watershed of approximately 350 acres. Pre- and post-development conditions peak runoff values for the 100-year peak flows were determined for the onsite and offsite areas using the Rational Method. Aerial photos and topographic base mapping was used to document existing hydrologic characteristics.

Hydrologic calculations were performed using methodologies defined in the County of San Diego Hydrology Manual (June 2003). First, watershed boundaries, points of flow concentrations and land uses were established. This data was then entered into hydrologic modeling software and 100-year peak flows were calculated. Finally, a hydrology exhibit was prepared to illustrate the model parameters and hydrologic characteristics of the existing conditions.

2. DESCRIPTION OF WATERSHED

2.1 Area Characteristics

The Hagerty TPM site is located at the southwest corner of East Fallbrook Street and McDonald Road, in the unincorporated Fallbrook area of the County of San Diego (see Vicinity Map in Appendix I). The proposed project consists of subdividing a single lot into four new parcels and one remainder parcel. The remainder parcel will retain an existing residence with a driveway approach off of East Fallbrook Street. The proposed use is residential in nature and is compatible with the surrounding land use and residential density. Onsite flows generally travel in a southwesterly towards the southerly property line. Storm runoff from these subbasins will confluence immediately downstream (south) of the property.

Site reconnaissance of the Hagerty property and offsite watershed were performed on May 15, 2010 and August 24, 2011 to verify and document existing land use conditions and drainage structures. The offsite watershed land use consists primarily of single-family residential and scattered open space, with a public park and some commercial properties

The Hagerty property receives offsite flows from the north and east. The major drainageway that conveys these flows is Ostrich Farms Creek. These flows generally concentrate at two locations as they reach the north side of East Fallbrook Street. At these two locations, there are a 48-inch reinforced concrete pipe (RCP) and 54-inch corrugated metal pipe (CMP) that convey these flows southerly under East Fallbrook Street onto the Hagerty property. The 48-inch RCP captures the majority of the flows from the Ostrich Farms Creek watershed and discharges into a vegetated creek that flows along the western boundary of the property (Remainder Parcel). Flows at this location are attenuated by a significant depressed area located on the upstream (north) side of East Fallbrook Street.

The majority of the 100-year peak flow reaching the inlet headwall of the 54-inch CMP will be conveyed under E. Fallbrook Street. This 54-inch CMP transitions to a 48-inch HDPE before discharging into a drainageway along the eastern portion of the property (Parcel 4). This drainageway carries flows southerly and offsite of the property. Proposed improvements will not impact the existing pipes or drainageways.

A portion of the 100-year flow at the 54-inch CMP crossing will overtop E. Fallbrook Street. This flow will travel southerly across the street and pond at an existing curb inlet located at the southwest corner of E. Fallbrook Street and McDonald Road. Additional storm runoff flows from E. Fallbrook Street and the residential neighborhood to the east will confluence with the overtopping flow. This water will continue to pond at the curb inlet location before overtopping the sidewalk and traveling southerly across the Hagerty property. This spill will eventually join the outflow from the 48-inch HDPE at the southerly property edge.

Refer to the Vicinity Map in Appendix I and the Drainage Map in Appendix III for further details.

2.2 Soil Type

The San Diego County Soils Interpretation Study Map for Bonsall and Temecula were used to determine Hydrologic Soil Groups for the drainage areas. The site is comprised of mainly of Placentia sandy loam with some Fallbrook sandy loam. The project site and offsite watershed is comprised of both soil groups B and D. Soil group D was assumed for all hydrologic calculations.

2.3 Land Uses

The existing parcel is comprised of an existing residential structure, driveway, dispersed tree coverage, and low-lying grasses. Residential uses lie adjacent to the site in all directions. Offsite watershed land use consists primarily of single-family residential and scattered open space, with a public park and some commercial properties

Runoff coefficients for existing and proposed land uses were determined using the formula in the County of San Diego Hydrology Manual which considers percent impervious in its calculation. Existing land uses (onsite and offsite) were determined through field reconnaissance and GoogleEarth imagery. Composite runoff coefficients were calculated for both onsite and offsite areas containing various land uses (see spreadsheets under Appendix I).

2.4 Topography

One-foot contour mapping provided by Farrington Engineering Consultants was used to determine onsite drainage boundaries. County of San Diego 1"=200', 5-foot contour mapping was used to determine offsite drainage boundaries.

3. METHODOLOGY

3.1 Modified Rational Method

Per the County of San Diego Hydrology Manual (dated June 2003) for watersheds less than one square mile with stream junctions, we used the modified rational formula, as excerpted below. Computer calculations were prepared using CIVILDESIGN Rational Method Hydrology Program. The calculations are included in Appendix II.

From the Hydrology Manual, this method is as follows:

Use the Rational Formula Q = CIA where:

Q is the peak rate of flow in cubic feet per second (cfs).

C is a runoff coefficient expressed as that percentage of rainfall that becomes surface runoff.

I is the average rainfall intensity in inches per hour for a storm duration equal to the time of concentration (T_c) of the contributing drainage area.

A is the drainage area in acres tributary to design point.

1) Runoff Coefficient, C

Table 3-1 lists the estimated coefficient for each type of land use. Multiply this coefficient by the percentage of the total area included in that class. The sum of the products for all land uses in San Diego County is the weighted runoff coefficient.

2) Rainfall Intensity, I

Intensity - duration - precipitation curves applicable to all areas within San Diego County are given in Figure 3-1. The 100-year, 6-hour and 100-year, 24-hour precipitation values are 3.0 and 5.5 inches, respectively.

3) Time of Concentration, T_c

The time of concentration for initial areas was determined using the maximum overland flow length per Table 3-2 of the hydrology manual. The initial time of concentration was obtained using Figure 3-3. Where distances for initial areas

were greater than those listed in Figure 3-3 the Kirpich formula was used to determine the time for the remaining distance and the time was added to the initial time of concentration. The time of concentration between nodes is calculated using Manning's equation for open channels.

3.2 Rational Method Hydrograph

The Rational Method Hydrograph Procedure described in the San Diego County Hydrology Manual was used to develop the inflow hydrograph for flows captured by the depressed area upstream of the 48-inch RCP along Ostrich Farms Creek. The concept of this hydrograph procedure is based on the Rational Method formula, Q=CIA. This procedure has a particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures.

Inflow hydrographs were developed using the RatHydro Program developed by Rick Engineering. These hydrographs and rating curve data were then input into the ACOE HEC-1 program and detention routing calculations were performed. These calculations are included under Appendix II.

3.3 Storm Frequency

The 100-year frequency storm was used for the design of the onsite drainage system. The 100-year, 6-hour Rational Method Hydrograph was used to analyze the attenuation impacts from the depressed area at the 48-inch RCP crossing.

4. HYDROLOGY RESULTS

4.1 Offsite Hydrology

The goals of the offsite hydrologic analyses were to determine the carrying capacity of the existing culverts under E. Fallbrook Street, and to define 100-year flow rates for potential flood inundation areas on the Hagerty property. Digital copies of the County of San Diego 1"=200' orthotopos were obtained to delineate contributing watersheds to the culvert crossings under East Fallbrook Street. Areas were then adjusted based on field reconnaissance observations (see Offsite Drainage Map under Appendix III). Based on this information, it was determined that the contributing drainage areas to the 48-inch (Ostrich Farms Creek) and 54-inch culvert crossings were 184.3 acres and 102.5 acres, respectively. Storm runoff from offsite areas 100 and 102 both discharge onto Fallbrook Street and confluence at Node 100, located at the southwest corner of E. Fallbrook Street and McDonald Road. A summary of sub-basin areas and 100-year peaks flows at key locations is included under Table 4.1.1 below.

Table 4.1.1 Offsite Existing Conditions Rational Method Results

Location	Existing		Description
	Area (Acre)	100-Yr Flow (cfs)	
Node 104	102.5	151.9	54" culvert inlet
Area 100	1.2	3.0	E. Fallbrook St. from west
Area 102	40.0	60.7	Neighborhood to east
Node 200	184.3	236.7	Ostrich Farms Creek crossing (48")

Detention routing analyses were then performed for Node 200, the sump area located at the upstream (northerly) side of E. Fallbrook Street at the Ostrich Farms Creek crossing (48-inch culvert). This analyses was done to determine the quantity of flow conveyed under the road through the existing 48-inch culvert, and if there were any overtopping flows during a 100-year storm. A hydrograph was developed at Node 200 using the RatHydro Program developed by Rick Engineering and using the Rational Method results summarized in Table 4.2.1. Storage rating and outlet pipe rating curves were developed for the detention basin. The hydrograph and rating curve data were then input into the ACOE HEC-1 program and detention routing calculations were performed.

The existing sump area located at Node 200 is approximately 8.5-feet deep and contains a volume of approximately 5.3 acre-feet. Basin outflows are controlled by a 48-inch culvert. The results show that the 48-inch culvert is able to convey the entire 100-year flow under E. Fallbrook Street with no overtopping. The maximum ponded elevation was calculated to be approximately 708.7 feet, which is lower than the lowest top of road elevation of 709.5. See Appendix II for HEC-1 results.

Table 4.1.2 below lists the results from the detention routing analyses.

Table 4.1.2 Detention Routing Results

Location	Existing Conditions w/out Detention			Existing Conditions w/ Detention		
	Area (Acre)	Peak Flow (cfs)	Time of Conc. (min)	Area (Acre)	Peak Flow (cfs)	Time of Conc. (min)
Node 200	184.3	236.7	28.6	184.3	140.0	42.4

There is no significant storage at the 54-inch headwall, therefore, culvert sizing nomographs were used to determine the capacity of the existing 54-inch CMP. There is approximately 1.5 feet of fill above the top of the 54-inch CMP at its inlet (total headwater depth is 6.0 feet). Based on the nomograph, the 54-inch CMP is able to capture and convey approximately 135 cfs before flows overtop Fallbrook Street. The remaining 16.9 cfs (151.9-135) will spill onto E. Fallbrook

Street and travel southerly across the street to the existing curb inlet located at the southwest corner of McDonald Road and E. Fallbrook Street.

Additional storm runoff flows from E. Fallbrook Street (Area 100, 3.0 cfs) and a nearby residential neighborhood to the east (Area 102, 60.0 cfs) will confluence with this overtopping flow. Based on the Rational Method results, the total flow at the curb inlet will be approximately 81 cfs (16.9+3.0+60.7=80.6 cfs). This water will continue to pond at the curb inlet location before overtopping the sidewalk and travel southerly across the Hagerty property. This spill eventually confluences with the outflow from the 48-inch HDPE at the existing drainageway located on Parcel 4.

4.2 Onsite Hydrology

Hydrologic analyses for onsite conditions were focused on determining the impact of the proposed TPM improvements. Sub-basins were delineated for both pre- and post-project conditions to fully assess increases to storm runoff from the increased impervious area. Storm runoff from all proposed improvements will be directed to one of a total five bioretention basins proposed for the project. The results of the pre- and post-project condition analyses are summarized in Tables 4.1.1 below and more detailed analyses are included under Appendix II. The node numbers, sub-basin boundaries, and drainage systems discussed in this section are shown on the maps located in Appendix III.

Table 4.2.1 Rational Method Results – 100-Year Storm

Sub-Basin	Pre-Project			Post-Project			Post-Project with Mitigation	
	Area (acres)	Time of Conc. (min)	Discharge (cfs)	Area (acres)	Time of Conc. (min)	Discharge (cfs)	Area (acres)	Discharge* (cfs)
100	1.38	12.06	2.16	0.18	7.24	0.64		
200	0.23	7.98	0.47	0.15	8.92	0.47		
300	0.14	5.00	0.96	0.06	7.95	0.20	0.37	0.76
400				0.47	5.57	2.46	0.47	0.96
500				0.31	12.98	0.46		
600				0.14	9.14	0.39		
700				0.12	5.00	0.83		
800				0.32	8.23	0.64	0.91	1.87
Total	**1.75**		**3.59**	**1.75**		**6.09**	**1.75**	**3.59**

***Proposed bioretention basins will be designed to reduce Post-Project Conditions 100-year flows to Pre-Project Conditions.**

As shown in the tables above, the project's contributing 100-year peak discharge will increase by approximately 2.5 cfs due to the proposed improvements. The higher peak flows can be attributed to the increases in impervious area due to the proposed residential structures and cul-de-sac. In addition, these results do not take into account the routing and confluencing of subbasins.

Five bioretention basins are proposed to attenuate post-project peak flows to pre-project levels. Table 4.2.2 below provides a summary of the minimum bioretention basin volumes and areas to meet water quality treatment volume and hydromodification requirements in accordance with County of San Diego August 2012 SUSMP guidelines. Report summaries of the County of San Diego BMP Sizing Calculator calculations are included under Appendix II.

Table 4.2.2 Summary of Bioretention Basin Facilities*

LOCATION	Minimum Plan Area (ft^2)	Minimum Volume 1 (ft^3)	Minimum Volume 2 (ft^3)	Proposed Depth (ft)	Maximum Orifice Size (in)
Parcel 1	332	276	199	1.0	0.38
Parcel 2	317	263	190	1.0	0.34
Parcel 3	100	84	60	1.0	0.22
Parcel 4	1498	1248	899	1.0	0.61
Open Space	140	117	84	1.0	0.16

***Note: The basin sizes listed in this table meet the minimum water quality treatment volume and hydromodification requirements in accordance with County of San Diego August 2012 SUSMP guidelines. These basins will be sized to meet 100-year flood control detention volume requirements as well during the final design phase.**

5. FLOODPLAIN ANALYSIS

5.1 Floodplain Descriptions

There are two floodplains that traverse through the Hagerty property. The Ostrich Creek Farms floodplain is located on the western side of the property and travels through the remainder parcel. The floodplain and floodway for this creek is defined on the County of San Diego Floodplain Orthotopo 438-1695. A digital image of this map was obtained from County records and the floodplain/floodway linework was transposed onto the Floodplain Map located under Appendix III. It was difficult to accurately correlate County's floodplain/floodway limits to the new topography since these limits were generated in 1984 and do not accurately represent existing conditions.

The second floodplain is defined by the spill overflow from the 54-inch culvert crossing (Node 104) and the existing drainageway that traverses across Parcel 4. The spill overflow is approximately 81 cfs and is captured by a proposed concrete channel as it enters the northern portion of the Hagerty property. The channel will then convey flows to a new 42-inch pipe

which directs flows to the existing 48-inch culvert downstream headwall. The 81 cfs from the 42-inch pipe will confluence with the 135 cfs from the 48-inch pipe at this location. The downstream existing drainageway will then convey the total 216 cfs downstream to the southern edge of the property.

5.2 HEC-RAS Analyses

Hydraulic analyses was performed for the existing and proposed drainageways traversing the property using the ACOE HEC-RAS computer program. As explained under Section 5.1, a 100-year peak discharge of 216 cfs was used for these analyses for both existing and proposed conditions. Cross section station and elevation data were extracted from topographic files provided by Farrington Engineering Consultants. The main channel downstream of the existing 48-inch pipe is heavily vegetated through the entire study reach. Manning's n-values of 0.07 for the low-flow channel and 0.040 for the overbanks were assumed for the channel reach.

Three (3) HEC-RAS models were prepared to determine 100-year inundation limits for existing and proposed conditions. These models (plans) are described below.

- Plan 01 (*.p01): Existing conditions model of drainageway immediately downstream of existing 48-inch storm drain outlet.
- Plan 02 (*.p02): Existing conditions model of overflow spill that sheet flows from Fallbrook Street southerly across the property.
- Plan 03 (*.p03): Proposed conditions model of drainageway immediately downstream of existing 48-inch storm drain outlet.

Table 5.2.1 below summarizes 100-year water surface elevations and velocities for proposed conditions (Plan 03). HEC-RAS calculations are included in Appendix II. The work maps showing cross section locations and 100-year floodplain limits are located in Appendix III.

Table 5.2.1: HEC-RAS Model Results

CROSS SECTION	PROPOSED CONDITIONS		
	Q_{100} (cfs)	100-YR WSEL (ft)	100-YR VEL (fps)
1	216	700.9	4.7
2	216	701.6	2.7
3	216	701.7	3.3
4	216	701.9	6.7
5	216	703.3	7.9

Model results show that 100-year water surface elevations (wsels) are contained within the channel and do not spill into the overbank areas.

6. CONCLUSION

Onsite hydrologic analyses results show that 100-year peak flows will increase by approximately 2.5 cfs due to the proposed TPM improvements. The higher peak flows can be attributed to the increases in impervious area due to the proposed residential structures and cul-de-sac. These results do not take into account the routing and confluencing of subbasins.

The proposed bioretention basins listed in this study meet the minimum water quality volume and hydromodification sizing requirements in accordance with County of San Diego August 2012 SUSMP guidelines. These basins will be sized to meet 100-year flood control detention volume requirements as well during the final design phase.

There are two floodplains that traverse through the Hagerty property. The Ostrich Creek Farms floodplain is located on the western side of the property and travels through the remainder parcel. The second floodplain is defined by the spill overflow from the 54-inch culvert crossing and the existing drainageway that traverses across Parcel 4. Both floodplains are contained within their respective main channels and do not spill into the overbank areas. No existing or proposed structures lie within the 100-year limits of inundation of either floodplain.

We do not anticipate any increased impact to downstream watershed conditions. There will be no change to the existing drainage pattern of the area. In conclusion, the proposed bioretention basins will mitigate increases in the rate and amount of surface runoff therefore mitigating potential erosion or siltation on- or off-site.

7. REFERENCES

CivilCadd/CivilDesign Engineering Software, Rational Method Hydrology System Model, © 1989-2001, Version 6.4.

U.S. Army Corps of Engineers, HEC-RAS River Analysis System, Version 4.1.0, January 2010

County of San Diego, Hydrology Manual, June 2003

U.S. Army Corps of Engineers, HEC-1 Flood Hydrograph Package, Version 4.1, June 1998

HY-8 Version 7.2, Federal Highway Administration, June 28, 2011

Hydraulic Toolbox Version 2.1, Federal Highway Administration, June 18, 2011

County of San Diego, Soils Interpretation Study, Bonsall, 1969

County of San Diego, Soils Interpretation Study, Temecula, 1969

DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the engineer of work for this drainage study. That I have exercised responsible charge over the project's hydrology study as defined in Section 6703 of the Business and Professions Code, and that the hydrologic analyses is consistent with current standards.

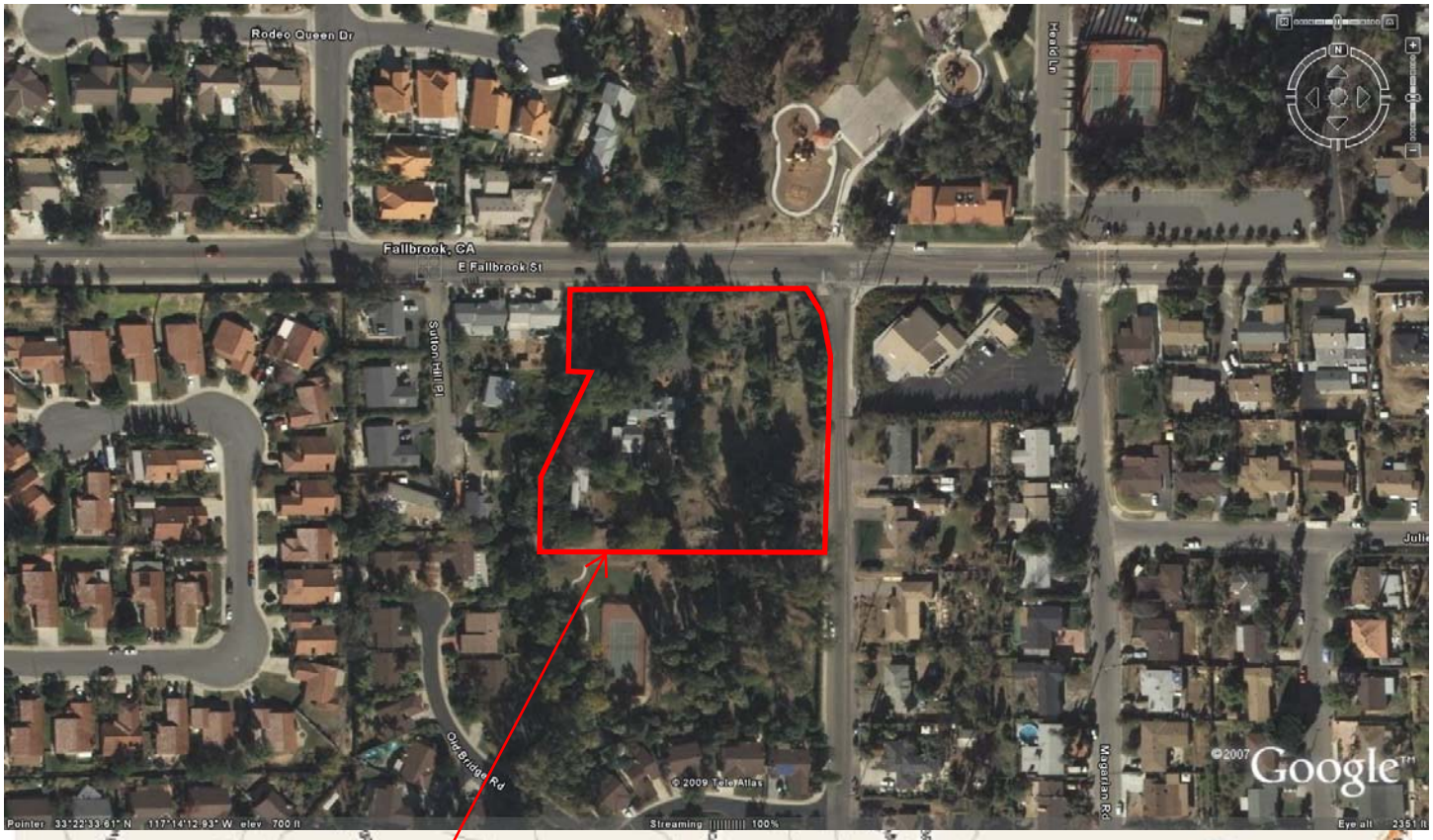
I understand that the check of this hydrology study by the County of San Diego is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for hydrologic and hydraulic analyses.

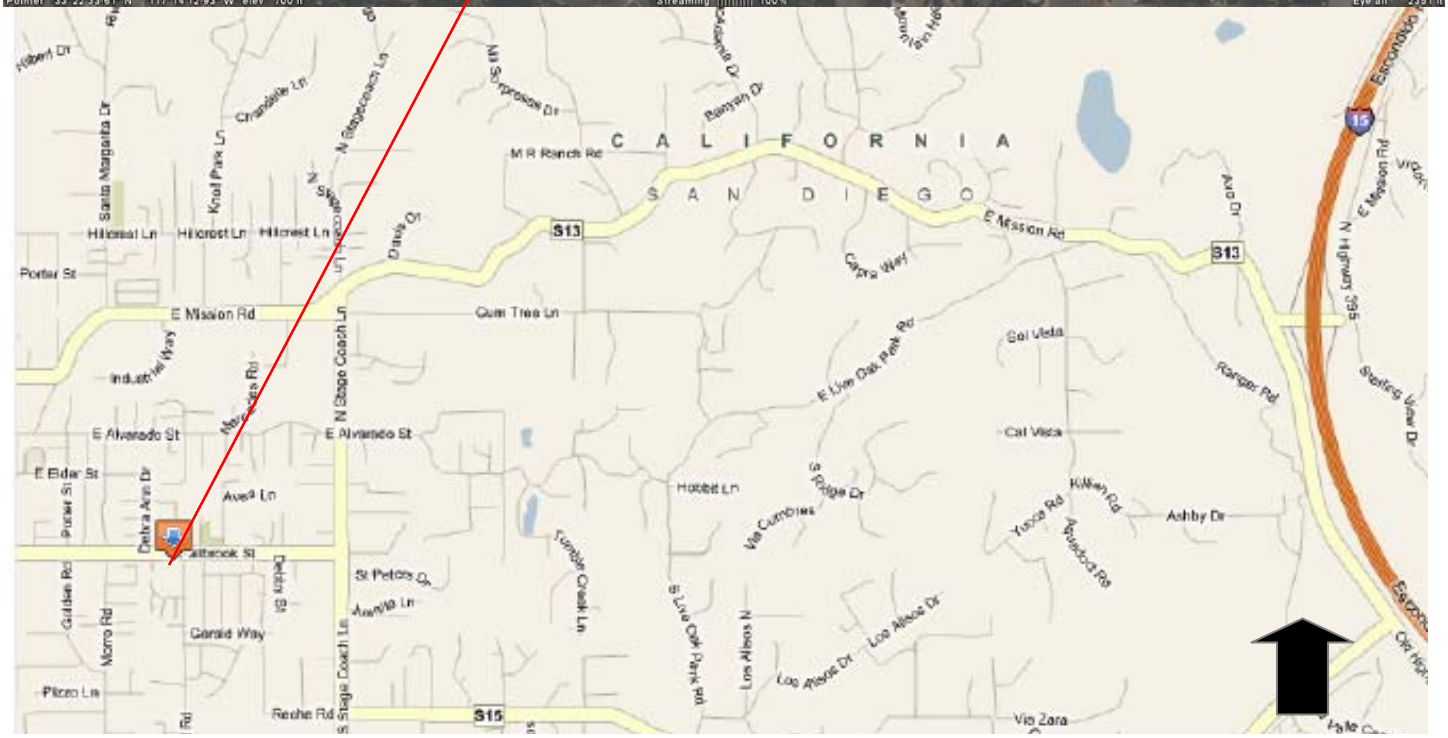
Scott R. Lyle 6/14/2015

Scott R. Lyle R.C.E. 44062 Date

Exp. 06-30-2017

APPENDIX I: SUPPORTING TABLES AND FIGURES





Date: 04/15/2009 Scale: N.T.S. Path:_____ DWG Name: VICINITY MAP Plotting View: NONE Designer: SRL Proj Mgr:	LYLE ENGINEERING, INC. 1030 LIGHTHOUSE ROAD CARLSBAD, CA 92011 (760) 703-1477 (760) 603-8128 FAX	# VICINITY MAP 1065 E. FALLBROOK STREET FALLBROOK, CA COUNTY OF SAN DIEGO JOB NUMBER: 09-07 1 OF 1 SHEET

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

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RATIONAL METHOD CALCULATION SHEET

PROJECT	HAGERTY TPM 21144 - ONSITE RUNOFF COEFFICIENTS			
FREQUENCY	100-YEAR			
SOIL TYPE	D			
DRAINAGE AREA	**LAND USE**	**A ACRES**	**C**	**CUM C**
EXISTING CONDITIONS				
100	OPEN SPACE, LANDSCAPED	1.38	0.35	0.35
200	OPEN SPACE, LANDSCAPED	0.23	0.35	0.35
300	ROADWAY	0.14	0.87	0.87
	TOTAL	1.75		
PROPOSED CONDITIONS				
100	MDR, 7.3 DU/A OR LESS	0.18	0.57	0.57
200	MDR, 7.3 DU/A OR LESS	0.15	0.57	0.57
300	MDR, 7.3 DU/A OR LESS	0.06	0.57	0.57
400	MDR, 7.3 DU/A OR LESS	0.25	0.57	
	ROADWAY	0.22	0.87	0.71
500	OPEN SPACE, LANDSCAPED	0.31	0.35	0.35
600	OPEN SPACE, LANDSCAPED	0.10	0.35	
	CONCRETE CHANNEL	0.04	0.90	0.52
700	ROADWAY	0.12	0.87	0.87
800	OPEN SPACE, LANDSCAPED	0.32	0.35	0.35
	TOTAL	1.75		

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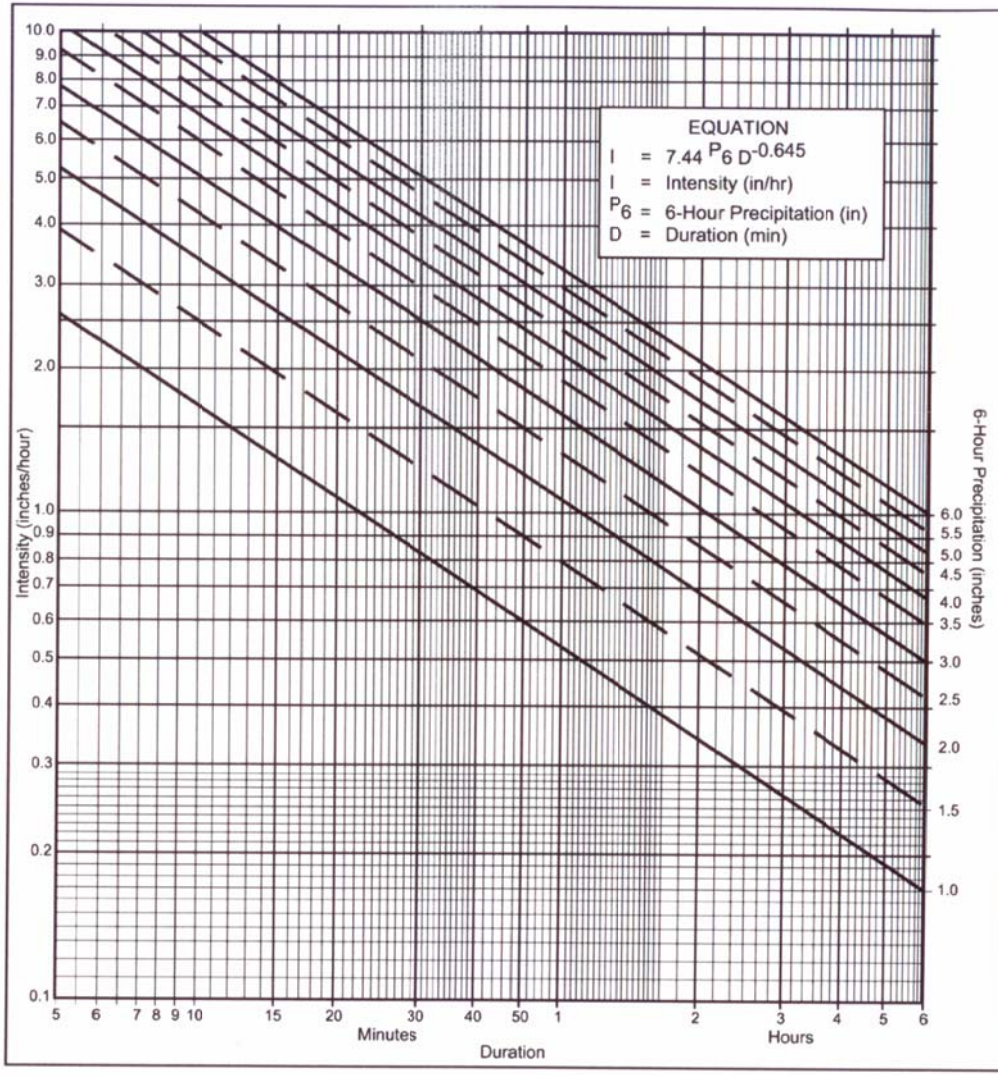
RATIONAL METHOD CALCULATION SHEET

PROJECT	HAGERTY TPM 21144 - OFFSITE RUNOFF COEFFICIENTS			
FREQUENCY	100-YEAR			
SOIL TYPE	D			
DRAINAGE AREA	**LAND USE**	**A ACRES**	**C**	**CUM C**
EXISTING CONDITIONS				
100	ROADWAY W/ SHOULDERS	1.2	0.87	0.87
102	MDR, 4.3 DU/A OR LESS	40.0	0.52	0.52
104	NEIGHBORHOOD COMM.	8.0	0.79	
	PARK, OPEN SPACE	2.0	0.41	0.71
106	LDR, 2.9 DU/A OR LESS	12.8	0.49	0.49
108	LDR, 2.9 DU/A OR LESS	9.0	0.49	
	OPEN SPACE	2.8	0.35	0.46
110	LDR, 2.9 DU/A OR LESS	14.9	0.49	0.49
119	LDR, 2.9 DU/A OR LESS	18.8	0.49	
	MDR, 10.9 DU/A OR LESS	4.2	0.60	
	AG/OPEN SPACE	2.8	0.35	0.49
120	LDR, 2.9 DU/A OR LESS	16.4	0.49	0.49
122	LDR, 2.9 DU/A OR LESS	10.8	0.49	0.49
200	MDR, 7.3 DU/A OR LESS	29.2	0.57	
	LDR, 2.9 DU/A OR LESS	16.4	0.49	
	OPEN SPACE	7.2	0.35	0.52
202	LDR, 2.9 DU/A OR LESS	6.7	0.49	
	MDR, 4.3 DU/A OR LESS	6.0	0.52	
	MDR, 7.3 DU/A OR LESS	4.0	0.57	0.52
204	LDR, 2.9 DU/A OR LESS	23.7	0.49	
	OPEN SPACE	7.0	0.35	0.46
206	LDR, 2.9 DU/A OR LESS	12.1	0.49	
	OPEN SPACE	4.0	0.35	0.46
208	MDR, 4.3 DU/A OR LESS	8.4	0.52	
	BALLFIELDS	2.0	0.41	
	OPEN SPACE	4.0	0.35	0.46
212	LDR, 2.9 DU/A OR LESS	14.4	0.49	
	MDR, 7.3 DU/A OR LESS	31.2	0.57	
	AG/OPEN SPACE	8.0	0.35	0.52
TOTAL		**328.0**		



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.0 in., P_{24} = 5.5, $\frac{P_6}{P_{24}}$ = 55 %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = VARIES min.

(e) I = VARIES in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

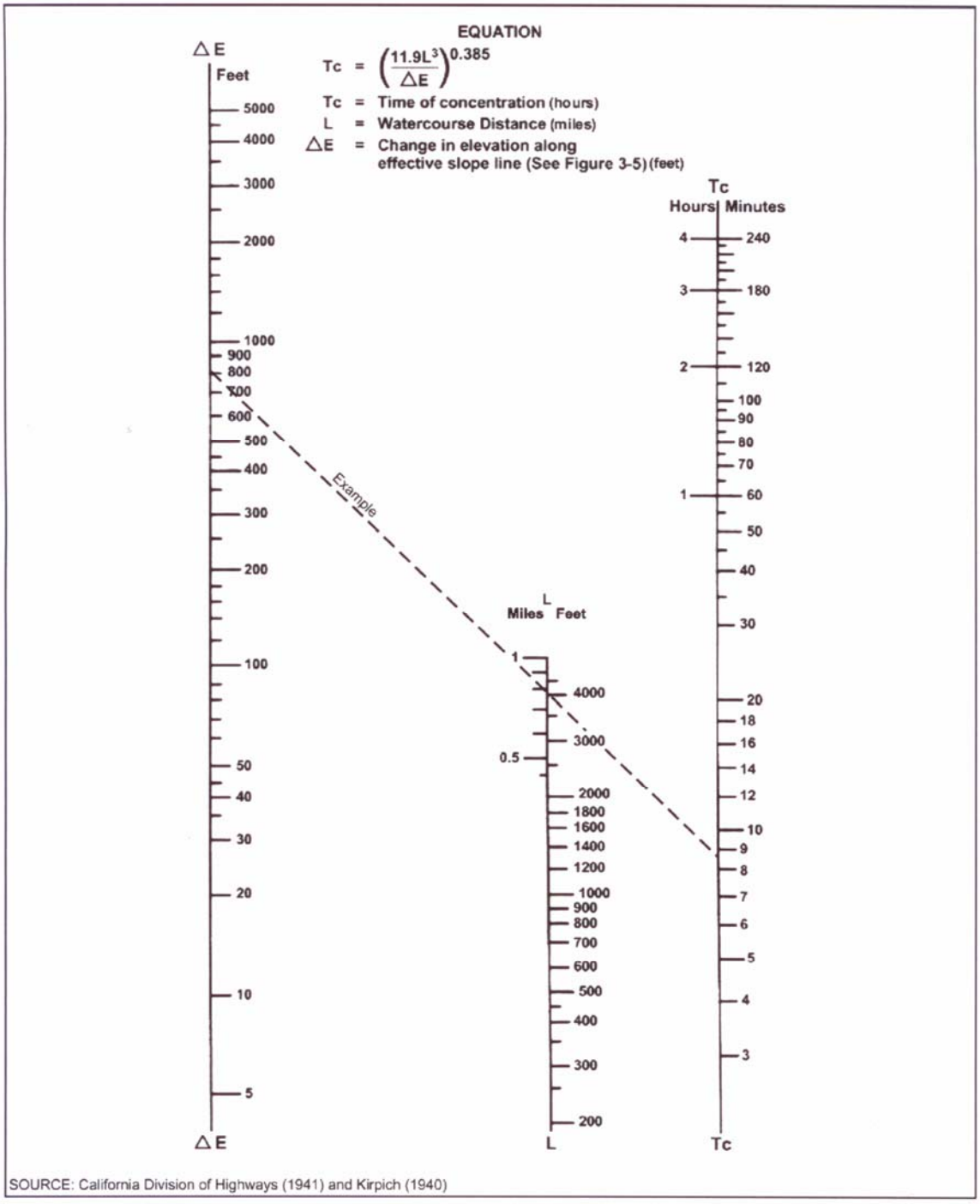
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

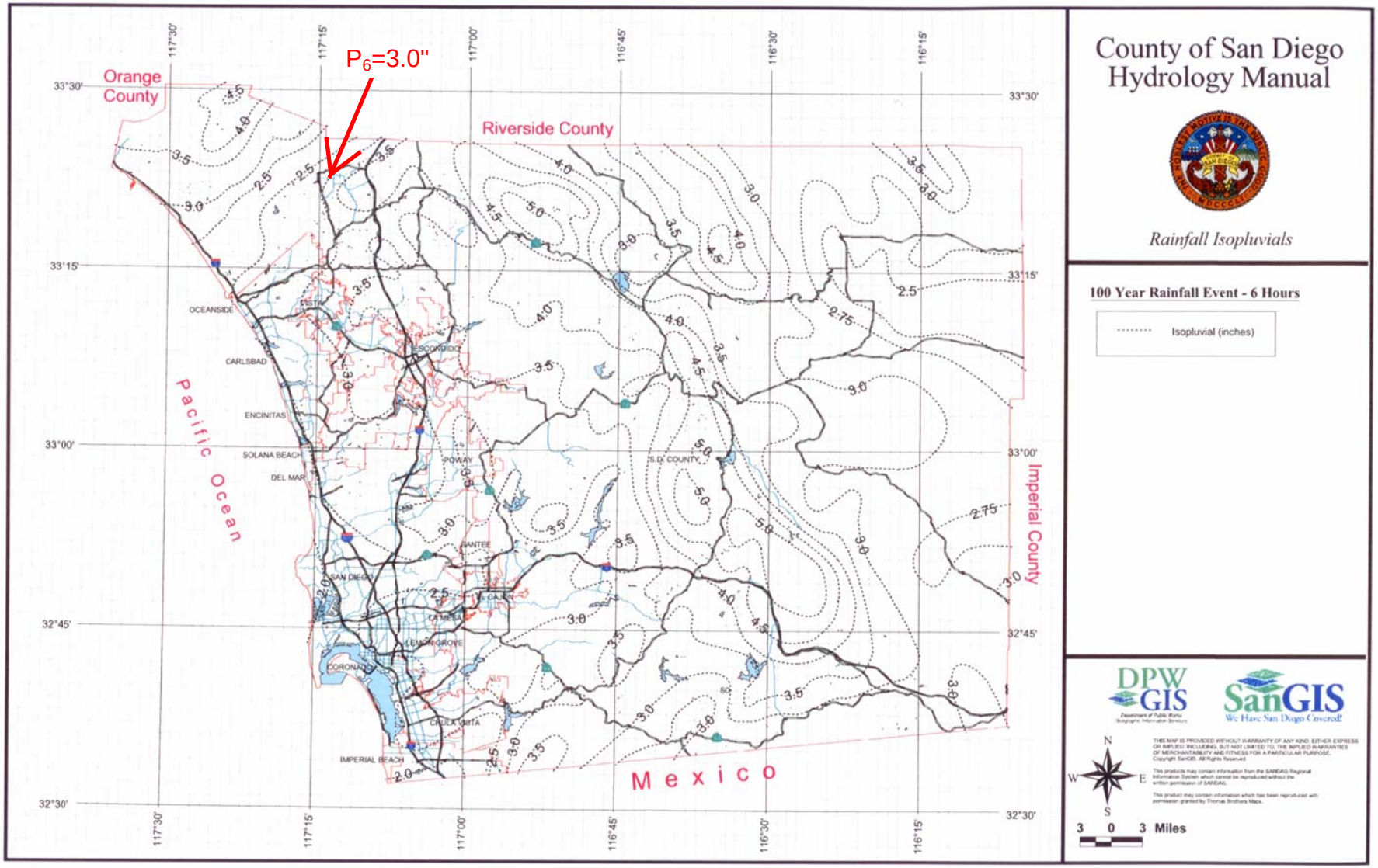
*See Table 3-1 for more detailed description



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

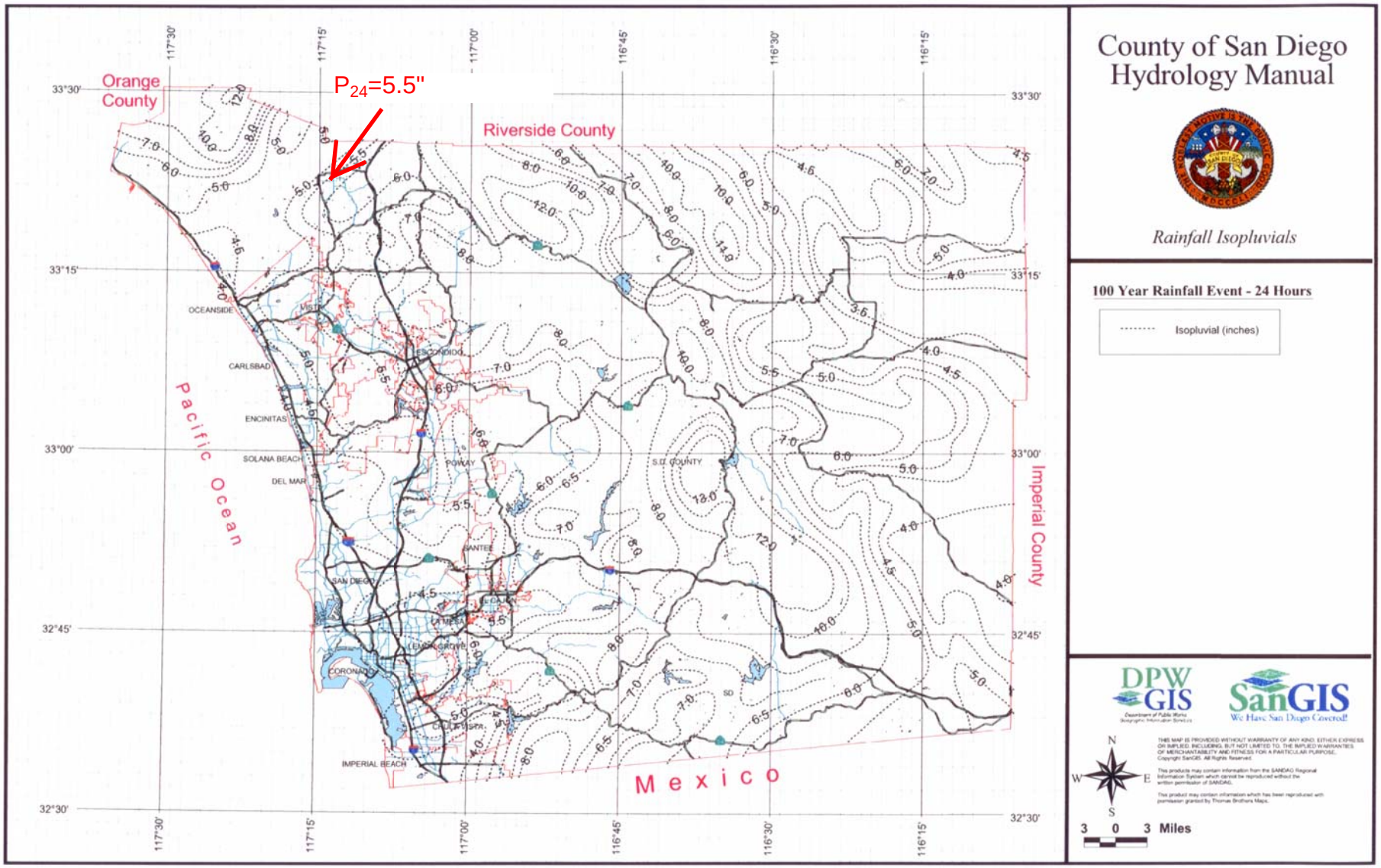
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

APPENDIX II: CALCULATIONS

Rational Method Calculations
(100-Year Pre-Development Conditions)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/03/15

HAGERTY TPM 21144
EXISTING CONDITIONS BASIN 100
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++

Process from Point/Station 102.000 to Point/Station 100.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 328.000(Ft.)
Highest elevation = 708.500(Ft.)
Lowest elevation = 700.000(Ft.)
Elevation difference = 8.500(Ft.) Slope = 2.591 %
Top of Initial Area Slope adjusted by User to 2.500 %
Bottom of Initial Area Slope adjusted by User to 2.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 2.50 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 9.95 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(2.500^(1/3)]= 9.95
The initial area total distance of 328.00 (Ft.) entered leaves a
remaining distance of 228.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 2.11 minutes

for a distance of 228.00 (Ft.) and a slope of 2.50 %
with an elevation difference of   5.70(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   2.113 Minutes
Tt=[(11.9*0.0432^3)/(5.70)]^.385= 2.11
Total initial area Ti =   9.95 minutes from Figure 3-3 formula plus
  2.11 minutes from the Figure 3-4 formula = 12.06 minutes
Rainfall intensity (I) =   4.479(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =   2.164(CFS)
Total initial stream area =   1.380(Ac.)
End of computations, total study area =   1.380 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study   Date: 04/03/15

HAGERTY TPM 21144
EXISTING CONDITIONS BASIN 200
100-YEAR

 *********   Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 =   54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   202.000 to Point/Station   200.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 172.000(Ft.)
Highest elevation = 711.200(Ft.)
Lowest elevation = 699.200(Ft.)
Elevation difference =   12.000(Ft.) Slope = 6.977 %
Top of Initial Area Slope adjusted by User to 20.000 %
Bottom of Initial Area Slope adjusted by User to 0.100 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 20.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.97 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(20.000^(1/3)]=   4.97
The initial area total distance of 172.00 (Ft.) entered leaves a
remaining distance of   72.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.00 minutes

for a distance of 72.00 (Ft.) and a slope of 0.10 %
with an elevation difference of 0.07(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 = 3.004 Minutes
Tt=[(11.9*0.0136^3)/(0.07)]^.385= 3.00
Total initial area Ti = 4.97 minutes from Figure 3-3 formula plus
  3.00 minutes from the Figure 3-4 formula = 7.98 minutes
Rainfall intensity (I) = 5.848(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.471(CFS)
Total initial stream area = 0.230(Ac.)
End of computations, total study area = 0.230 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/03/15

HAGERTY TPM 21144
EXISTING CONDITIONS BASIN 300
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 302.000 to Point/Station 300.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type]
(General Industrial)
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance = 190.000(Ft.)
Highest elevation = 712.500(Ft.)
Lowest elevation = 709.500(Ft.)
Elevation difference = 3.000(Ft.) Slope = 1.579 %
Top of Initial Area Slope adjusted by User to 1.111 %
Bottom of Initial Area Slope adjusted by User to 1.111 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 1.11 %, in a development type of
General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.10 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(60.000^.5)/(1.111^(1/3)]= 3.10
The initial area total distance of 190.00 (Ft.) entered leaves a
remaining distance of 130.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.87 minutes

for a distance of 130.00 (Ft.) and a slope of 1.11 %
with an elevation difference of   1.44(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   1.874 Minutes
Tt=[(11.9*0.0246^3)/(1.44)]^.385= 1.87
Total initial area Ti =   3.10 minutes from Figure 3-3 formula plus
  1.87 minutes from the Figure 3-4 formula =   4.97 minutes
Calculated TC of   4.970 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =   7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =   0.963(CFS)
Total initial stream area =   0.140(Ac.)
End of computations, total study area =   0.140 (Ac.)

Rational Method Calculations
(100-Year Post-Development Conditions)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 100
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++

Process from Point/Station 102.000 to Point/Station 100.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(7.3 DU/A or Less)
Impervious value, Ai = 0.400
Sub-Area C Value = 0.570
Initial subarea total flow distance = 120.000(Ft.)
Highest elevation = 708.000(Ft.)
Lowest elevation = 705.000(Ft.)
Elevation difference = 3.000(Ft.) Slope = 2.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
for the top area slope value of 2.50 %, in a development type of
7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 6.85 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5700)*(95.000^.5)/(2.500^(1/3)]= 6.85
The initial area total distance of 120.00 (Ft.) entered leaves a
remaining distance of 25.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 0.39 minutes
for a distance of 25.00 (Ft.) and a slope of 2.50 %
with an elevation difference of 0.63(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   0.385 Minutes
Tt=[(11.9*0.0047^3)/(0.63)]^.385= 0.39
Total initial area Ti =   6.85 minutes from Figure 3-3 formula plus
  0.39 minutes from the Figure 3-4 formula =   7.24 minutes
Rainfall intensity (I) =   6.227(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff =   0.639(CFS)
Total initial stream area =   0.180(Ac.)
End of computations, total study area =   0.180 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 200
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 202.000 to Point/Station 200.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(7.3 DU/A or Less)
Impervious value, Ai = 0.400
Sub-Area C Value = 0.570
Initial subarea total flow distance = 112.000(Ft.)
Highest elevation = 708.000(Ft.)
Lowest elevation = 707.000(Ft.)
Elevation difference = 1.000(Ft.) Slope = 0.893 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of 0.89 %, in a development type of
7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 7.99 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5700)*(65.000^.5)/(0.893^(1/3)]= 7.99
The initial area total distance of 112.00 (Ft.) entered leaves a
remaining distance of 47.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 0.93 minutes
for a distance of 47.00 (Ft.) and a slope of 0.89 %
with an elevation difference of 0.42(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   0.931 Minutes
Tt=[(11.9*0.0089^3)/(0.42)]^.385= 0.93
Total initial area Ti =   7.99 minutes from Figure 3-3 formula plus
  0.93 minutes from the Figure 3-4 formula =   8.92 minutes
Rainfall intensity (I) =   5.442(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff =   0.465(CFS)
Total initial stream area =   0.150(Ac.)
End of computations, total study area =   0.150 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 300
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 302.000 to Point/Station 300.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(7.3 DU/A or Less)
Impervious value, Ai = 0.400
Sub-Area C Value = 0.570
Initial subarea total flow distance = 90.000(Ft.)
Highest elevation = 704.000(Ft.)
Lowest elevation = 703.000(Ft.)
Elevation difference = 1.000(Ft.) Slope = 1.111 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of 1.11 %, in a development type of
7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 7.43 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5700)*(65.000^.5)/(1.111^(1/3)]= 7.43
The initial area total distance of 90.00 (Ft.) entered leaves a
remaining distance of 25.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 0.53 minutes
for a distance of 25.00 (Ft.) and a slope of 1.11 %
with an elevation difference of 0.28(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   0.527 Minutes
Tt=[(11.9*0.0047^3)/(0.28)]^.385= 0.53
Total initial area Ti =   7.43 minutes from Figure 3-3 formula plus
  0.53 minutes from the Figure 3-4 formula =   7.95 minutes
Rainfall intensity (I) =   5.860(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff =   0.200(CFS)
Total initial stream area =   0.060(Ac.)
End of computations, total study area =   0.060 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 400
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 402.000 to Point/Station 400.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL]
(24.0 DU/A or Less)
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance = 272.000(Ft.)
Highest elevation = 712.000(Ft.)
Lowest elevation = 700.000(Ft.)
Elevation difference = 12.000(Ft.) Slope = 4.412 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
for the top area slope value of 4.41 %, in a development type of
24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.17 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7100)*(95.000^.5)/(4.412^(1/3)]= 4.17
The initial area total distance of 272.00 (Ft.) entered leaves a
remaining distance of 177.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.40 minutes
for a distance of 177.00 (Ft.) and a slope of 4.41 %
with an elevation difference of 7.81(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   1.397 Minutes
Tt=[(11.9*0.0335^3)/(7.81)]^.385= 1.40
Total initial area Ti =   4.17 minutes from Figure 3-3 formula plus
  1.40 minutes from the Figure 3-4 formula =   5.57 minutes
Rainfall intensity (I) =   7.373(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =   2.460(CFS)
Total initial stream area =   0.470(Ac.)
End of computations, total study area =   0.470 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 500
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 502.000 to Point/Station 500.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 300.000(Ft.)
Highest elevation = 708.000(Ft.)
Lowest elevation = 704.000(Ft.)
Elevation difference = 4.000(Ft.) Slope = 1.333 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.33 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 10.27 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(70.000^.5)/(1.330^(1/3)]= 10.27
The initial area total distance of 300.00 (Ft.) entered leaves a
remaining distance of 230.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 2.71 minutes
for a distance of 230.00 (Ft.) and a slope of 1.33 %
with an elevation difference of 3.06(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   2.713 Minutes
Tt=[(11.9*0.0436^3)/(3.06)]^.385= 2.71
Total initial area Ti = 10.27 minutes from Figure 3-3 formula plus
  2.71 minutes from the Figure 3-4 formula = 12.98 minutes
Rainfall intensity (I) =   4.271(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =   0.463(CFS)
Total initial stream area =   0.310(Ac.)
End of computations, total study area =   0.310 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 600
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 602.000 to Point/Station 600.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(4.3 DU/A or Less)
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance = 150.000(Ft.)
Highest elevation = 704.000(Ft.)
Lowest elevation = 702.000(Ft.)
Elevation difference = 2.000(Ft.) Slope = 1.333 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.33 %, in a development type of
4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 7.94 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*(70.000^.5)/(1.333^(1/3)]= 7.94
The initial area total distance of 150.00 (Ft.) entered leaves a
remaining distance of 80.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.20 minutes
for a distance of 80.00 (Ft.) and a slope of 1.33 %
with an elevation difference of 1.07(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   1.202 Minutes
Tt=[(11.9*0.0152^3)/(1.07)]^.385= 1.20
Total initial area Ti =   7.94 minutes from Figure 3-3 formula plus
  1.20 minutes from the Figure 3-4 formula =   9.14 minutes
Rainfall intensity (I) =   5.357(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =   0.390(CFS)
Total initial stream area =   0.140(Ac.)
End of computations, total study area =   0.140 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 700
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 702.000 to Point/Station 700.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type]
(General Industrial)
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance = 175.000(Ft.)
Highest elevation = 712.600(Ft.)
Lowest elevation = 709.500(Ft.)
Elevation difference = 3.100(Ft.) Slope = 1.771 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.77 %, in a development type of
General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 2.86 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(70.000^.5)/(1.770^(1/3)]= 2.86
The initial area total distance of 175.00 (Ft.) entered leaves a
remaining distance of 105.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.33 minutes
for a distance of 105.00 (Ft.) and a slope of 1.77 %
with an elevation difference of 1.86(Ft.) from the end of the top area

Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   1.329 Minutes
Tt=[(11.9*0.0199^3)/(1.86)]^.385= 1.33
Total initial area Ti =   2.86 minutes from Figure 3-3 formula plus
  1.33 minutes from the Figure 3-4 formula =   4.19 minutes
Calculated TC of   4.192 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =   7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =   0.825(CFS)
Total initial stream area =   0.120(Ac.)
End of computations, total study area =   0.120 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study   Date: 04/04/15

HAGERTY TPM 21144
PROPOSED CONDITIONS BASIN 800
100-YEAR

 *********   Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 =   54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   802.000 to Point/Station   800.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 180.000(Ft.)
Highest elevation = 711.200(Ft.)
Lowest elevation = 699.200(Ft.)
Elevation difference =   12.000(Ft.) Slope = 6.667 %
Top of Initial Area Slope adjusted by User to 20.000 %
Bottom of Initial Area Slope adjusted by User to 0.100 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 20.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.97 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(20.000^(1/3)]=   4.97
The initial area total distance of 180.00 (Ft.) entered leaves a
remaining distance of   80.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.26 minutes

for a distance of 80.00 (Ft.) and a slope of 0.10 %
with an elevation difference of 0.08(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 = 3.258 Minutes
Tt=[(11.9*0.0152^3)/(0.08)]^.385= 3.26
Total initial area Ti = 4.97 minutes from Figure 3-3 formula plus
  3.26 minutes from the Figure 3-4 formula = 8.23 minutes
Rainfall intensity (I) = 5.731(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.642(CFS)
Total initial stream area = 0.320(Ac.)
End of computations, total study area = 0.320 (Ac.)

Offsite Hydrology

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 7.5

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study   Date: 08/26/11

HAGERTY TPM 21144
54" CULVERT CONTRIBUTING WATERSHED
100-YEAR

 *********   Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 =   54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   112.000 to Point/Station   110.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL   ]
(2.9 DU/A or Less   )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.490
Initial subarea total flow distance = 1453.000(Ft.)
Highest elevation = 902.000(Ft.)
Lowest elevation = 795.000(Ft.)
Elevation difference = 107.000(Ft.) Slope = 7.364 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   7.36 %, in a development type of
 2.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.64 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4900)*(100.000^.5)/(7.364^(1/3)]=   5.64
The initial area total distance of 1453.00 (Ft.) entered leaves a
remaining distance of 1353.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.49 minutes
for a distance of 1353.00 (Ft.) and a slope of 7.36 %
with an elevation difference of 99.63(Ft.) from the end of the top area

```
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.494 Minutes
Tt=[(11.9*0.2562^3)/( 99.63)]^.385=  5.49
Total initial area Ti =   5.64 minutes from Figure 3-3 formula plus
  5.49 minutes from the Figure 3-4 formula =  11.14 minutes
Rainfall intensity (I) =      4.715(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.490
Subarea runoff =     34.427(CFS)
Total initial stream area =       14.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      108.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   795.000(Ft.)
Downstream point elevation =   760.000(Ft.)
Channel length thru subarea  =   737.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     43.186(CFS)
Manning's 'N'    = 0.060
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     43.186(CFS)
Depth of flow =   1.072(Ft.), Average velocity =   4.334(Ft/s)
Channel flow top width =   13.580(Ft.)
Flow Velocity =    4.33(Ft/s)
Travel time  =    2.83 min.
Time of concentration =   13.97 min.
Critical depth =      1.008(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.460
Rainfall intensity =      4.074(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.477  CA =     12.729
Subarea runoff =     17.430(CFS) for     11.800(Ac.)
Total runoff =     51.858(CFS)   Total area =      26.700(Ac.)
Depth of flow =   1.174(Ft.), Average velocity =   4.555(Ft/s)
Critical depth =      1.109(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      106.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   760.000(Ft.)
Downstream point elevation =   720.000(Ft.)
Channel length thru subarea  =  1545.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     55.828(CFS)
Manning's 'N'    = 0.060
```

```
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     55.828(CFS)
Depth of flow =   1.410(Ft.), Average velocity =   3.721(Ft/s)
Channel flow top width =   16.280(Ft.)
Flow Velocity =    3.72(Ft/s)
Travel time  =    6.92 min.
Time of concentration =   20.89 min.
Critical depth =      1.156(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.490
Rainfall intensity =      3.143(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.481  CA =     19.001
Subarea runoff =      7.859(CFS) for     12.800(Ac.)
Total runoff =     59.716(CFS)   Total area =      39.500(Ac.)
Depth of flow =   1.456(Ft.), Average velocity =   3.788(Ft/s)
Critical depth =      1.203(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     39.500(Ac.)
Runoff from this stream =     59.716(CFS)
Time of concentration =   20.89 min.
Rainfall intensity =     3.143(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      122.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.490
Initial subarea total flow distance  =  892.000(Ft.)
Highest elevation =  893.000(Ft.)
Lowest elevation =  835.000(Ft.)
Elevation difference =   58.000(Ft.) Slope =  6.502 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.50 %, in a development type of
 2.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.88 minutes
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```
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4900)*( 100.000^.5)/(   6.502^(1/3)]=   5.88
The initial area total distance of  892.00 (Ft.) entered leaves a
remaining distance of  792.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.82 minutes
for a distance of 792.00 (Ft.) and a slope of  6.50 %
with an elevation difference of  51.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.816 Minutes
Tt=[(11.9*0.1500^3)/( 51.50)]^.385=  3.82
Total initial area Ti =   5.88 minutes from Figure 3-3 formula plus
  3.82 minutes from the Figure 3-4 formula =   9.70 minutes
Rainfall intensity (I) =      5.155(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.490
Subarea runoff =     27.283(CFS)
Total initial stream area =       10.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      120.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   835.000(Ft.)
Downstream point elevation =   770.000(Ft.)
Channel length thru subarea  =  1098.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     41.510(CFS)
Manning's 'N'    = 0.060
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     41.510(CFS)
Depth of flow =   1.044(Ft.), Average velocity =   4.892(Ft/s)
Channel flow top width =   11.262(Ft.)
Flow Velocity =    4.89(Ft/s)
Travel time  =    3.74 min.
Time of concentration =   13.44 min.
Critical depth =      1.039(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.490
Rainfall intensity =      4.177(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.490  CA =     13.328
Subarea runoff =     28.392(CFS) for     16.400(Ac.)
Total runoff =     55.674(CFS)   Total area =      27.200(Ac.)
Depth of flow =   1.213(Ft.), Average velocity =   5.310(Ft/s)
Critical depth =      1.219(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      106.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   770.000(Ft.)
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Downstream point elevation =   720.000(Ft.)
Channel length thru subarea  =  1198.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     72.259(CFS)
Manning's 'N'    = 0.080
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     72.259(CFS)
Depth of flow =   1.738(Ft.), Average velocity =   4.069(Ft/s)
Channel flow top width =   15.431(Ft.)
Flow Velocity =    4.07(Ft/s)
Travel time  =    4.91 min.
Time of concentration =   18.35 min.
Critical depth =      1.406(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                      ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.490
Rainfall intensity =      3.417(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.490  CA =     25.970
Subarea runoff =     33.077(CFS) for     25.800(Ac.)
Total runoff =     88.751(CFS)   Total area =      53.000(Ac.)
Depth of flow =   1.920(Ft.), Average velocity =   4.297(Ft/s)
Critical depth =      1.563(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     53.000(Ac.)
Runoff from this stream =     88.751(CFS)
Time of concentration =   18.35 min.
Rainfall intensity =     3.417(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       59.716     20.89            3.143
2       88.751     18.35            3.417
Qmax(1) =
        1.000 *    1.000 *    59.716) +
        0.920 *    1.000 *    88.751) + =     141.335
Qmax(2) =
        1.000 *    0.878 *    59.716) +
        1.000 *    1.000 *    88.751) + =     141.194

Total of 2 main streams to confluence:
Flow rates before confluence point:
      59.716      88.751
```

```
Maximum flow rates at confluence using above data:
      141.335      141.194
Area of streams before confluence:
       39.500       53.000


Results of confluence:
Total flow rate =    141.335(CFS)
Time of concentration =    20.891 min.
Effective stream area after confluence  =     92.500(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      104.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   720.000(Ft.)
Downstream point elevation =   704.000(Ft.)
Channel length thru subarea  =   663.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =    146.638(CFS)
Manning's 'N'    = 0.080
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    146.638(CFS)
Depth of flow =   3.062(Ft.), Average velocity =   4.305(Ft/s)
Channel flow top width =   17.248(Ft.)
Flow Velocity =    4.30(Ft/s)
Travel time  =    2.57 min.
Time of concentration =   23.46 min.
Critical depth =      2.219(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Rainfall intensity =      2.916(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.508  CA =     52.071
Subarea runoff =     10.528(CFS) for     10.000(Ac.)
Total runoff =    151.863(CFS)   Total area =     102.500(Ac.)
Depth of flow =   3.114(Ft.), Average velocity =   4.344(Ft/s)
Critical depth =      2.266(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
```

```
Sub-Area C Value = 0.870
Time of concentration =    23.46 min.
Rainfall intensity =      2.916(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.512  CA =     53.115
Subarea runoff =      3.045(CFS) for      1.200(Ac.)
Total runoff =    154.908(CFS)   Total area =     103.700(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Time of concentration =    23.46 min.
Rainfall intensity =      2.916(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.514  CA =     73.915
Subarea runoff =     60.662(CFS) for     40.000(Ac.)
Total runoff =    215.570(CFS)   Total area =     143.700(Ac.)
End of computations, total study area =         143.700 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 7.5

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 08/26/11

HAGERTY TPM 21144
OSTRICH CREEK CONTRIBUTING WATERSHED
100-YEAR

********* Hydrology Study Control Information **********

Program License Serial Number 4071

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.500
P6/P24 = 54.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 210.000 to Point/Station 208.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL]
(2.0 DU/A or Less)
Impervious value, Ai = 0.200
Sub-Area C Value = 0.460
Initial subarea total flow distance = 1393.000(Ft.)
Highest elevation = 967.000(Ft.)
Lowest elevation = 855.000(Ft.)
Elevation difference = 112.000(Ft.) Slope = 8.040 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 8.04 %, in a development type of
2.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.75 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4600)*(100.000^.5)/(8.040^(1/3)]= 5.75
The initial area total distance of 1393.00 (Ft.) entered leaves a
remaining distance of 1293.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 5.13 minutes
for a distance of 1293.00 (Ft.) and a slope of 8.04 %
with an elevation difference of 103.96(Ft.) from the end of the top area

```
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.129 Minutes
Tt=[(11.9*0.2449^3)/(103.96)]^.385=  5.13
Total initial area Ti =   5.75 minutes from Figure 3-3 formula plus
  5.13 minutes from the Figure 3-4 formula =  10.88 minutes
Rainfall intensity (I) =      4.787(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.460
Subarea runoff =     31.711(CFS)
Total initial stream area =       14.400(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      206.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   855.000(Ft.)
Downstream point elevation =   805.000(Ft.)
Channel length thru subarea  =   758.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     44.207(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     44.207(CFS)
Depth of flow =   1.460(Ft.), Average velocity =   3.824(Ft/s)
Channel flow top width =   10.839(Ft.)
Flow Velocity =    3.82(Ft/s)
Travel time  =    3.30 min.
Time of concentration =   14.18 min.
Critical depth =      1.141(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.460
Rainfall intensity =      4.035(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.460  CA =     14.030
Subarea runoff =     24.895(CFS) for     16.100(Ac.)
Total runoff =     56.606(CFS)   Total area =      30.500(Ac.)
Depth of flow =   1.661(Ft.), Average velocity =   4.096(Ft/s)
Critical depth =      1.313(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      204.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   805.000(Ft.)
Downstream point elevation =   772.000(Ft.)
Channel length thru subarea  =  1029.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     75.021(CFS)
Manning's 'N'    = 0.100
```

```
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     75.021(CFS)
Depth of flow =   2.299(Ft.), Average velocity =   3.400(Ft/s)
Channel flow top width =   14.196(Ft.)
Flow Velocity =    3.40(Ft/s)
Travel time  =    5.04 min.
Time of concentration =   19.23 min.
Critical depth =      1.547(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.460
Rainfall intensity =      3.316(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.460  CA =     28.152
Subarea runoff =     36.735(CFS) for     30.700(Ac.)
Total runoff =     93.341(CFS)   Total area =      61.200(Ac.)
Depth of flow =   2.560(Ft.), Average velocity =   3.603(Ft/s)
Critical depth =      1.750(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      202.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   772.000(Ft.)
Downstream point elevation =   735.000(Ft.)
Channel length thru subarea  =  1175.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =    100.156(CFS)
Manning's 'N'    = 0.060
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    100.156(CFS)
Depth of flow =   1.681(Ft.), Average velocity =   4.446(Ft/s)
Channel flow top width =   21.807(Ft.)
Flow Velocity =    4.45(Ft/s)
Travel time  =    4.40 min.
Time of concentration =   23.63 min.
Critical depth =      1.484(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Rainfall intensity =      2.903(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.473  CA =     36.836
Subarea runoff =     13.578(CFS) for     16.700(Ac.)
Total runoff =    106.919(CFS)   Total area =      77.900(Ac.)
Depth of flow =   1.731(Ft.), Average velocity =   4.522(Ft/s)
```

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Critical depth =      1.531(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      202.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     77.900(Ac.)
Runoff from this stream =    106.919(CFS)
Time of concentration =   23.63 min.
Rainfall intensity =     2.903(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance  = 2632.000(Ft.)
Highest elevation =  850.000(Ft.)
Lowest elevation =  735.000(Ft.)
Elevation difference =  115.000(Ft.) Slope =  4.369 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   4.37 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.39 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*( 100.000^.5)/(   4.369^(1/3)]=   6.39
The initial area total distance of 2632.00 (Ft.) entered leaves a
remaining distance of 2532.00 (Ft.)
Using Figure 3-4, the travel time for this distance is  10.88 minutes
for a distance of 2532.00 (Ft.) and a slope of  4.37 %
with an elevation difference of 110.62(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   10.882 Minutes
Tt=[(11.9*0.4795^3)/(110.62)]^.385= 10.88
Total initial area Ti =   6.39 minutes from Figure 3-3 formula plus
 10.88 minutes from the Figure 3-4 formula =  17.27 minutes
Rainfall intensity (I) =      3.554(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =     99.046(CFS)
Total initial stream area =       53.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      202.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
```

```
In Main Stream number: 2
Stream flow area =     53.600(Ac.)
Runoff from this stream =     99.046(CFS)
Time of concentration =   17.27 min.
Rainfall intensity =     3.554(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      106.919     23.63            2.903
2       99.046     17.27            3.554
Qmax(1) =
         1.000 *    1.000 *   106.919) +
         0.817 *    1.000 *    99.046) + =     187.820
Qmax(2) =
         1.000 *    0.731 *   106.919) +
         1.000 *    1.000 *    99.046) + =     177.173

Total of 2 main streams to confluence:
Flow rates before confluence point:
     106.919      99.046
Maximum flow rates at confluence using above data:
      187.820      177.173
Area of streams before confluence:
       77.900       53.600


Results of confluence:
Total flow rate =    187.820(CFS)
Time of concentration =    23.632 min.
Effective stream area after confluence  =    131.500(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      200.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   735.000(Ft.)
Downstream point elevation =   702.000(Ft.)
Channel length thru subarea  =  1508.000(Ft.)
Channel base width    =   10.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    212.334(CFS)
Manning's 'N'    = 0.060
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    212.334(CFS)
Depth of flow =   2.412(Ft.), Average velocity =   5.108(Ft/s)
Channel flow top width =   24.471(Ft.)
Flow Velocity =    5.11(Ft/s)
Travel time  =    4.92 min.
Time of concentration =   28.55 min.
Critical depth =      1.969(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
```

(4.3 DU/A or Less)
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Rainfall intensity = 2.569(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.500 CA = 92.164
Subarea runoff = 48.969(CFS) for 52.800(Ac.)
Total runoff = 236.789(CFS) Total area = 184.300(Ac.)
Depth of flow = 2.549(Ft.), Average velocity = 5.264(Ft/s)
Critical depth = 2.094(Ft.)
End of computations, total study area = 184.300 (Ac.)

Offsite Detention and Hydraulic Calculations

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 8/27/2011
HYDROGRAPH FILE NAME Text1

TIME OF CONCENTRATION 29 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 184.3 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 237 CFS

TIME (MIN) = 0 DISCHARGE (CFS) = 0
TIME (MIN) = 29 DISCHARGE (CFS) = 17.2
TIME (MIN) = 58 DISCHARGE (CFS) = 18.3
TIME (MIN) = 87 DISCHARGE (CFS) = 20.9
TIME (MIN) = 116 DISCHARGE (CFS) = 22.7
TIME (MIN) = 145 DISCHARGE (CFS) = 27.8
TIME (MIN) = 174 DISCHARGE (CFS) = 31.6
TIME (MIN) = 203 DISCHARGE (CFS) = 46.4
TIME (MIN) = 232 DISCHARGE (CFS) = 62.8
TIME (MIN) = 261 DISCHARGE (CFS) = 237
TIME (MIN) = 290 DISCHARGE (CFS) = 37.2
TIME (MIN) = 319 DISCHARGE (CFS) = 24.9
TIME (MIN) = 348 DISCHARGE (CFS) = 19.5
TIME (MIN) = 377 DISCHARGE (CFS) = 0

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   30AUG11  TIME  14:27:01  *                                    *           (916) 756-1104             *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                  HEC-1 INPUT                                                  PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                        *DIAGRAM
 *** FREE ***
              1         ID   HAGERTY TPM 21144
              2         ID   OSTRICH CREEK CROSSING AT E. FALLBROOK ST.
              3         ID   100-YEAR ROUTING ANALYSES
              4         ID   RATIONAL METHOD HYDROGRAPH BASED ON 2003 COUNTY HYDROLOGY MANUAL
              5         IT       2 01JAN90    1200     300

              6         KK     200
              7         KM   6HR RAINFALL = 3.00 INCHES
              8         KM   RATIONAL METHOD AVERAGE RUNOFF COEFFICIENT = 0.50
              9         KM   RATIONAL METHOD TIME OF CONCENTRATION = 28.55 MIN.
             10         BA   0.288
             11         IN      29 01JAN90    1155
             12         QI     0.0    17.2    18.3    20.9    22.7    27.8    31.6    46.4    62.8   237.0
             13         QI    37.2    24.9    19.5     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             14         QI     0.0     0.0

             15         KK   BASIN
             16         KM   48" CULVERT
             17         KO       1       2
             18         RS       1    STOR      -1
             19         SV  0.0000   0.169   0.675   1.200   1.868   2.672   3.613   5.281
             20         SQ       0    15.2    44.8    71.1    94.2   113.9   130.4   151.5
             21         SE   701.1   702.5     704     705     706     707     708   709.5
             22         ZZ
1
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

    NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

      6         200
                  V
                  V
     15       BASIN

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   30AUG11  TIME  14:27:01  *                                    *           (916) 756-1104             *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************


                            HAGERTY TPM 21144
                            OSTRICH CREEK CROSSING AT E. FALLBROOK ST.
                            100-YEAR ROUTING ANALYSES
                            RATIONAL METHOD HYDROGRAPH BASED ON 2003 COUNTY HYDROLOGY MANUAL

      IT          HYDROGRAPH TIME DATA
                        NMIN          2  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1JAN90  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1JAN90  ENDING DATE
                      NDTIME        2158  ENDING TIME
                       ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL     .03 HOURS
                         TOTAL TIME BASE    9.97 HOURS

               ENGLISH UNITS
                    DRAINAGE AREA         SQUARE MILES
                    PRECIPITATION DEPTH   INCHES
                    LENGTH, ELEVATION     FEET
```

FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

*** ***

```
          **************
          *            *
  6 KK    *      200   *
          *            *
          **************
```

6HR RAINFALL = 3.00 INCHES
RATIONAL METHOD AVERAGE RUNOFF COEFFICIENT = 0.50
RATIONAL METHOD TIME OF CONCENTRATION = 28.55 MIN.

11 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 29 TIME INTERVAL IN MINUTES
JXDATE 1JAN90 STARTING DATE
JXTIME 1155 STARTING TIME

SUBBASIN RUNOFF DATA

10 BA SUBBASIN CHARACTERISTICS
TAREA .29 SUBBASIN AREA

***

****

HYDROGRAPH AT STATION 200

****

DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW
1 JAN 1200	1	3.	1 JAN 1430	76	29.	1 JAN 1700	151	31.	1 JAN 1930	226	0.
1 JAN 1202	2	4.	1 JAN 1432	77	29.	1 JAN 1702	152	30.	1 JAN 1932	227	0.
1 JAN 1204	3	5.	1 JAN 1434	78	30.	1 JAN 1704	153	29.	1 JAN 1934	228	0.
1 JAN 1206	4	7.	1 JAN 1436	79	30.	1 JAN 1706	154	28.	1 JAN 1936	229	0.
1 JAN 1208	5	8.	1 JAN 1438	80	30.	1 JAN 1708	155	27.	1 JAN 1938	230	0.
1 JAN 1210	6	9.	1 JAN 1440	81	30.	1 JAN 1710	156	27.	1 JAN 1940	231	0.
1 JAN 1212	7	10.	1 JAN 1442	82	31.	1 JAN 1712	157	26.	1 JAN 1942	232	0.
1 JAN 1214	8	11.	1 JAN 1444	83	31.	1 JAN 1714	158	25.	1 JAN 1944	233	0.
1 JAN 1216	9	12.	1 JAN 1446	84	31.	1 JAN 1716	159	25.	1 JAN 1946	234	0.
1 JAN 1218	10	14.	1 JAN 1448	85	31.	1 JAN 1718	160	24.	1 JAN 1948	235	0.
1 JAN 1220	11	15.	1 JAN 1450	86	32.	1 JAN 1720	161	24.	1 JAN 1950	236	0.
1 JAN 1222	12	16.	1 JAN 1452	87	33.	1 JAN 1722	162	23.	1 JAN 1952	237	0.
1 JAN 1224	13	17.	1 JAN 1454	88	34.	1 JAN 1724	163	23.	1 JAN 1954	238	0.
1 JAN 1226	14	17.	1 JAN 1456	89	35.	1 JAN 1726	164	23.	1 JAN 1956	239	0.
1 JAN 1228	15	17.	1 JAN 1458	90	36.	1 JAN 1728	165	22.	1 JAN 1958	240	0.
1 JAN 1230	16	17.	1 JAN 1500	91	37.	1 JAN 1730	166	22.	1 JAN 2000	241	0.
1 JAN 1232	17	18.	1 JAN 1502	92	38.	1 JAN 1732	167	22.	1 JAN 2002	242	0.
1 JAN 1234	18	18.	1 JAN 1504	93	39.	1 JAN 1734	168	21.	1 JAN 2004	243	0.
1 JAN 1236	19	18.	1 JAN 1506	94	40.	1 JAN 1736	169	21.	1 JAN 2006	244	0.
1 JAN 1238	20	18.	1 JAN 1508	95	41.	1 JAN 1738	170	20.	1 JAN 2008	245	0.
1 JAN 1240	21	18.	1 JAN 1510	96	42.	1 JAN 1740	171	20.	1 JAN 2010	246	0.
1 JAN 1242	22	18.	1 JAN 1512	97	43.	1 JAN 1742	172	20.	1 JAN 2012	247	0.
1 JAN 1244	23	18.	1 JAN 1514	98	44.	1 JAN 1744	173	19.	1 JAN 2014	248	0.
1 JAN 1246	24	18.	1 JAN 1516	99	45.	1 JAN 1746	174	17.	1 JAN 2016	249	0.
1 JAN 1248	25	18.	1 JAN 1518	100	46.	1 JAN 1748	175	16.	1 JAN 2018	250	0.
1 JAN 1250	26	18.	1 JAN 1520	101	48.	1 JAN 1750	176	15.	1 JAN 2020	251	0.
1 JAN 1252	27	18.	1 JAN 1522	102	49.	1 JAN 1752	177	13.	1 JAN 2022	252	0.
1 JAN 1254	28	18.	1 JAN 1524	103	50.	1 JAN 1754	178	12.	1 JAN 2024	253	0.
1 JAN 1256	29	19.	1 JAN 1526	104	51.	1 JAN 1756	179	11.	1 JAN 2026	254	0.
1 JAN 1258	30	19.	1 JAN 1528	105	52.	1 JAN 1758	180	9.	1 JAN 2028	255	0.
1 JAN 1300	31	19.	1 JAN 1530	106	53.	1 JAN 1800	181	8.	1 JAN 2030	256	0.
1 JAN 1302	32	19.	1 JAN 1532	107	54.	1 JAN 1802	182	7.	1 JAN 2032	257	0.
1 JAN 1304	33	19.	1 JAN 1534	108	55.	1 JAN 1804	183	5.	1 JAN 2034	258	0.
1 JAN 1306	34	19.	1 JAN 1536	109	57.	1 JAN 1806	184	4.	1 JAN 2036	259	0.
1 JAN 1308	35	20.	1 JAN 1538	110	58.	1 JAN 1808	185	3.	1 JAN 2038	260	0.
1 JAN 1310	36	20.	1 JAN 1540	111	59.	1 JAN 1810	186	1.	1 JAN 2040	261	0.
1 JAN 1312	37	20.	1 JAN 1542	112	60.	1 JAN 1812	187	0.	1 JAN 2042	262	0.
1 JAN 1314	38	20.	1 JAN 1544	113	61.	1 JAN 1814	188	0.	1 JAN 2044	263	0.
1 JAN 1316	39	20.	1 JAN 1546	114	62.	1 JAN 1816	189	0.	1 JAN 2046	264	0.
1 JAN 1318	40	21.	1 JAN 1548	115	69.	1 JAN 1818	190	0.	1 JAN 2048	265	0.
1 JAN 1320	41	21.	1 JAN 1550	116	81.	1 JAN 1820	191	0.	1 JAN 2050	266	0.
1 JAN 1322	42	21.	1 JAN 1552	117	93.	1 JAN 1822	192	0.	1 JAN 2052	267	0.
1 JAN 1324	43	21.	1 JAN 1554	118	105.	1 JAN 1824	193	0.	1 JAN 2054	268	0.
1 JAN 1326	44	21.	1 JAN 1556	119	117.	1 JAN 1826	194	0.	1 JAN 2056	269	0.
1 JAN 1328	45	21.	1 JAN 1558	120	129.	1 JAN 1828	195	0.	1 JAN 2058	270	0.
1 JAN 1330	46	21.	1 JAN 1600	121	141.	1 JAN 1830	196	0.	1 JAN 2100	271	0.
1 JAN 1332	47	22.	1 JAN 1602	122	153.	1 JAN 1832	197	0.	1 JAN 2102	272	0.
1 JAN 1334	48	22.	1 JAN 1604	123	165.	1 JAN 1834	198	0.	1 JAN 2104	273	0.
1 JAN 1336	49	22.	1 JAN 1606	124	177.	1 JAN 1836	199	0.	1 JAN 2106	274	0.
1 JAN 1338	50	22.	1 JAN 1608	125	189.	1 JAN 1838	200	0.	1 JAN 2108	275	0.
1 JAN 1340	51	22.	1 JAN 1610	126	201.	1 JAN 1840	201	0.	1 JAN 2110	276	0.
1 JAN 1342	52	22.	1 JAN 1612	127	213.	1 JAN 1842	202	0.	1 JAN 2112	277	0.
1 JAN 1344	53	22.	1 JAN 1614	128	225.	1 JAN 1844	203	0.	1 JAN 2114	278	0.
1 JAN 1346	54	22.	1 JAN 1616	129	237.	1 JAN 1846	204	0.	1 JAN 2116	279	0.
1 JAN 1348	55	23.	1 JAN 1618	130	223.	1 JAN 1848	205	0.	1 JAN 2118	280	0.
1 JAN 1350	56	23.	1 JAN 1620	131	209.	1 JAN 1850	206	0.	1 JAN 2120	281	0.
1 JAN 1352	57	23.	1 JAN 1622	132	196.	1 JAN 1852	207	0.	1 JAN 2122	282	0.
1 JAN 1354	58	23.	1 JAN 1624	133	182.	1 JAN 1854	208	0.	1 JAN 2124	283	0.
1 JAN 1356	59	24.	1 JAN 1626	134	168.	1 JAN 1856	209	0.	1 JAN 2126	284	0.
1 JAN 1358	60	24.	1 JAN 1628	135	154.	1 JAN 1858	210	0.	1 JAN 2128	285	0.
1 JAN 1400	61	24.	1 JAN 1630	136	141.	1 JAN 1900	211	0.	1 JAN 2130	286	0.
1 JAN 1402	62	25.	1 JAN 1632	137	127.	1 JAN 1902	212	0.	1 JAN 2132	287	0.
1 JAN 1404	63	25.	1 JAN 1634	138	113.	1 JAN 1904	213	0.	1 JAN 2134	288	0.
1 JAN 1406	64	25.	1 JAN 1636	139	99.	1 JAN 1906	214	0.	1 JAN 2136	289	0.
1 JAN 1408	65	26.	1 JAN 1638	140	85.	1 JAN 1908	215	0.	1 JAN 2138	290	0.
1 JAN 1410	66	26.	1 JAN 1640	141	72.	1 JAN 1910	216	0.	1 JAN 2140	291	0.
1 JAN 1412	67	26.	1 JAN 1642	142	58.	1 JAN 1912	217	0.	1 JAN 2142	292	0.
1 JAN 1414	68	27.	1 JAN 1644	143	44.	1 JAN 1914	218	0.	1 JAN 2144	293	0.
1 JAN 1416	69	27.	1 JAN 1646	144	37.	1 JAN 1916	219	0.	1 JAN 2146	294	0.
1 JAN 1418	70	27.	1 JAN 1648	145	36.	1 JAN 1918	220	0.	1 JAN 2148	295	0.
1 JAN 1420	71	28.	1 JAN 1650	146	35.	1 JAN 1920	221	0.	1 JAN 2150	296	0.
1 JAN 1422	72	28.	1 JAN 1652	147	34.	1 JAN 1922	222	0.	1 JAN 2152	297	0.
1 JAN 1424	73	28.	1 JAN 1654	148	33.	1 JAN 1924	223	0.	1 JAN 2154	298	0.

1 JAN 1426	74	29.	*	1 JAN 1656	149	33.	*	1 JAN 1926	224	0.	*	1 JAN 2156	299	0.					
1 JAN 1428	75	29.	*	1 JAN 1658	150	32.	*	1 JAN 1928	225	0.	*	1 JAN 2158	300	0.					

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	9.97-HR
(CFS)	(HR)				
		(CFS)			
237.	4.27	46.	27.	27.	27.
		(INCHES) 1.469	1.473	1.473	1.473
		(AC-FT) 23.	23.	23.	23.

CUMULATIVE AREA = .29 SQ MI

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          **************
          *            *
 15 KK    *     BASIN  *
          *            *
          **************
                  48" CULVERT

 17 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          2  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

             HYDROGRAPH ROUTING DATA

 18 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X        .00 WORKING R AND D COEFFICIENT

 19 SV            STORAGE         .0       .2       .7      1.2      1.9      2.7      3.6      5.3

 20 SQ          DISCHARGE         0.       15.      45.      71.      94.     114.     130.     152.

 21 SE          ELEVATION      701.10   702.50   704.00   705.00   706.00   707.00   708.00   709.50
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HYDROGRAPH AT STATION BASIN

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DA MON HRMN ORD	OUTFLOW	STORAGE	STAGE	DA MON HRMN ORD	OUTFLOW	STORAGE	STAGE	DA MON HRMN ORD	OUTFLOW	STORAGE	STAGE
1 JAN 1200 1	3.	.0	701.4	1 JAN 1520 101	41.	.6	703.8	1 JAN 1840 201	0.	.0	701.1
1 JAN 1202 2	3.	.0	701.4	1 JAN 1522 102	42.	.6	703.9	1 JAN 1842 202	0.	.0	701.1
1 JAN 1204 3	3.	.0	701.4	1 JAN 1524 103	43.	.7	703.9	1 JAN 1844 203	0.	.0	701.1
1 JAN 1206 4	4.	.0	701.5	1 JAN 1526 104	45.	.7	704.0	1 JAN 1846 204	0.	.0	701.1
1 JAN 1208 5	5.	.1	701.5	1 JAN 1528 105	45.	.7	704.0	1 JAN 1848 205	0.	.0	701.1
1 JAN 1210 6	5.	.1	701.6	1 JAN 1530 106	46.	.7	704.1	1 JAN 1850 206	0.	.0	701.1
1 JAN 1212 7	6.	.1	701.7	1 JAN 1532 107	47.	.7	704.1	1 JAN 1852 207	0.	.0	701.1
1 JAN 1214 8	7.	.1	701.8	1 JAN 1534 108	48.	.7	704.1	1 JAN 1854 208	0.	.0	701.1
1 JAN 1216 9	8.	.1	701.9	1 JAN 1536 109	49.	.8	704.2	1 JAN 1856 209	0.	.0	701.1
1 JAN 1218 10	9.	.1	702.0	1 JAN 1538 110	50.	.8	704.2	1 JAN 1858 210	0.	.0	701.1
1 JAN 1220 11	10.	.1	702.1	1 JAN 1540 111	51.	.8	704.2	1 JAN 1900 211	0.	.0	701.1
1 JAN 1222 12	12.	.1	702.2	1 JAN 1542 112	52.	.8	704.3	1 JAN 1902 212	0.	.0	701.1
1 JAN 1224 13	13.	.1	702.3	1 JAN 1544 113	53.	.8	704.3	1 JAN 1904 213	0.	.0	701.1
1 JAN 1226 14	14.	.2	702.4	1 JAN 1546 114	54.	.9	704.4	1 JAN 1906 214	0.	.0	701.1
1 JAN 1228 15	14.	.2	702.4	1 JAN 1548 115	56.	.9	704.4	1 JAN 1908 215	0.	.0	701.1
1 JAN 1230 16	15.	.2	702.5	1 JAN 1550 116	58.	.9	704.5	1 JAN 1910 216	0.	.0	701.1
1 JAN 1232 17	15.	.2	702.5	1 JAN 1552 117	62.	1.0	704.7	1 JAN 1912 217	0.	.0	701.1
1 JAN 1234 18	16.	.2	702.5	1 JAN 1554 118	67.	1.1	704.8	1 JAN 1914 218	0.	.0	701.1
1 JAN 1236 19	16.	.2	702.5	1 JAN 1556 119	72.	1.2	705.0	1 JAN 1916 219	0.	.0	701.1
1 JAN 1238 20	16.	.2	702.6	1 JAN 1558 120	77.	1.4	705.2	1 JAN 1918 220	0.	.0	701.1
1 JAN 1240 21	17.	.2	702.6	1 JAN 1600 121	82.	1.5	705.5	1 JAN 1920 221	0.	.0	701.1
1 JAN 1242 22	17.	.2	702.6	1 JAN 1602 122	88.	1.7	705.7	1 JAN 1922 222	0.	.0	701.1
1 JAN 1244 23	17.	.2	702.6	1 JAN 1604 123	94.	1.9	706.0	1 JAN 1924 223	0.	.0	701.1
1 JAN 1246 24	17.	.2	702.6	1 JAN 1606 124	99.	2.1	706.3	1 JAN 1926 224	0.	.0	701.1
1 JAN 1248 25	17.	.2	702.6	1 JAN 1608 125	105.	2.3	706.5	1 JAN 1928 225	0.	.0	701.1
1 JAN 1250 26	17.	.2	702.6	1 JAN 1610 126	111.	2.5	706.8	1 JAN 1930 226	0.	.0	701.1
1 JAN 1252 27	17.	.2	702.6	1 JAN 1612 127	116.	2.8	707.1	1 JAN 1932 227	0.	.0	701.1
1 JAN 1254 28	18.	.2	702.6	1 JAN 1614 128	121.	3.1	707.4	1 JAN 1934 228	0.	.0	701.1
1 JAN 1256 29	18.	.2	702.6	1 JAN 1616 129	126.	3.4	707.7	1 JAN 1936 229	0.	.0	701.1
1 JAN 1258 30	18.	.2	702.6	1 JAN 1618 130	131.	3.6	708.0	1 JAN 1938 230	0.	.0	701.1
1 JAN 1300 31	18.	.2	702.6	1 JAN 1620 131	134.	3.9	708.2	1 JAN 1940 231	0.	.0	701.1
1 JAN 1302 32	18.	.2	702.7	1 JAN 1622 132	136.	4.1	708.4	1 JAN 1942 232	0.	.0	701.1
1 JAN 1304 33	18.	.2	702.7	1 JAN 1624 133	138.	4.2	708.5	1 JAN 1944 233	0.	.0	701.1
1 JAN 1306 34	18.	.2	702.7	1 JAN 1626 134	139.	4.3	708.6	1 JAN 1946 234	0.	.0	701.1
1 JAN 1308 35	19.	.2	702.7	1 JAN 1628 135	140.	4.4	708.7	1 JAN 1948 235	0.	.0	701.1
1 JAN 1310 36	19.	.2	702.7	1 JAN 1630 136	140.	4.4	708.7	1 JAN 1950 236	0.	.0	701.1
1 JAN 1312 37	19.	.2	702.7	1 JAN 1632 137	140.	4.4	708.7	1 JAN 1952 237	0.	.0	701.1
1 JAN 1314 38	19.	.2	702.7	1 JAN 1634 138	139.	4.3	708.6	1 JAN 1954 238	0.	.0	701.1
1 JAN 1316 39	19.	.2	702.7	1 JAN 1636 139	138.	4.2	708.6	1 JAN 1956 239	0.	.0	701.1
1 JAN 1318 40	19.	.2	702.7	1 JAN 1638 140	137.	4.1	708.4	1 JAN 1958 240	0.	.0	701.1
1 JAN 1320 41	20.	.2	702.7	1 JAN 1640 141	135.	3.9	708.3	1 JAN 2000 241	0.	.0	701.1
1 JAN 1322 42	20.	.2	702.7	1 JAN 1642 142	132.	3.8	708.1	1 JAN 2002 242	0.	.0	701.1
1 JAN 1324 43	20.	.3	702.7	1 JAN 1644 143	129.	3.5	707.9	1 JAN 2004 243	0.	.0	701.1
1 JAN 1326 44	20.	.3	702.8	1 JAN 1646 144	125.	3.3	707.7	1 JAN 2006 244	0.	.0	701.1
1 JAN 1328 45	20.	.3	702.8	1 JAN 1648 145	121.	3.1	707.4	1 JAN 2008 245	0.	.0	701.1
1 JAN 1330 46	20.	.3	702.8	1 JAN 1650 146	117.	2.8	707.2	1 JAN 2010 246	0.	.0	701.1
1 JAN 1332 47	21.	.3	702.8	1 JAN 1652 147	112.	2.6	706.9	1 JAN 2012 247	0.	.0	701.1
1 JAN 1334 48	21.	.3	702.8	1 JAN 1654 148	107.	2.4	706.7	1 JAN 2014 248	0.	.0	701.1
1 JAN 1336 49	21.	.3	702.8	1 JAN 1656 149	102.	2.2	706.4	1 JAN 2016 249	0.	.0	701.1
1 JAN 1338 50	21.	.3	702.8	1 JAN 1658 150	98.	2.0	706.2	1 JAN 2018 250	0.	.0	701.1
1 JAN 1340 51	21.	.3	702.8	1 JAN 1700 151	93.	1.8	706.0	1 JAN 2020 251	0.	.0	701.1
1 JAN 1342 52	21.	.3	702.8	1 JAN 1702 152	88.	1.7	705.7	1 JAN 2022 252	0.	.0	701.1
1 JAN 1344 53	21.	.3	702.8	1 JAN 1704 153	82.	1.5	705.5	1 JAN 2024 253	0.	.0	701.1
1 JAN 1346 54	22.	.3	702.8	1 JAN 1706 154	77.	1.4	705.3	1 JAN 2026 254	0.	.0	701.1
1 JAN 1348 55	22.	.3	702.8	1 JAN 1708 155	73.	1.3	705.1	1 JAN 2028 255	0.	.0	701.1

1	JAN	1350	56	22.	.3	702.8	*	1	JAN	1710	156	68.	1.1	704.9	*	1	JAN	2030	256	0.	.0	701.1
1	JAN	1352	57	22.	.3	702.8	*	1	JAN	1712	157	62.	1.0	704.7	*	1	JAN	2032	257	0.	.0	701.1
1	JAN	1354	58	22.	.3	702.9	*	1	JAN	1714	158	58.	.9	704.5	*	1	JAN	2034	258	0.	.0	701.1
1	JAN	1356	59	22.	.3	702.9	*	1	JAN	1716	159	53.	.8	704.3	*	1	JAN	2036	259	0.	.0	701.1
1	JAN	1358	60	23.	.3	702.9	*	1	JAN	1718	160	50.	.8	704.2	*	1	JAN	2038	260	0.	.0	701.1
1	JAN	1400	61	23.	.3	702.9	*	1	JAN	1720	161	46.	.7	704.1	*	1	JAN	2040	261	0.	.0	701.1
1	JAN	1402	62	23.	.3	702.9	*	1	JAN	1722	162	43.	.6	703.9	*	1	JAN	2042	262	0.	.0	701.1
1	JAN	1404	63	23.	.3	702.9	*	1	JAN	1724	163	40.	.6	703.8	*	1	JAN	2044	263	0.	.0	701.1
1	JAN	1406	64	24.	.3	702.9	*	1	JAN	1726	164	38.	.6	703.6	*	1	JAN	2046	264	0.	.0	701.1
1	JAN	1408	65	24.	.3	702.9	*	1	JAN	1728	165	35.	.5	703.5	*	1	JAN	2048	265	0.	.0	701.1
1	JAN	1410	66	24.	.3	703.0	*	1	JAN	1730	166	33.	.5	703.4	*	1	JAN	2050	266	0.	.0	701.1
1	JAN	1412	67	24.	.3	703.0	*	1	JAN	1732	167	32.	.4	703.3	*	1	JAN	2052	267	0.	.0	701.1
1	JAN	1414	68	25.	.3	703.0	*	1	JAN	1734	168	30.	.4	703.3	*	1	JAN	2054	268	0.	.0	701.1
1	JAN	1416	69	25.	.3	703.0	*	1	JAN	1736	169	29.	.4	703.2	*	1	JAN	2056	269	0.	.0	701.1
1	JAN	1418	70	25.	.3	703.0	*	1	JAN	1738	170	28.	.4	703.1	*	1	JAN	2058	270	0.	.0	701.1
1	JAN	1420	71	26.	.3	703.0	*	1	JAN	1740	171	26.	.4	703.1	*	1	JAN	2100	271	0.	.0	701.1
1	JAN	1422	72	26.	.4	703.1	*	1	JAN	1742	172	25.	.3	703.0	*	1	JAN	2102	272	0.	.0	701.1
1	JAN	1424	73	26.	.4	703.1	*	1	JAN	1744	173	25.	.3	703.0	*	1	JAN	2104	273	0.	.0	701.1
1	JAN	1426	74	27.	.4	703.1	*	1	JAN	1746	174	24.	.3	702.9	*	1	JAN	2106	274	0.	.0	701.1
1	JAN	1428	75	27.	.4	703.1	*	1	JAN	1748	175	23.	.3	702.9	*	1	JAN	2108	275	0.	.0	701.1
1	JAN	1430	76	27.	.4	703.1	*	1	JAN	1750	176	22.	.3	702.8	*	1	JAN	2110	276	0.	.0	701.1
1	JAN	1432	77	28.	.4	703.1	*	1	JAN	1752	177	20.	.3	702.8	*	1	JAN	2112	277	0.	.0	701.1
1	JAN	1434	78	28.	.4	703.1	*	1	JAN	1754	178	19.	.2	702.7	*	1	JAN	2114	278	0.	.0	701.1
1	JAN	1436	79	28.	.4	703.2	*	1	JAN	1756	179	18.	.2	702.6	*	1	JAN	2116	279	0.	.0	701.1
1	JAN	1438	80	28.	.4	703.2	*	1	JAN	1758	180	17.	.2	702.6	*	1	JAN	2118	280	0.	.0	701.1
1	JAN	1440	81	29.	.4	703.2	*	1	JAN	1800	181	16.	.2	702.5	*	1	JAN	2120	281	0.	.0	701.1
1	JAN	1442	82	29.	.4	703.2	*	1	JAN	1802	182	14.	.2	702.4	*	1	JAN	2122	282	0.	.0	701.1
1	JAN	1444	83	29.	.4	703.2	*	1	JAN	1804	183	12.	.1	702.2	*	1	JAN	2124	283	0.	.0	701.1
1	JAN	1446	84	30.	.4	703.2	*	1	JAN	1806	184	11.	.1	702.1	*	1	JAN	2126	284	0.	.0	701.1
1	JAN	1448	85	30.	.4	703.2	*	1	JAN	1808	185	9.	.1	701.9	*	1	JAN	2128	285	0.	.0	701.1
1	JAN	1450	86	30.	.4	703.3	*	1	JAN	1810	186	7.	.1	701.8	*	1	JAN	2130	286	0.	.0	701.1
1	JAN	1452	87	30.	.4	703.3	*	1	JAN	1812	187	6.	.1	701.7	*	1	JAN	2132	287	0.	.0	701.1
1	JAN	1454	88	31.	.4	703.3	*	1	JAN	1814	188	5.	.1	701.5	*	1	JAN	2134	288	0.	.0	701.1
1	JAN	1456	89	31.	.4	703.3	*	1	JAN	1816	189	4.	.0	701.4	*	1	JAN	2136	289	0.	.0	701.1
1	JAN	1458	90	32.	.5	703.4	*	1	JAN	1818	190	3.	.0	701.4	*	1	JAN	2138	290	0.	.0	701.1
1	JAN	1500	91	33.	.5	703.4	*	1	JAN	1820	191	2.	.0	701.3	*	1	JAN	2140	291	0.	.0	701.1
1	JAN	1502	92	34.	.5	703.4	*	1	JAN	1822	192	2.	.0	701.3	*	1	JAN	2142	292	0.	.0	701.1
1	JAN	1504	93	34.	.5	703.5	*	1	JAN	1824	193	1.	.0	701.2	*	1	JAN	2144	293	0.	.0	701.1
1	JAN	1506	94	35.	.5	703.5	*	1	JAN	1826	194	1.	.0	701.2	*	1	JAN	2146	294	0.	.0	701.1
1	JAN	1508	95	36.	.5	703.6	*	1	JAN	1828	195	1.	.0	701.2	*	1	JAN	2148	295	0.	.0	701.1
1	JAN	1510	96	37.	.5	703.6	*	1	JAN	1830	196	1.	.0	701.2	*	1	JAN	2150	296	0.	.0	701.1
1	JAN	1512	97	38.	.6	703.6	*	1	JAN	1832	197	0.	.0	701.1	*	1	JAN	2152	297	0.	.0	701.1
1	JAN	1514	98	39.	.6	703.7	*	1	JAN	1834	198	0.	.0	701.1	*	1	JAN	2154	298	0.	.0	701.1
1	JAN	1516	99	40.	.6	703.7	*	1	JAN	1836	199	0.	.0	701.1	*	1	JAN	2156	299	0.	.0	701.1
1	JAN	1518	100	41.	.6	703.8	*	1	JAN	1838	200	0.	.0	701.1	*	1	JAN	2158	300	0.	.0	701.1

****

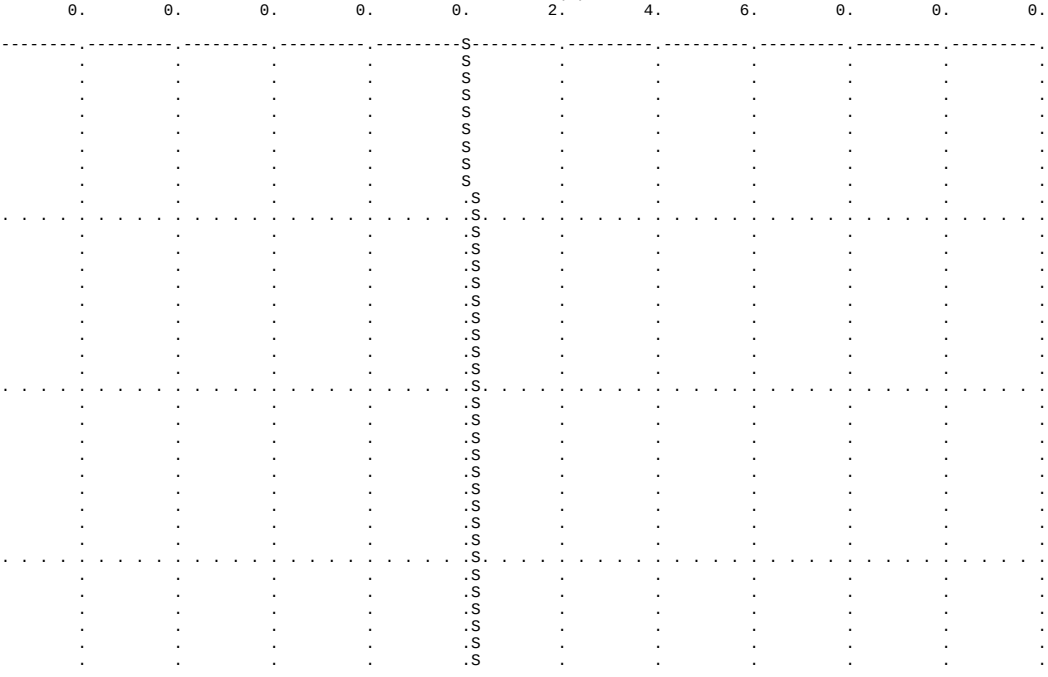
PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	9.97-HR
+ (CFS)	(HR)				
		(CFS)			
+ 140.	4.50	45.	28.	28.	28.
		(INCHES) 1.466	1.475	1.475	1.475
		(AC-FT) 23.	23.	23.	23.

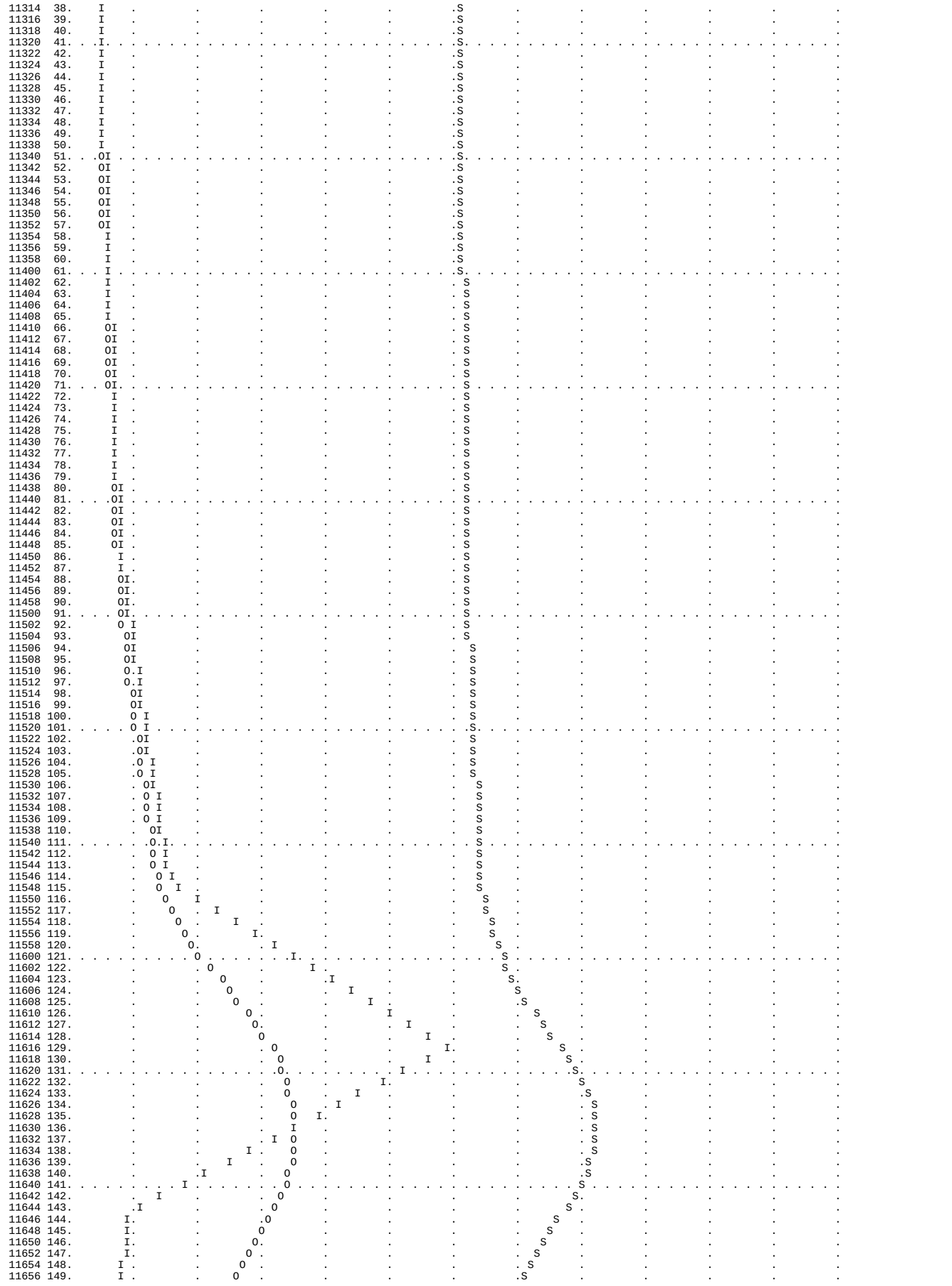
PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	9.97-HR
+ (AC-FT)	(HR)				
4.	4.50	1.	1.	1.	1.

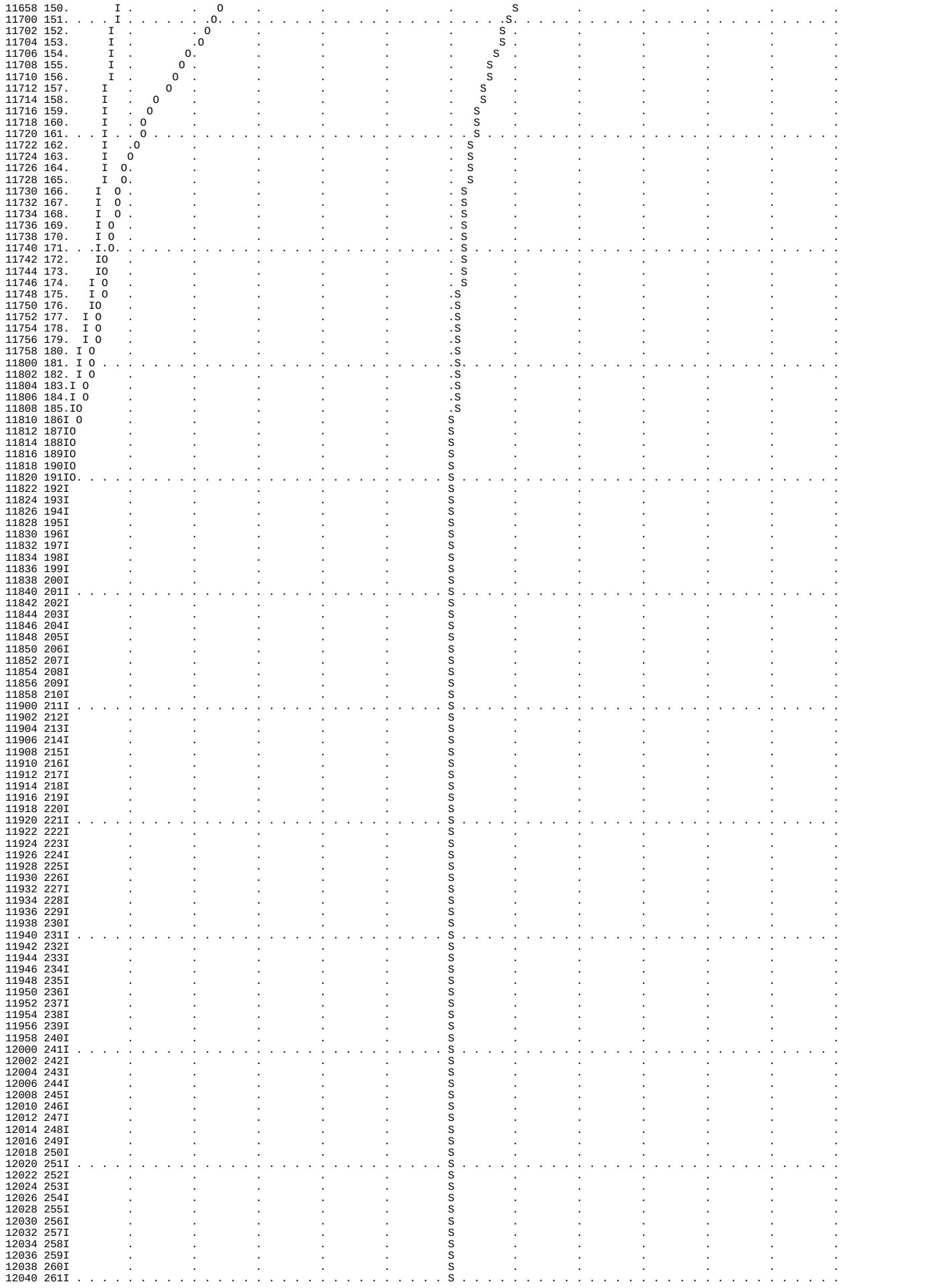
PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	9.97-HR
+ (FEET)	(HR)				
708.70	4.50	703.93	702.82	702.82	702.82

CUMULATIVE AREA = .29 SQ MI

1 STATION BASIN







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  12048 265I         .         .         .         .         .         S         .         .         .         .         .         .
  12050 266I         .         .         .         .         .         S         .         .         .         .         .         .
  12052 267I         .         .         .         .         .         S         .         .         .         .         .         .
  12054 268I         .         .         .         .         .         S         .         .         .         .         .         .
  12056 269I         .         .         .         .         .         S         .         .         .         .         .         .
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  12104 273I         .         .         .         .         .         S         .         .         .         .         .         .
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  12108 275I         .         .         .         .         .         S         .         .         .         .         .         .
  12110 276I         .         .         .         .         .         S         .         .         .         .         .         .
  12112 277I         .         .         .         .         .         S         .         .         .         .         .         .
  12114 278I         .         .         .         .         .         S         .         .         .         .         .         .
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  12138 290I         .         .         .         .         .         S         .         .         .         .         .         .
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  12142 292I         .         .         .         .         .         S         .         .         .         .         .         .
  12144 293I         .         .         .         .         .         S         .         .         .         .         .         .
  12146 294I         .         .         .         .         .         S         .         .         .         .         .         .
  12148 295I         .         .         .         .         .         S         .         .         .         .         .         .
  12150 296I         .         .         .         .         .         S         .         .         .         .         .         .
  12152 297I         .         .         .         .         .         S         .         .         .         .         .         .
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  12156 299I         .         .         .         .         .         S         .         .         .         .         .         .
  12158 300I---------.---------.---------.---------.---------.---------S---------.---------.---------.---------.---------.---------.
1
1
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	200	237.	4.27	46.	27.	27.	.29		
+	ROUTED TO	BASIN	140.	4.50	45.	28.	28.	.29		
+									708.70	4.50

*** NORMAL END OF HEC-1 ***

Hydraulic Analysis Report

Project Data

Project Title: HAGERTY TPM
Designer:
Project Date: Tuesday, August 23, 2011
Project Units: U.S. Customary Units
Notes:

Channel Analysis: Trapezoidal Channel

Notes:

Input Parameters

Channel Type: Trapezoidal
Side Slope 1 (Z1): 1.5000 (ft/ft)
Side Slope 2 (Z2): 1.5000 (ft/ft)
Channel Width: 3.0000 (ft)
Longitudinal Slope: 0.0200 (ft/ft)
Manning's n: 0.0350
Flow: 81.0000 (cfs)

Result Parameters

Depth: 2.0093 (ft)
Area of Flow: 12.0841 (ft^2)
Wetted Perimeter: 10.2447 (ft)
Average Velocity: 6.7030 (ft/s)
Top Width: 9.0280 (ft)
Froude Number: 1.0210
Critical Depth: 2.0313 (ft)
Critical Velocity: 6.5944 (ft/s)
Critical Slope: 0.0191 (ft/ft)
Critical Top Width: 9.0939 (ft)
Calculated Max Shear Stress: 2.5076 (lb/ft^2)
Calculated Avg Shear Stress: 1.4721 (lb/ft^2)

HAGERTY TPM 21144
HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: 42" Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
705.19	50.00	50.00	0.00	1
705.42	55.00	55.00	0.00	1
705.67	60.00	60.00	0.00	1
705.94	65.00	65.00	0.00	1
706.22	70.00	70.00	0.00	1
706.52	75.00	75.00	0.00	1
706.84	80.00	80.00	0.00	1
706.91	81.00	81.00	0.00	1
707.56	90.00	90.00	0.00	1
707.95	95.00	95.00	0.00	1
708.37	100.00	100.00	0.00	1
710.00	117.39	117.39	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50.00	50.00	705.19	3.385	0.0*	1-	1.381	2.203	1.432	2.666	13.509	2.251
55.00	55.00	705.42	3.624	0.0*	5-	1.454	2.314	1.463	2.784	14.424	2.306
60.00	60.00	705.67	3.874	0.0*	5-	1.525	2.425	1.534	2.895	14.780	2.358
65.00	65.00	705.94	4.138	0.0*	5-	1.596	2.520	1.670	3.001	14.337	2.406
70.00	70.00	706.22	4.419	0.0*	5-	1.667	2.611	1.747	3.102	14.580	2.452
75.00	75.00	706.52	4.720	0.0*	5-	1.737	2.702	1.825	3.199	14.787	2.495
80.00	80.00	706.84	5.043	0.0*	5-	1.805	2.793	1.901	3.292	14.992	2.536
81.00	81.00	706.91	5.110	0.0*	5-	1.819	2.808	1.916	3.310	15.035	2.544
90.00	90.00	707.56	5.756	0.0*	5-	1.939	2.923	2.047	3.467	15.407	2.613
95.00	95.00	707.95	6.149	3.751	4-FFf	2.006	2.986	2.006	3.551	16.660	2.649
100.00	100.00	708.37	6.565	4.221	4-FFf	2.074	3.050	2.074	3.632	16.848	2.683

* theoretical depth is impractical. Depth reported is corrected.

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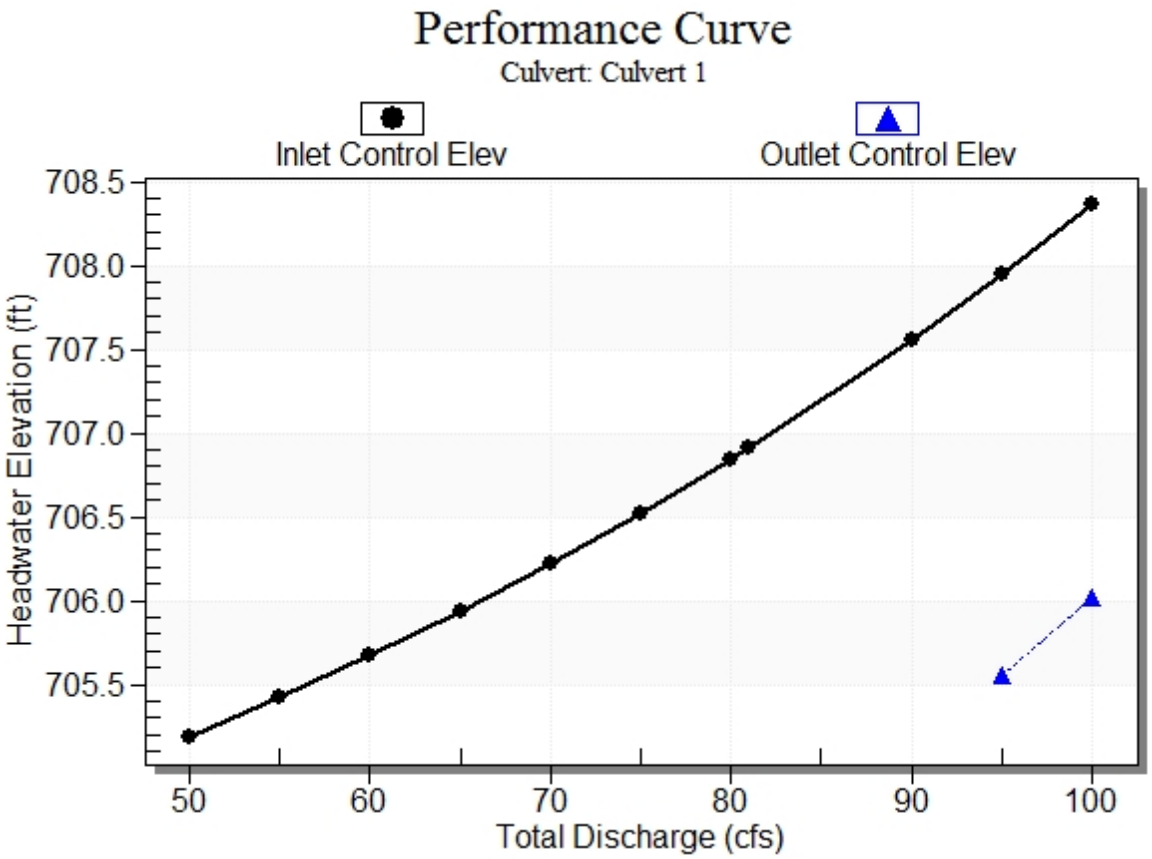
Inlet Elevation (invert): 701.80 ft, Outlet Elevation (invert): 698.40 ft

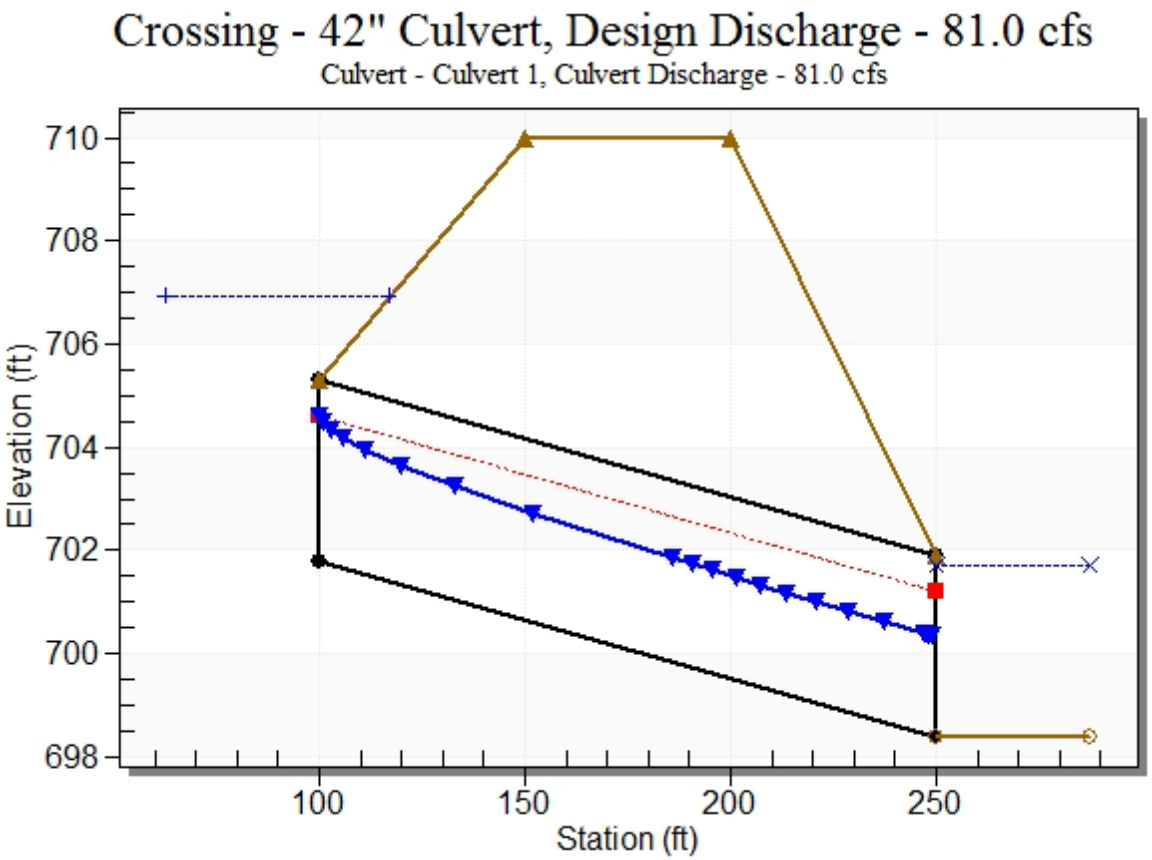
Culvert Length: 150.04 ft, Culvert Slope: 0.0227

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 100.00 ft

Inlet Elevation: 701.80 ft

Outlet Station: 250.00 ft

Outlet Elevation: 698.40 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: 42" Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
50.00	701.07	2.67	2.25	2.25	0.31
55.00	701.18	2.78	2.31	2.34	0.31
60.00	701.30	2.90	2.36	2.44	0.31
65.00	701.40	3.00	2.41	2.53	0.32
70.00	701.50	3.10	2.45	2.61	0.32
75.00	701.60	3.20	2.49	2.69	0.32
80.00	701.69	3.29	2.54	2.77	0.32
81.00	701.71	3.31	2.54	2.79	0.32
90.00	701.87	3.47	2.61	2.92	0.32
95.00	701.95	3.55	2.65	2.99	0.32
100.00	702.03	3.63	2.68	3.06	0.32

Tailwater Channel Data - 42" Culvert

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0135

Channel Manning's n: 0.1000

Channel Invert Elevation: 698.40 ft

Roadway Data for Crossing: 42" Culvert

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 5.00 ft

Crest Elevation: 710.00 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

County of San Diego BMP Sizing Calculator Results

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name:	Basin 1	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
DMA 1	5028	D	Flat	Landscaping	0.1	0.1	0.0833	0.06	50	42	30
DMA 1	2500	D	Flat	Rooftops	1.0	0.1	0.0833	0.06	250	208	150
DMA 1	313	D	Flat	Driveway	1.0	0.1	0.0833	0.06	31	26	19
Total BMP Area	7841							Minimum BMP Size	331.58	276	199
								Proposed BMP Size*			
									Soil Matrix Depth	18.00	in
									Minimum Ponding Depth	N/A	in
									Maximum Ponding Depth	N/A	in
									Selected Ponding Depth	10.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name	Basin 1	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
DMA 1	Lake Wohlford	D	Scrub	Flat	0.253	0.115	0.003	**0.07**
DMA 1	Lake Wohlford	D	Scrub	Flat	0.253	0.057	0.001	**0.04**
DMA 1	Lake Wohlford	D	Scrub	Flat	0.253	0.007	0.000	**0.00**

0.005	**0.11**	**0.38**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	N/A

Drawdown time exceeds 96 Hrs. Project must implement a vector control program.

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name:	Basin 2	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
DMA 2	3747	D	Flat	Landscaping	0.1	0.1	0.0833	0.06	37	31	22
DMA 2	2500	D	Flat	Rooftops	1.0	0.1	0.0833	0.06	250	208	150
DMA 2	287	D	Flat	Driveway	1.0	0.1	0.0833	0.06	29	24	17
Total BMP Area	6534							Minimum BMP Size	316.17	263	190
								Proposed BMP Size*			
								Soil Matrix Depth		18.00	in
								Minimum Ponding Depth		N/A	in
								Maximum Ponding Depth		N/A	in
								Selected Ponding Depth		10.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name	Basin 2	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
DMA 2	Lake Wohlford	D	Scrub	Flat	0.253	0.086	0.002	**0.05**
DMA 2	Lake Wohlford	D	Scrub	Flat	0.253	0.057	0.001	**0.04**
DMA 2	Lake Wohlford	D	Scrub	Flat	0.253	0.007	0.000	**0.00**

0.004	**0.09**	**0.34**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	N/A

Drawdown time exceeds 96 Hrs. Project must implement a vector control program.

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name:	Basin 3	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
DMA 3	1789	D	Flat	Landscaping	0.1	0.1	0.0833	0.06	18	15	11
DMA 3	825	D	Flat	Rooftops	1.0	0.1	0.0833	0.06	83	69	50
Total BMP Area	2614							Minimum BMP Size	100.39	84	60
								Proposed BMP Size*			
								Soil Matrix Depth		18.00	in
								Minimum Ponding Depth		N/A	in
								Maximum Ponding Depth		N/A	in
								Selected Ponding Depth		10.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name	Basin 3	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
DMA 3	Lake Wohlford	D	Scrub	Flat	0.253	0.041	0.001	**0.03**
DMA 3	Lake Wohlford	D	Scrub	Flat	0.253	0.019	0.000	**0.01**
		D	Scrub	Flat				

0.002	**0.04**	**0.22**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	N/A

Drawdown time exceeds 96 Hrs. Project must implement a vector control program.

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name:	Basin 4	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
DMA 4	6098	D	Flat	Landscaping	0.1	0.1	0.0833	0.06	61	51	37
DMA 4	3920	D	Flat	Rooftops	1.0	0.1	0.0833	0.06	392	327	235
DMA 4	1307	D	Flat	Driveway	1.0	0.1	0.0833	0.06	131	109	78
DMA 4	9148	D	Flat	Cul-de-sac	1.0	0.1	0.0833	0.06	915	762	549
Total BMP Area	20473							Minimum BMP Size	1498.48	1248	899
								Proposed BMP Size*			
								Soil Matrix Depth		18.00	in
								Minimum Ponding Depth		N/A	in
								Maximum Ponding Depth		N/A	in
								Selected Ponding Depth		10.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name	Basin 4	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
DMA 4	Lake Wohlford	D	Scrub	Flat	0.253	0.140	0.004	**0.09**
DMA 4	Lake Wohlford	D	Scrub	Flat	0.253	0.090	0.002	**0.06**
DMA 4	Lake Wohlford	D	Scrub	Flat	0.253	0.030	0.001	**0.02**
DMA 4	Lake Wohlford	D	Scrub	Flat	0.253	0.210	0.005	**0.13**

0.012	**0.29**	**0.61**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	N/A

Drawdown time exceeds 96 Hrs. Project must implement a vector control program.

BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name:	Basin 5	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
DMA 5	1400	D	Flat	Sidewalk	1.0	0.1	0.0833	0.06	140	117	84
Total BMP Area	1400							Minimum BMP Size	140	117	84
								Proposed BMP Size*			
								Soil Matrix Depth		18.00	in
								Minimum Ponding Depth		N/A	in
								Maximum Ponding Depth		N/A	in
								Selected Ponding Depth		10.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
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BMP Sizing Spreadsheet V1.04			
Project Name:	Hagerty TPM 21144	Hydrologic Unit:	San Luis Rey
Project Applicant:	Jack Hagerty	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	38862
Parcel (APN):	105-800-63	Low Flow Threshold:	0.1Q2
BMP Name	Basin 5	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
DMA 5	Lake Wohlford	D	Scrub	Flat	0.253	0.032	0.001	**0.02**
		D	Scrub	Flat				
		D	Scrub	Flat				

0.001	**0.02**	**0.16**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

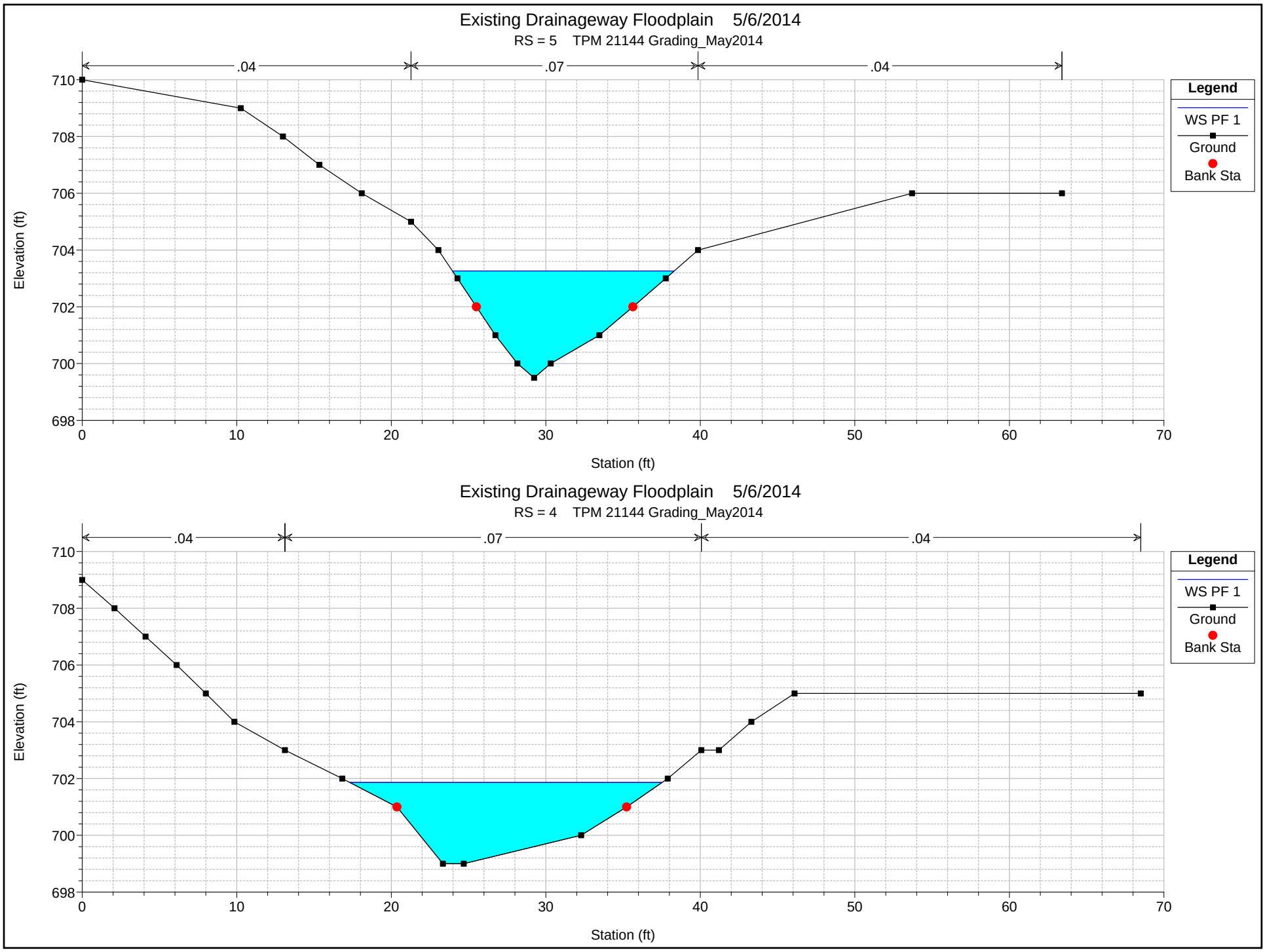
Drawdown (Hrs)	N/A

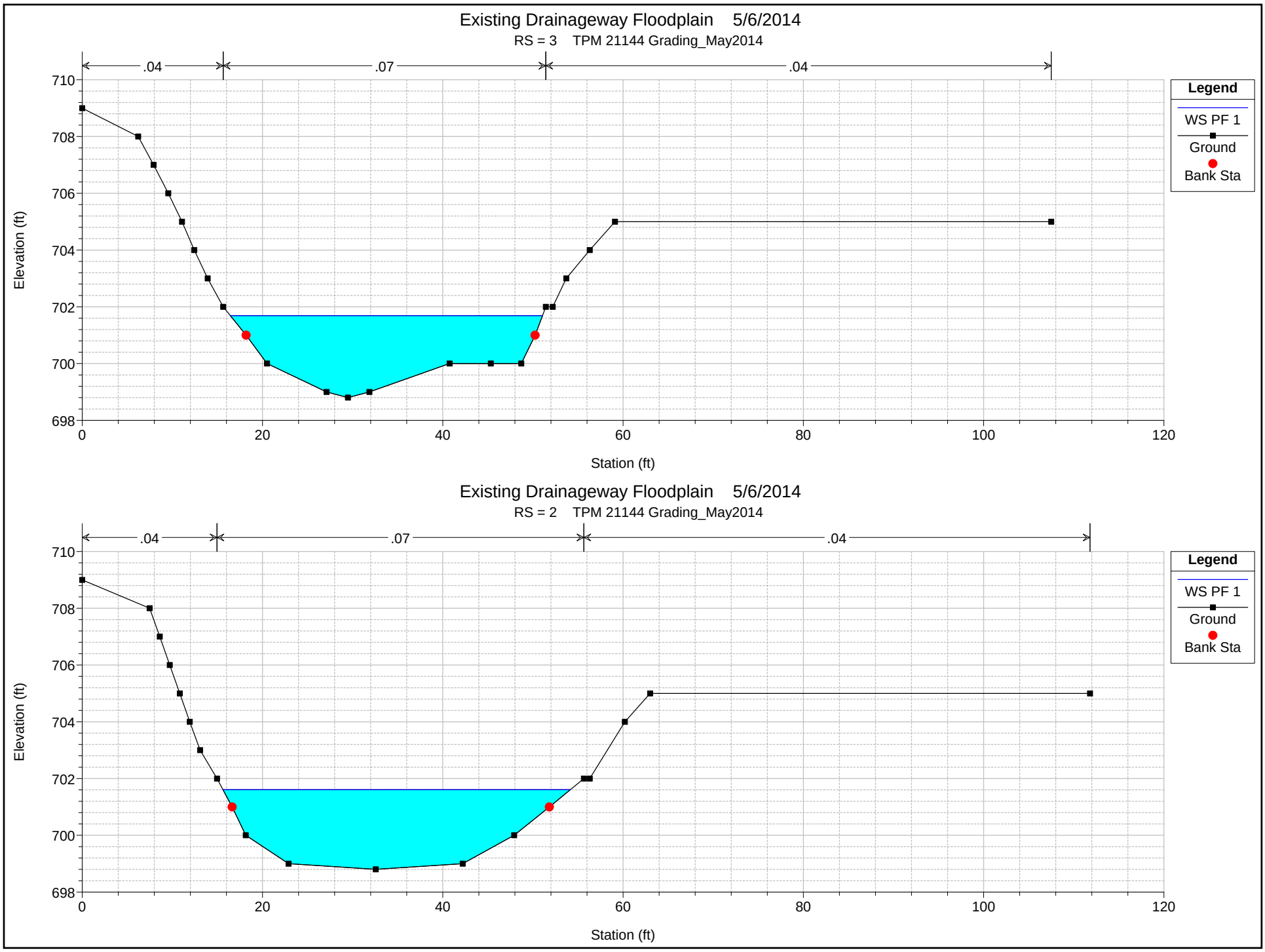
Drawdown time exceeds 96 Hrs. Project must implement a vector control program.

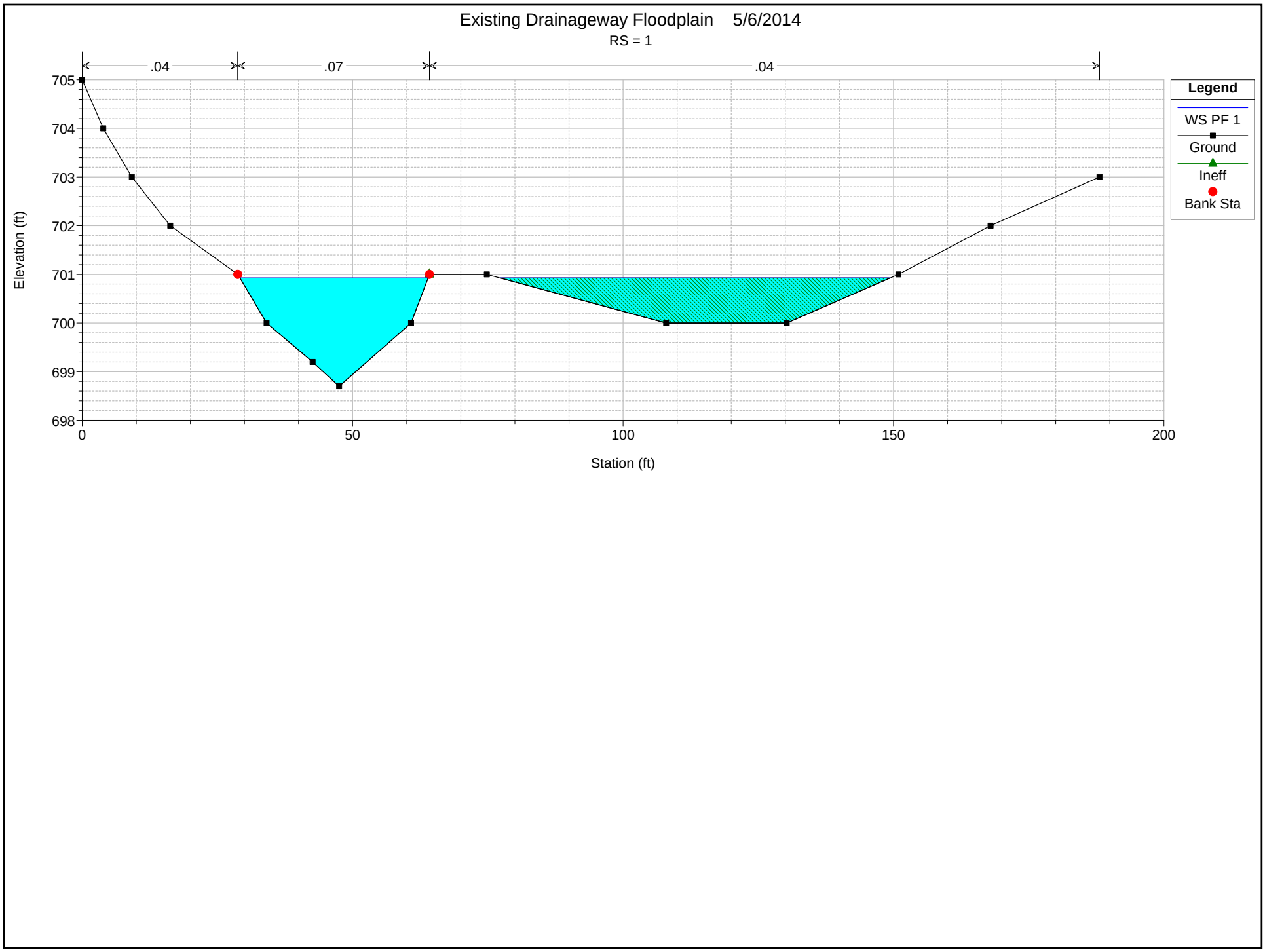
HEC-RAS Calculations

HEC-RAS Plan: ex drain River: East Side Drain Reach: Hagerty TPM Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Hagerty TPM	1	PF 1	216.00	698.70	700.93	700.63	701.27	0.035031	4.73	45.65	106.87	0.73
Hagerty TPM	2	PF 1	216.00	698.80	701.61		701.72	0.005408	2.68	81.45	38.55	0.31
Hagerty TPM	3	PF 1	216.00	698.80	701.69		701.86	0.009612	3.30	66.13	34.63	0.41
Hagerty TPM	4	PF 1	216.00	699.00	701.86	701.66	702.55	0.039686	6.71	33.70	20.22	0.81
Hagerty TPM	5	PF 1	216.00	699.50	703.26	703.14	704.21	0.046065	7.94	28.87	14.35	0.87


Existing Drainageway Floodplain 5/6/2014
RS = 5 TPM 21144 Grading_May2014
.04
.07
.04
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Drainageway Floodplain 5/6/2014
RS = 4 TPM 21144 Grading_May2014
.04
.07
.04
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Existing Drainageway Floodplain 5/6/2014
RS = 3 TPM 21144 Grading_May2014
.04
.07
.04
Elevation (ft)
710
708
706
704
702
700
698
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Existing Drainageway Floodplain 5/6/2014
RS = 2 TPM 21144 Grading_May2014
.04
.07
.04
Elevation (ft)
710
708
706
704
702
700
698
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Existing Drainageway Floodplain 5/6/2014
RS = 1
.04
.07
.04
705
704
703
702
701
700
699
698
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta

APPENDIX III: MAPS

E. FALLBROOK ST.

McDONALD RD.

OSTRICH FARMS CREEK

EXIST. HOUSE

EXISTING DRAINAGE SWALE

Ex. 48" SD

Ex. 54" SD

Ex. 48" SD

L= 328'

L= 172'

L= 190'

102

100
1.38

302

202

300
0.14

200
0.23

100

300

200

A=1.38 AC
Q_{100}=2.16 CFS

A=0.23 AC
Q_{100}=0.47 CFS

A=0.14 AC
Q_{100}=0.96 CFS

LEGEND

100 / 1.38	SUBBASIN NO. SUBBASIN AREA, AC
102	NODE POINT
	SUBBASIN BOUNDARY
	FLOWPATH
	PROPERTY BOUNDARY

N

40 0 40

Scale 1" = 40'

LYLE ENGINEERING, INC.
P.O. BOX 4296
SAN RAFAEL, CA 94913
(415) 497-2717

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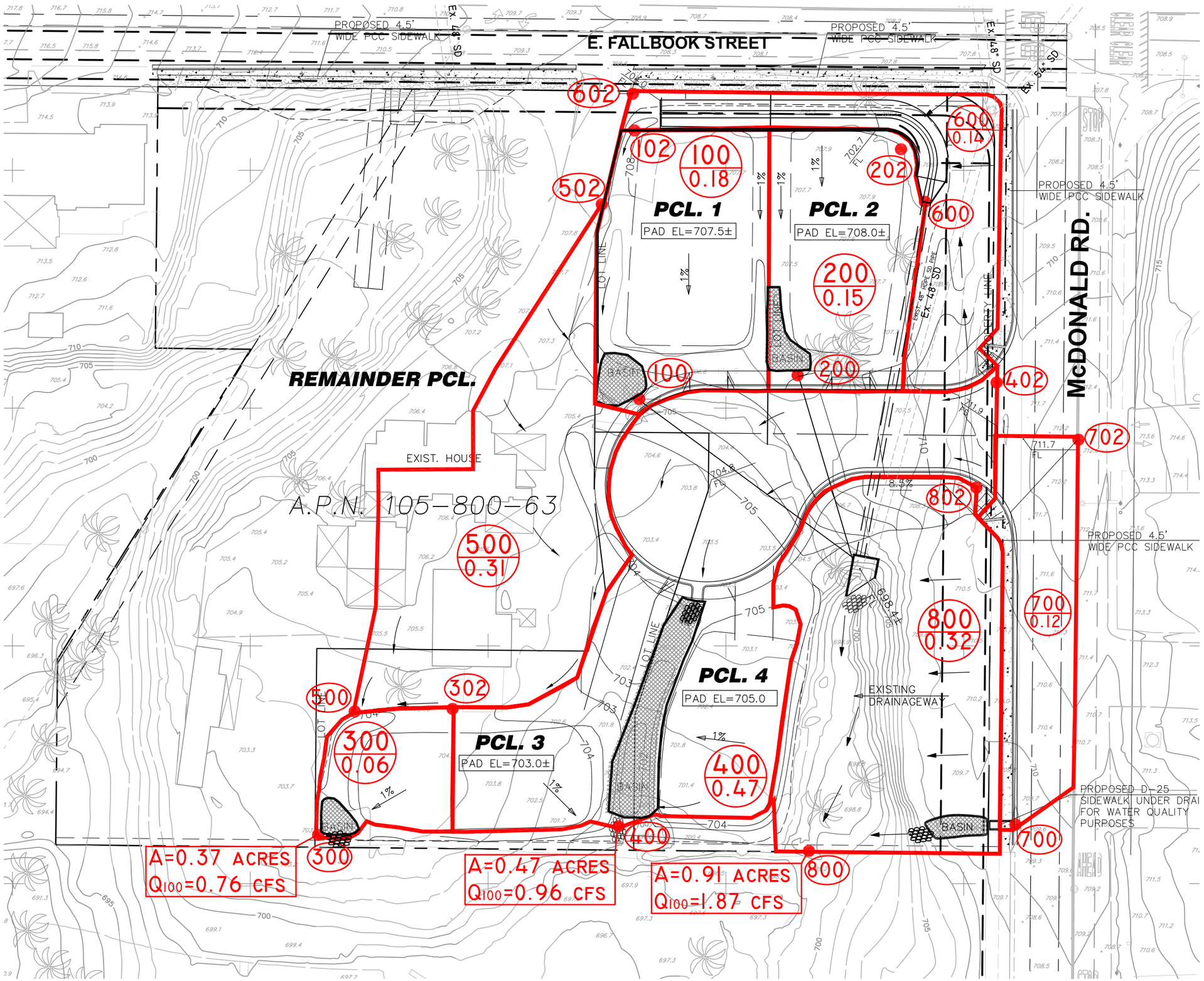
COUNTY OF SAN DIEGO

1065 E. FALLBROOK STREET
FALLBROOK , CA

PRE-PROJECT CONDITIONS DRAINAGE MAP
APRIL 2015



LEGEND

- 100 / 0.18 — SUBBASIN NO. / SUBBASIN AREA, AC
- 102 — NODE POINT
- SUBBASIN BOUNDARY
- DRAINAGE PATTERN

N

40 0 40

Scale 1" = 40'

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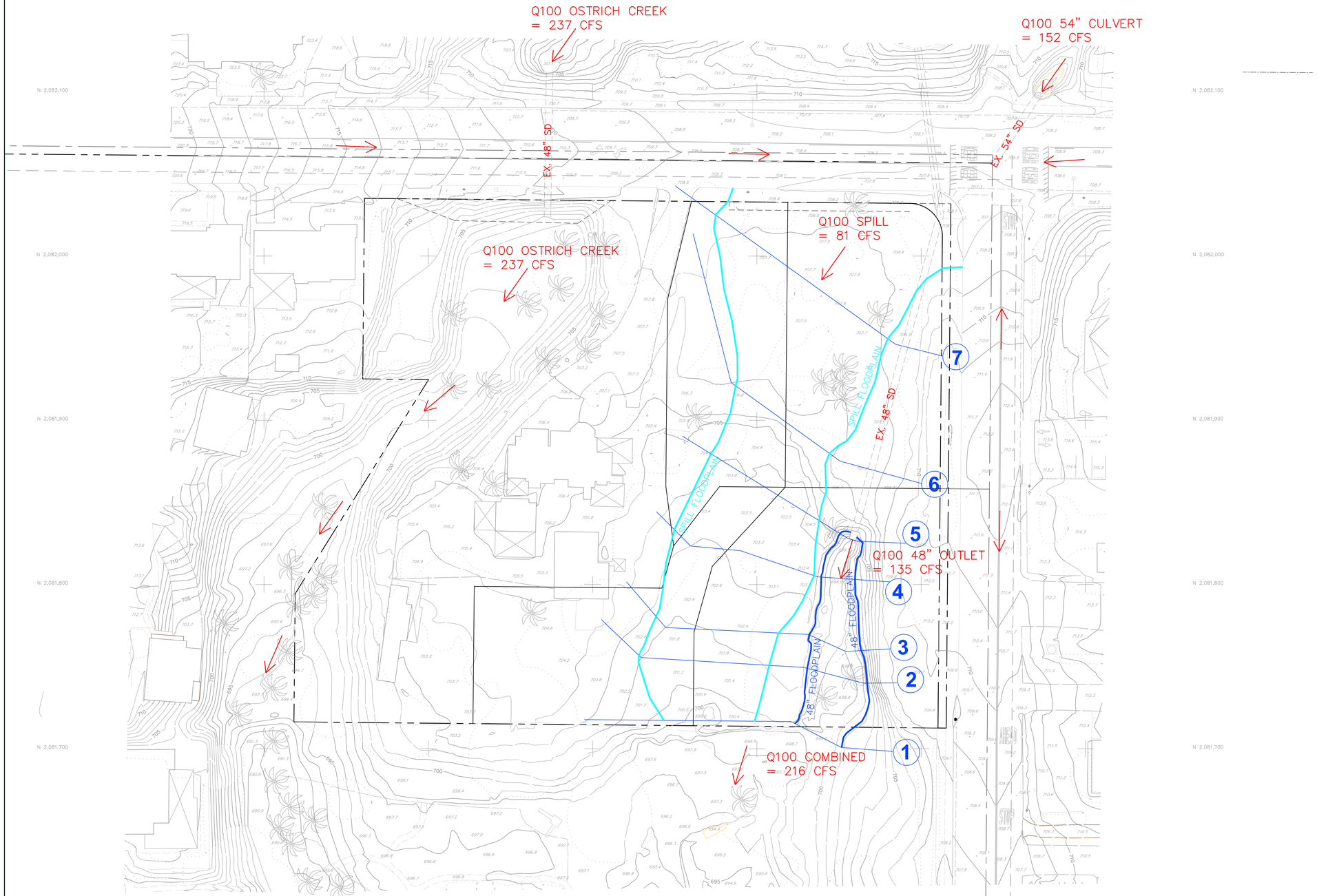
COUNTY OF SAN DIEGO

1065 E. FALLBROOK STREET
FALLBROOK , CA

HAGERTY TPM 21144
POST-DEVELOPMENT ONSITE DRAINAGE MAP
APRIL 2015



LEGEND

- HEC-RAS SECTION — 5
- SPILL FLOODPLAIN
- 48" FLOODPLAIN
- CREEK THALWEG
- DRAINAGE PATTERN

HAGERTY TPM
HEC-RAS EXHIBIT
EXISTING CONDITIONS

COUNTY OF SAN DIEGO, FALLBROOK

AUGUST 2011

30 0 30

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PHOTO GEODETIC CORPORATION
AERIAL MAPPING PROFESSIONALS

PROJECT NAME: MCDONALD FALLBROCK
PROJECT NUMBER: 370507
DATE OF PHOTOGRAPHY: 5-30-07
SCALE OF MAP: 1"=20'

LYLE ENGINEERING, INC.

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E. FALLBROOK ST.

EX. 48" SD

EX. 54" SD

Q100 SPILL=81 CFS

PROPOSED BIO-FILTER SWALE (TYP.)

PCL. 1

PAD EL=707.5±

PCL. 2

PAD EL=708.0±

REMAINDER PCL.

EXIST. HOUSE

A.P.N. 105-800-63

PCL. 4

PAD EL=705.0

PCL. 3

PAD EL=703.0±

BASIN

LOT LINE

PROPERTY LINE

EX. 48" SD

PR. 42" SD

McDONALD RD.

OSTRICH FARMS CREEK

EXISTING DRAINAGEWAY

Q100 48"=135 CFS

Q100=216 CFS

1%

LEGEND

100-YEAR FLOODPLAIN (SPILL AND DRAINAGEWAY)

HEC-RAS SECTION

100-YEAR FLOODPLAIN (COUNTY ORTHOTOPO 438-1695)

FLOODWAY (COUNTY ORTHOTOPO 438-1695)

DRAINAGE FLOW DIRECTION

40 0 40

Scale 1" = 40'

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COUNTY OF SAN DIEGO

1065 E. FALLBROOK STREET
FALLBROOK , CA

HAGERTY TPM 21144
FLOODPLAIN MAP

MAY 2014

MISSION ROAD

ALVARADO STREET

FALLBROOK STREET

MACDONALD ROAD

STAGE COACH LANE

202
16.7

204
30.7

206
16.1

208
14.4

210

212
53.6

200
52.8

202

204

206

208

210

212

L=2632'

L=1395'

L=1453'

L=892'

100
1.2

102
40.0

104
10.0

106

108
11.8

110
14.9

112

119
25.8

120
16.4

122
10.8

124

PRUETTS ADD
MAP 561

FALLBROOK MEADOWS
MAP 8690

FALLBROOK HEIGHTS
MAP 2771

FALLBROOK KNOLLS
MAP 4220

LA PALOMA RANCHOS
UNIT NO. 1
MAP 7404

LA PALOMA RANCHOS
UNIT NO. 2
MAP 7854

BUENA VISTA
HEIGHTS
MAP 20

CO. OF S.D. TCT
NO. 35173
MAP 9248

CO. OF S.D. TCP
NO. 35173
MAP 9248

CO. OF S.D. TCP NO. 3635
MAP 9368

SHUPLEY TCT
MAP 1380

SHUPLEY TCT
MAP 1380

T 9 S

250' 0 250'

LEGEND

- 102 / 0.12 — SUBBASIN NO. / SUBBASIN AREA, AC
- 102 — NODE POINT
- SUBBASIN BOUNDARY
- FLOWPATH
- HAGERTY PROPERTY

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COUNTY OF SAN DIEGO
1065 E. FALLBROOK STREET
FALLBROOK , CA

HAGERTY TPM 21144
OFFSITE DRAINAGE MAP
MAY 2014