Otay Hills Construction Aggregate and Inert Debris Engineered Fill Operation Project

Appendix D1

Hydrology Report

for the

Public Review
Draft Environmental Impact Report

PDS2004-3300-04-004 (MUP);
PDS2004-3310-04-001 (RP);
PDS2010-3813-10-002 (SPA);
Log No. 04-190-04

June 2020

Prepared for:

County of San Diego
Planning & Development Services
5510 Overland Avenue, Suite 310
San Diego, California 92123

CEQA-LEVEL
HYDROLOGY REPORT
FOR THE
OTAY HILLS QUARRY

(Log No. 93-19-006J, P04-004, RP04-001)

February 19, 2015

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FOR REVIEW ONLY

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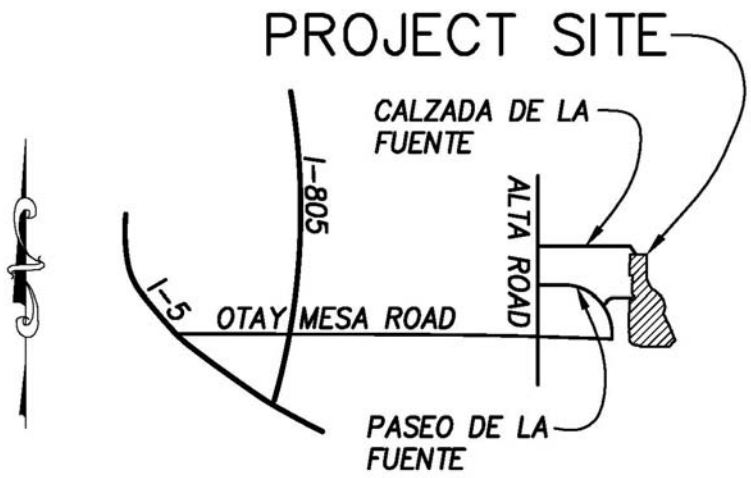
APPENDIX

MAP POCKET

INTRODUCTION

The Otay Hills Quarry is a proposed mineral resource recovery project located beyond the westerly terminus of Otay Mesa Road in southern San Diego County (see Vicinity Map). A plot plan and reclamation plan have been prepared for the proposed recovery activities by Chang Consultants. This CEQA-level drainage report analyzes the existing and proposed (ultimate) condition hydrology at the site. The existing condition reflects the site prior to the proposed project initiation. Recent grading and improvements have been performed and constructed immediately west of the site. These grading and improvements are included on the existing and proposed condition work maps in this report. During the extraction phases of the project, borrow areas will be created that act as retention basins. There will not be an increase in off-site runoff or associated impacts during extraction and backfill due to the retention. Therefore, the interim extraction and backfill phases are not analyzed. The proposed condition reflects the ultimate, post-reclamation condition.



VICINITY MAP
NO SCALE

HYDROLOGIC ANALYSES

Hydrologic analyses were performed to determine the 100-year existing and ultimate condition flow rates associated with the footprint of the resource recovery area. The existing and ultimate conditions are shown on the work maps at the back of this report. The County of San Diego's 2003 *Hydrology Manual* rational method procedure was used for the analyses. The rational method input parameters are summarized as follows:

- Precipitation: The 100-year, 6- and 24-hour precipitation values from the *Hydrology Manual* are 3.4 and 8.0 inches, respectively.

- Drainage areas: Surface runoff patterns from the site are generally towards the west and south. There are several locations where surface runoff exits the site. The overall drainage area has been grouped into three major drainage basins, or outflow areas, for the existing

and ultimate conditions (Basins 100, 200, and 300 for the existing conditions and Basins 10, 20, and 30 for the ultimate conditions). Existing Basin 100 generally corresponds to ultimate Basin 10, etc. The reclamation and plot plan were developed such that the project would generally maintain the existing off-site runoff directions.

The existing condition drainage basins were delineated using 5-foot contour topographic mapping prepared for the project as well as USGS data for off-site areas. The ultimate condition drainage basins were based on the project plans and the existing topographic mapping. A field visit was performed to verify the drainage basin delineations. The Rational Method Work Maps (see map pocket) contain the drainage basin boundaries as well as flow paths and rational method node numbers.

- Hydrologic soil groups: The hydrologic soil groups were determined from the Soil Conservation Service's *Soil Survey* for San Diego County. The soil group in the study area is entirely "D".

- Runoff coefficients: The runoff coefficients were selected based on the land use and Soil Group "D". The existing condition study area consists of relatively steep, entirely undeveloped hillsides. Since the project involves mineral recovery, the proposed condition land use will also be essentially undeveloped. According to Table 3 from the *Hydrology Manual,* undeveloped land under Soil Group "D" has a runoff coefficient of 0.35.

- Flow lengths and elevations: The flow lengths and elevations were obtained from the Rational Method Work Maps.

The 100-year rational method results are included in Appendix A. The analyses were performed for the existing and ultimate conditions using the CivilDesign Rational Method Hydrology Program, which is based on the County of San Diego criteria. There are five primary discharge locations from the site under existing conditions. These are labeled A through E on the Existing Condition Rational Method Work Map. Two are near the northwest corner, the third is approximately midway along the westerly boundary, and the final two are along the southerly boundary. Under existing conditions, the northwest-most discharge location, A, enters a natural watercourse that flows away from the site in a southwest direction. The additional two westerly discharge locations, B and C, enter a storm drain system constructed by the adjacent project. The storm drain ultimately conveys the runoff in a southwesterly direction away from the site. The southerly two overland discharge locations, D and E, enter natural drainage courses that confluence a short distance south of the site.

Under proposed conditions, the project runoff will continue to exit the site at discharge locations A, C, D, and E. Flow will not exit the site at discharge location B. The 100-year existing and proposed condition 100-year flow rate at each of the discharge locations from the site are summarized in Table 1.

Table 1 shows that the project will not increase the 100-year flow rate from discharge locations B through E. On the other hand, the flow rate from discharge location A will increase slightly. A detention analysis was performed to determine the required detention volume to attenuate the 100-year flow rate from 574 to 559 cfs. The County of San Diego's rational method to hydrograph routine was used to convert the 100-year peak flow rate results to a hydrograph. The results are included in Appendix B and show that a storage volume of at least 0.6 acre-feet is required. A basin is shown on the work map with this volume.

Discharge Location	Existing Condition			Proposed Condition		
	Tributary Area, ac	100-Year Flow, cfs	100-Year Velocity, fps	Tributary Area, ac	100-Year Flow, cfs	100-Year Velocity, fps
A	368.65	559	14.2	375.08	574	12.3
B	13.79	28	2.4	---	---	---
C	46.98	94	3.4	50.46	87	4.8
D	25.60	58	2.2	29.07	57	4.3
E	38.27	80	3.5	38.68	65	9.4

Table 1. Summary 100-Year Rational Method Results

HYDRAULIC ANALYSES

The flow velocities are provided in Table 1 from the rational method results. Under existing conditions, the flow velocities at each discharge location were determined using one of two methods. First, where the rational method routine tributary to the discharge location models an initial area (discharge locations B through E), the flow velocity was approximated by dividing the initial subarea flow distance by the total travel time. Second, where the rational method routine tributary to the discharge location models improved channel travel (discharge location A), the flow velocity was obtained from the improved channel results from the rational method output.

Under proposed conditions, normal depth analyses were performed to more accurately approximate the flow velocity at each of the four site discharge locations. The normal depth analyses were based on the proposed condition 100-year flow rates and the drainage conveyance at each discharge location. The analyses were performed using the FlowMaster program and the results are included after this report text. The results show that the flow velocities at discharge locations C and D are below the erosive threshold of 5 to 6 feet per second. Therefore, energy dissipation is not required at these locations. On the other hand, the flow velocities at discharge locations A and E are erosive. Discharge location A will consist of three 54-inch HDPE pipes. Riprap shall be installed at the pipe outlets in accordance with the County of San Diego's September 2014, *Hydraulic Design Manual* and *San Diego Regional Standard Drawing* D-40. For the outlet velocity of 12.3 feet per second, the rock size is required to be ½-ton with a 2.7 foot thickness over 1-inch gravel with a 1 foot thickness. Discharge Location E will consist of a drainage ditch per D-75. For the outlet velocity of 9.4 feet per second, the rock size is required to be No. 2 backing with a 1 foot thickness over ¼-inch gravel with a 1-foot thickness.

CONCLUSION

The CEQA-level hydrologic analyses show that the project will decrease the 100-year surface runoff at four of the five outflow locations (discharge locations B through E). At discharge location A, a detention basin can be installed near the outflow to mitigate for the 100-year flow increase. Based on this, the project will not adversely impact the off-site drainage conditions. Additional drainage design details will be included in the final drainage report for the project.

The northerly-most proposed pad has a tributary area exceeding 200 acres. The pad will convey the storm runoff through the site in accordance with the State Mining and Reclamation Act requirements. The mine operator shall ensure that the pad will not be adversely impacted by runoff from the watershed. Since the runoff will flow through the site within the pad and the project will not increase the runoff exiting the site, the pad will not adversely impact flow from the watershed.

DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the civil engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications 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 project design.

FOR REVIEW ONLY

Wayne W. Chang Date
RCE 46548
Exp. June 30, 2015

Worksheet for Discharge Location A - 191.3 cfs per pipe (3 pipes total)

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	4.45	ft
Diameter	4.45	ft
Discharge	191.30	ft³/s

Results

Diameter	4.45	ft
Normal Depth	4.45	ft
Flow Area	15.58	ft²
Wetted Perimeter	13.99	ft
Hydraulic Radius	1.11	ft
Top Width	0.00	ft
Critical Depth	3.97	ft
Percent Full	100.0	%
Critical Slope	0.00888	ft/ft
Velocity	12.28	ft/s
Velocity Head	2.34	ft
Specific Energy	6.80	ft
Froude Number	0.00	
Maximum Discharge	205.76	ft³/s
Discharge Full	191.28	ft³/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Worksheet for Discharge Location C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	5.00	ft/ft (H:V)
Right Side Slope	5.00	ft/ft (H:V)
Discharge	87.00	ft^3/s

Results

Normal Depth	1.91	ft
Flow Area	18.32	ft^2
Wetted Perimeter	19.52	ft
Hydraulic Radius	0.94	ft
Top Width	19.14	ft
Critical Depth	1.80	ft
Critical Slope	0.01395	ft/ft
Velocity	4.75	ft/s
Velocity Head	0.35	ft
Specific Energy	2.26	ft
Froude Number	0.86	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.91	ft
Critical Depth	1.80	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01395	ft/ft

Worksheet for Discharge Location D

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	5.00	ft/ft (H:V)
Right Side Slope	5.00	ft/ft (H:V)
Discharge	57.00	ft^3/s

Results

Normal Depth	1.63	ft
Flow Area	13.34	ft^2
Wetted Perimeter	16.66	ft
Hydraulic Radius	0.80	ft
Top Width	16.33	ft
Critical Depth	1.52	ft
Critical Slope	0.01476	ft/ft
Velocity	4.27	ft/s
Velocity Head	0.28	ft
Specific Energy	1.92	ft
Froude Number	0.83	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.63	ft
Critical Depth	1.52	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01476	ft/ft

Worksheet for Discharge Location E - D-75 Ditch

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.01000	ft/ft
Constructed Depth	3.00	ft
Constructed Top Width	5.00	ft
Discharge	65.00	ft^3/s

Results

Normal Depth	2.34	ft
Flow Area	6.89	ft^2
Wetted Perimeter	6.73	ft
Hydraulic Radius	1.02	ft
Top Width	4.42	ft
Critical Depth	2.70	ft
Critical Slope	0.00564	ft/ft
Velocity	9.43	ft/s
Velocity Head	1.38	ft
Specific Energy	3.72	ft
Froude Number	1.33	
Flow Type	Supercritical	

GVF Input Data

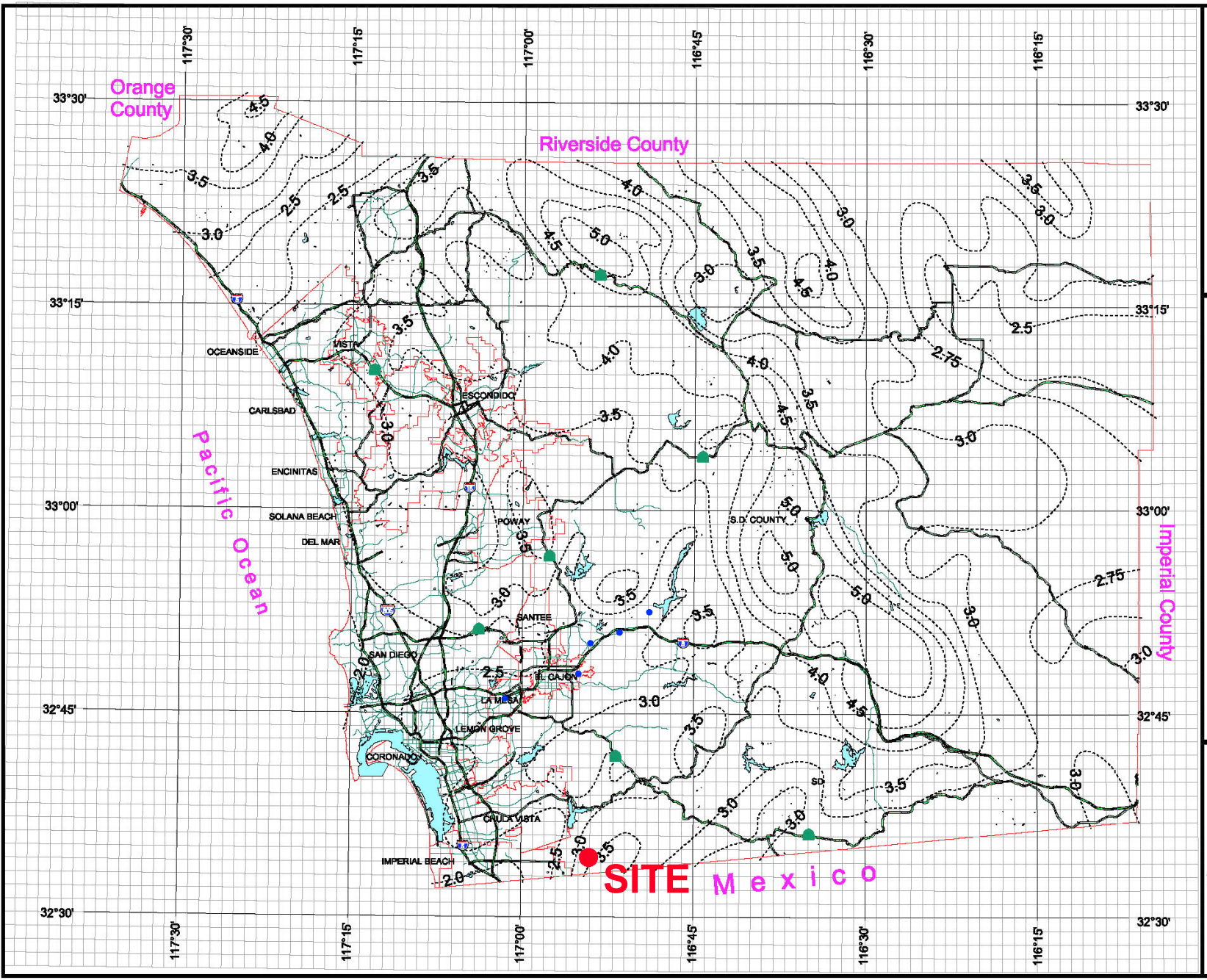
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.34	ft
Critical Depth	2.70	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00564	ft/ft

APPENDIX A

100-YEAR RATIONAL METHOD ANALYSES



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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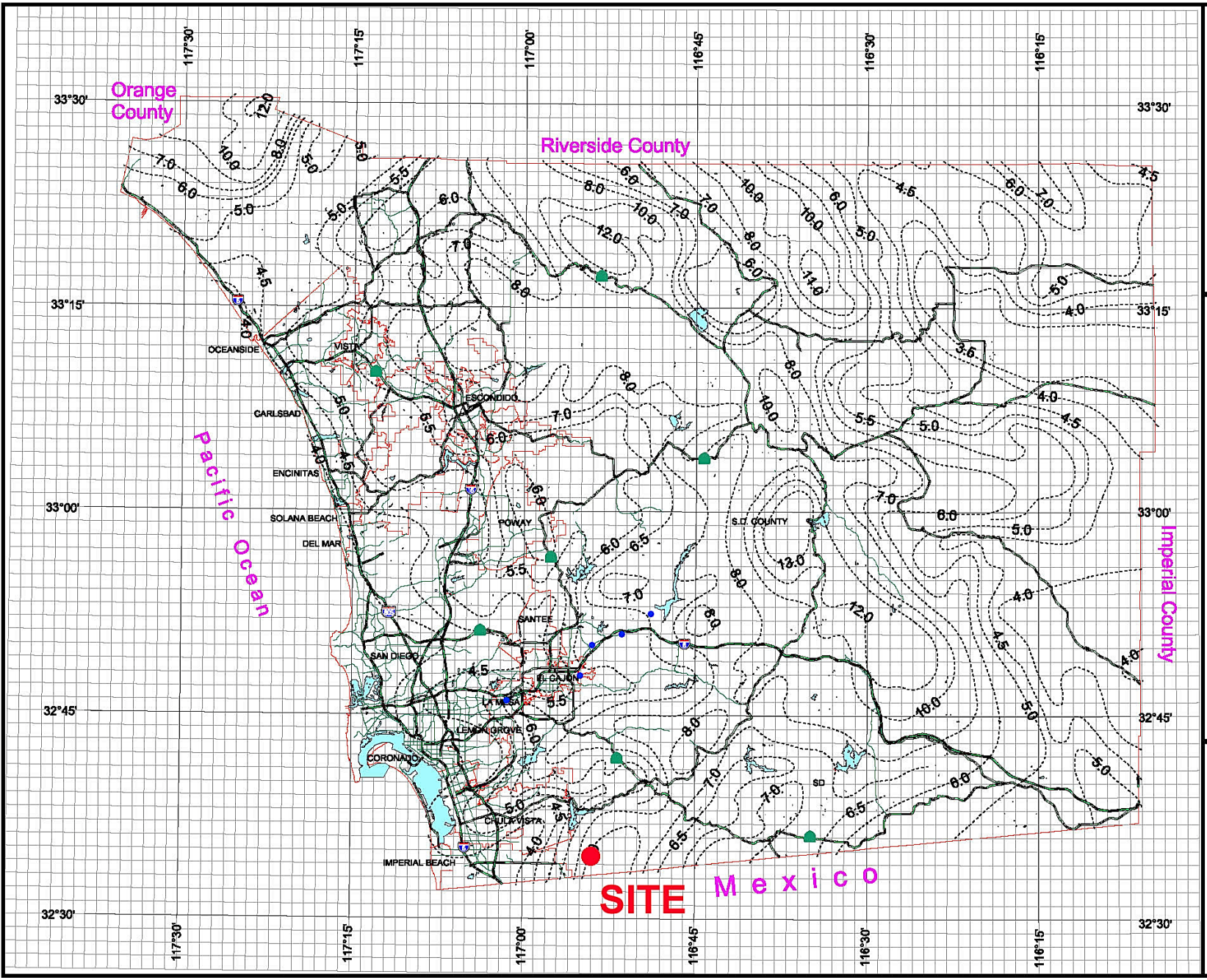
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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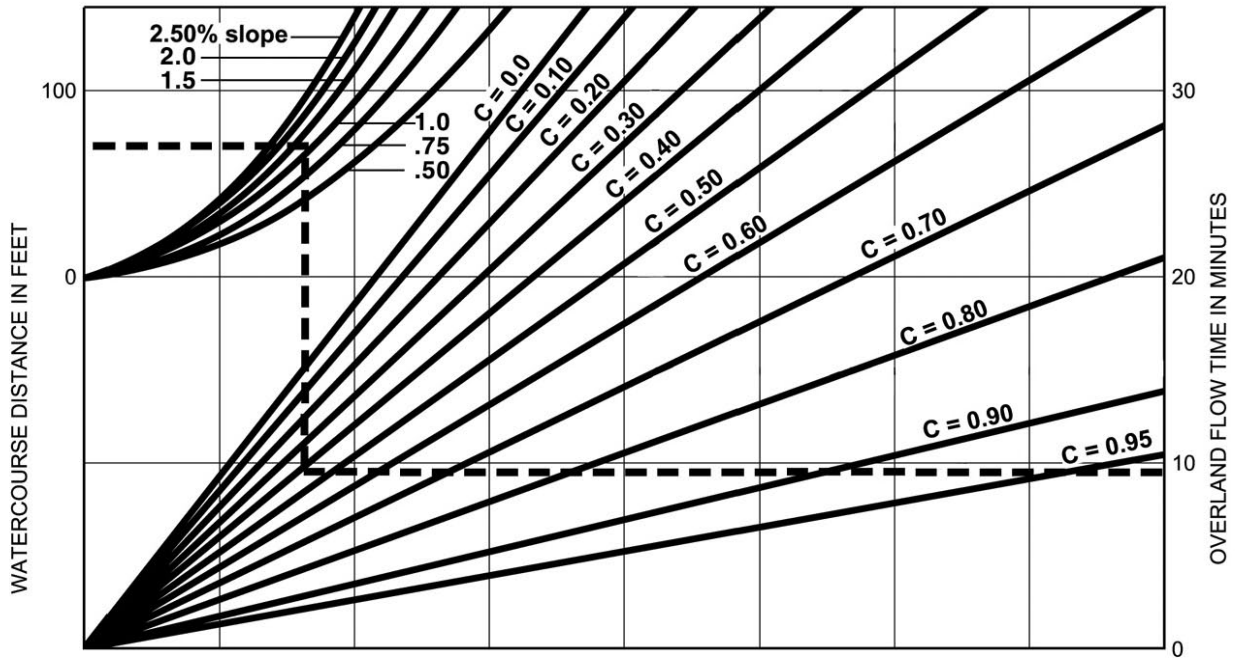


EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

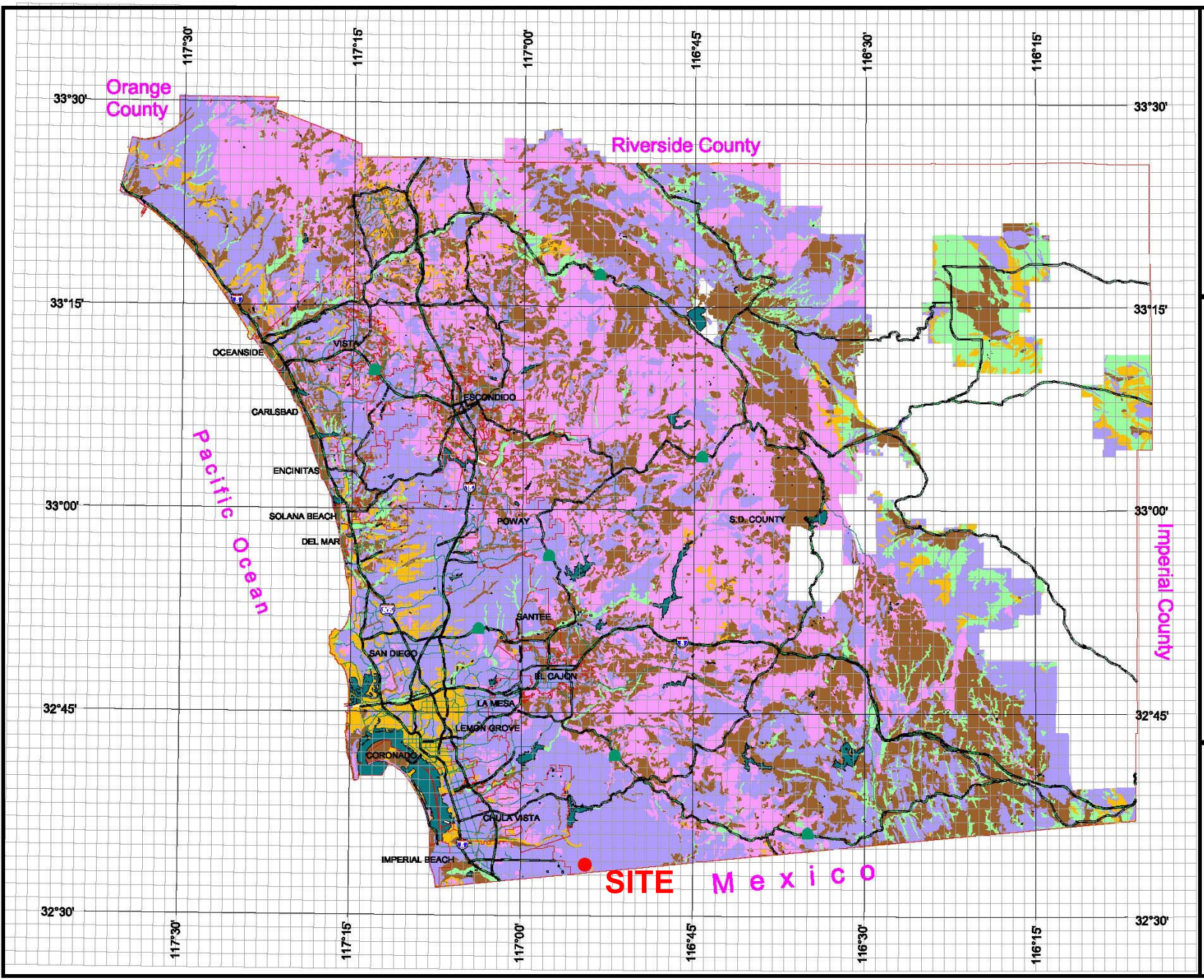
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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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: 02/16/15

Otay Hills Quarry
Existing Conditions
100-Year Storm Event

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

Program License Serial Number 4028

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 8.000
P6/P24 =   42.5%
Adjusted 6 hour precipitation (inches) = 3.600
Adjusted P6/P24 =   45.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   100.000 to Point/Station   101.000
**** 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 = 2615.000(Ft.)
Highest elevation = 1585.000(Ft.)
Lowest elevation = 895.000(Ft.)
Elevation difference = 690.000(Ft.) Slope = 26.386 %
Top of Initial Area Slope adjusted by User to 13.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 13.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.74 minutes

```
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  13.000^(1/3)]=   5.74
The initial area total distance of 2615.00 (Ft.) entered leaves a
remaining distance of 2515.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.42 minutes
for a distance of 2515.00 (Ft.) and a slope of 26.39 %
with an elevation difference of 663.61(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.417 Minutes
Tt=[(11.9*0.4763^3)/(663.61)]^.385=  5.42
Total initial area Ti =   5.74 minutes from Figure 3-3 formula plus
  5.42 minutes from the Figure 3-4 formula =  11.16 minutes
Rainfall intensity (I) =      5.652(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     81.574(CFS)
Total initial stream area =       41.240(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   895.000(Ft.)
Downstream point elevation =   651.000(Ft.)
Channel length thru subarea  =  4193.000(Ft.)
Channel base width      =    3.000(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 =    320.556(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    320.556(CFS)
Depth of flow =   2.933(Ft.), Average velocity =  12.328(Ft/s)
Channel flow top width =   14.732(Ft.)
Flow Velocity =   12.33(Ft/s)
Travel time  =    5.67 min.
Time of concentration =   16.83 min.
Critical depth =      3.688(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.336(In/Hr) for a   100.0 year storm
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
Rainfall intensity =      4.336(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =    129.028
Subarea runoff =    477.896(CFS) for    327.410(Ac.)
Total runoff =    559.470(CFS)      Total area =     368.650(Ac.)
Depth of flow =   3.753(Ft.), Average velocity =  14.192(Ft/s)
Critical depth =      4.781(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    368.650(Ac.)
Runoff from this stream =    559.470(CFS)
Time of concentration =   16.83 min.
Rainfall intensity =     4.336(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** 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  = 1559.000(Ft.)
Highest elevation =  828.000(Ft.)
Lowest elevation =  652.000(Ft.)
Elevation difference =  176.000(Ft.) Slope = 11.289 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.29 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.02 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  11.289^(1/3)]=   6.02
The initial area total distance of 1559.00 (Ft.) entered leaves a
remaining distance of 1459.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   4.94 minutes
for a distance of 1459.00 (Ft.) and a slope of 11.29 %
with an elevation difference of 164.71(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    4.939 Minutes
Tt=[(11.9*0.2763^3)/(164.71)]^.385=  4.94
Total initial area Ti =   6.02 minutes from Figure 3-3 formula plus
  4.94 minutes from the Figure 3-4 formula =  10.96 minutes
Rainfall intensity (I) =      5.718(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     27.600(CFS)
Total initial stream area =       13.790(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
```

```
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     13.790(Ac.)
Runoff from this stream =     27.600(CFS)
Time of concentration =   10.96 min.
Rainfall intensity =     5.718(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** 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  = 2258.000(Ft.)
Highest elevation =  997.000(Ft.)
Lowest elevation =  622.000(Ft.)
Elevation difference =  375.000(Ft.) Slope = 16.608 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  16.61 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.29 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  16.608^(1/3)]=   5.29
The initial area total distance of 2258.00 (Ft.) entered leaves a
remaining distance of 2158.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.75 minutes
for a distance of 2158.00 (Ft.) and a slope of 16.61 %
with an elevation difference of 358.40(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.754 Minutes
Tt=[(11.9*0.4087^3)/(358.40)]^.385=  5.75
Total initial area Ti =   5.29 minutes from Figure 3-3 formula plus
  5.75 minutes from the Figure 3-4 formula =  11.05 minutes
Rainfall intensity (I) =      5.689(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     93.541(CFS)
Total initial stream area =       46.980(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     46.980(Ac.)
Runoff from this stream =     93.541(CFS)
Time of concentration =   11.05 min.
Rainfall intensity =     5.689(In/Hr)
Summary of stream data:
```

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


1       27.600     10.96               5.718
2       93.541     11.05               5.689
Qmax(1) =
         1.000 *    1.000 *    27.600) +
         1.000 *    0.992 *    93.541) + =     120.390
Qmax(2) =
         0.995 *    1.000 *    27.600) +
         1.000 *    1.000 *    93.541) + =     120.997

Total of 2 streams to confluence:
Flow rates before confluence point:
      27.600      93.541
Maximum flow rates at confluence using above data:
      120.390      120.997
Area of streams before confluence:
       13.790       46.980
Results of confluence:
Total flow rate =    120.997(CFS)
Time of concentration =    11.046 min.
Effective stream area after confluence =     60.770(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      211.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     60.770(Ac.)
Runoff from this stream =    120.997(CFS)
Time of concentration =   11.05 min.
Rainfall intensity =     5.689(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** 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  = 2127.000(Ft.)
Highest elevation = 1015.000(Ft.)
Lowest elevation =  605.000(Ft.)
Elevation difference =  410.000(Ft.) Slope = 19.276 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
```

```
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  19.28 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.03 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  19.276^(1/3)]=   5.03
The initial area total distance of 2127.00 (Ft.) entered leaves a
remaining distance of 2027.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.18 minutes
for a distance of 2027.00 (Ft.) and a slope of 19.28 %
with an elevation difference of 390.72(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.178 Minutes
Tt=[(11.9*0.3839^3)/(390.72)]^.385=  5.18
Total initial area Ti =   5.03 minutes from Figure 3-3 formula plus
  5.18 minutes from the Figure 3-4 formula =  10.21 minutes
Rainfall intensity (I) =      5.984(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     80.151(CFS)
Total initial stream area =       38.270(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 3 in normal stream number 1
Stream flow area =     38.270(Ac.)
Runoff from this stream =     80.151(CFS)
Time of concentration =   10.21 min.
Rainfall intensity =     5.984(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      311.000
**** 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  = 1196.000(Ft.)
Highest elevation =  758.000(Ft.)
Lowest elevation =  576.000(Ft.)
Elevation difference =  182.000(Ft.) Slope = 15.217 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.22 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.45 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
```

```
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  15.220^(1/3)]=   5.45
The initial area total distance of 1196.00 (Ft.) entered leaves a
remaining distance of 1096.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.53 minutes
for a distance of 1096.00 (Ft.) and a slope of 15.22 %
with an elevation difference of 166.81(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.532 Minutes
Tt=[(11.9*0.2076^3)/(166.81)]^.385=  3.53
Total initial area Ti =   5.45 minutes from Figure 3-3 formula plus
  3.53 minutes from the Figure 3-4 formula =   8.98 minutes
Rainfall intensity (I) =      6.502(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     58.255(CFS)
Total initial stream area =       25.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      311.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 3 in normal stream number 2
Stream flow area =     25.600(Ac.)
Runoff from this stream =     58.255(CFS)
Time of concentration =    8.98 min.
Rainfall intensity =     6.502(In/Hr)
Summary of stream data:

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


1       80.151     10.21               5.984
2       58.255      8.98               6.502
Qmax(1) =
         1.000 *    1.000 *    80.151) +
         0.920 *    1.000 *    58.255) + =     133.766
Qmax(2) =
         1.000 *    0.879 *    80.151) +
         1.000 *    1.000 *    58.255) + =     128.728

Total of 2 streams to confluence:
Flow rates before confluence point:
      80.151      58.255
Maximum flow rates at confluence using above data:
      133.766      128.728
Area of streams before confluence:
       38.270       25.600
Results of confluence:
Total flow rate =    133.766(CFS)
Time of concentration =    10.213 min.
Effective stream area after confluence =     63.870(Ac.)


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Process from Point/Station      301.000 to Point/Station      311.000
**** CONFLUENCE OF MAIN STREAMS ****
```

```
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =     63.870(Ac.)
Runoff from this stream =    133.766(CFS)
Time of concentration =   10.21 min.
Rainfall intensity =     5.984(In/Hr)
Summary of stream data:

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


1      559.470     16.83               4.336
2      120.997     11.05               5.689
3      133.766     10.21               5.984
Qmax(1) =
         1.000 *    1.000 *   559.470) +
         0.762 *    1.000 *   120.997) +
         0.725 *    1.000 *   133.766) + =     748.626
Qmax(2) =
         1.000 *    0.656 *   559.470) +
         1.000 *    1.000 *   120.997) +
         0.951 *    1.000 *   133.766) + =     615.406
Qmax(3) =
         1.000 *    0.607 *   559.470) +
         1.000 *    0.925 *   120.997) +
         1.000 *    1.000 *   133.766) + =     585.187

Total of 3 main streams to confluence:
Flow rates before confluence point:
     559.470     120.997     133.766
Maximum flow rates at confluence using above data:
      748.626      615.406      585.187
Area of streams before confluence:
      368.650       60.770       63.870


Results of confluence:
Total flow rate =    748.626(CFS)
Time of concentration =    16.827 min.
Effective stream area after confluence  =    493.290(Ac.)
End of computations, total study area =         493.290 (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: 02/19/15

Otay Hills Quarry
Proposed Conditions
100-Year Storm Event

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

Program License Serial Number 4028

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 8.000
P6/P24 = 42.5%
Adjusted 6 hour precipitation (inches) = 3.600
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 11.000
**** 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 = 2998.000(Ft.)
Highest elevation = 1350.000(Ft.)
Lowest elevation = 683.000(Ft.)
Elevation difference = 667.000(Ft.) Slope = 22.248 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 22.25 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.80 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(22.248^(1/3)]= 4.80

```
The initial area total distance of 2998.00 (Ft.) entered leaves a
remaining distance of 2898.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   6.45 minutes
for a distance of 2898.00 (Ft.) and a slope of 22.25 %
with an elevation difference of 644.75(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    6.452 Minutes
Tt=[(11.9*0.5489^3)/(644.75)]^.385=  6.45
Total initial area Ti =   4.80 minutes from Figure 3-3 formula plus
  6.45 minutes from the Figure 3-4 formula =  11.25 minutes
Rainfall intensity (I) =      5.621(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =    111.199(CFS)
Total initial stream area =       56.520(Ac.)


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Process from Point/Station       11.000 to Point/Station       12.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   683.000(Ft.)
Downstream point elevation =   680.300(Ft.)
Channel length thru subarea  =   234.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =  20.000
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    111.199(CFS)
Depth of flow =   1.209(Ft.), Average velocity =   3.802(Ft/s)
Channel flow top width =   48.374(Ft.)
Flow Velocity =    3.80(Ft/s)
Travel time  =    1.03 min.
Time of concentration =   12.28 min.
Critical depth =      1.141(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     56.520(Ac.)
Runoff from this stream =    111.199(CFS)
Time of concentration =   12.28 min.
Rainfall intensity =     5.314(In/Hr)


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Process from Point/Station       13.000 to Point/Station       14.000
**** 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  = 2615.000(Ft.)
Highest elevation = 1585.000(Ft.)
Lowest elevation =  895.000(Ft.)
Elevation difference =  690.000(Ft.) Slope = 26.386 %
Top of Initial Area Slope adjusted by User to 13.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  13.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.74 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  13.000^(1/3)]=   5.74
The initial area total distance of 2615.00 (Ft.) entered leaves a
remaining distance of 2515.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.42 minutes
for a distance of 2515.00 (Ft.) and a slope of 26.39 %
with an elevation difference of 663.61(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.417 Minutes
Tt=[(11.9*0.4763^3)/(663.61)]^.385=  5.42
Total initial area Ti =   5.74 minutes from Figure 3-3 formula plus
  5.42 minutes from the Figure 3-4 formula =  11.16 minutes
Rainfall intensity (I) =      5.652(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     81.574(CFS)
Total initial stream area =       41.240(Ac.)


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Process from Point/Station       14.000 to Point/Station       15.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   895.000(Ft.)
Downstream point elevation =   683.000(Ft.)
Channel length thru subarea  =  3369.000(Ft.)
Channel base width      =    3.000(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 =    250.990(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    250.990(CFS)
Depth of flow =   2.579(Ft.), Average velocity =  11.927(Ft/s)
Channel flow top width =   13.317(Ft.)
Flow Velocity =   11.93(Ft/s)
Travel time  =    4.71 min.
Time of concentration =   15.87 min.
Critical depth =      3.313(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.504(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.504(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =     93.331
Subarea runoff =    338.754(CFS) for    225.420(Ac.)
Total runoff =    420.328(CFS)      Total area =     266.660(Ac.)
Depth of flow =   3.253(Ft.), Average velocity =  13.595(Ft/s)
Critical depth =      4.188(Ft.)


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Process from Point/Station       15.000 to Point/Station       12.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   683.000(Ft.)
Downstream point elevation =   680.300(Ft.)
Channel length thru subarea  =   238.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =  20.000
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    420.328(CFS)
Depth of flow =   1.998(Ft.), Average velocity =   5.267(Ft/s)
Channel flow top width =   79.901(Ft.)
Flow Velocity =    5.27(Ft/s)
Travel time  =    0.75 min.
Time of concentration =   16.62 min.
Critical depth =      1.938(Ft.)


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Process from Point/Station       15.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    266.660(Ac.)
Runoff from this stream =    420.328(CFS)
Time of concentration =   16.62 min.
Rainfall intensity =     4.371(In/Hr)
Summary of stream data:

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


1      111.199     12.28               5.314
2      420.328     16.62               4.371
Qmax(1) =
         1.000 *    1.000 *   111.199) +
         1.000 *    0.739 *   420.328) + =     421.721
Qmax(2) =
         0.823 *    1.000 *   111.199) +
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         1.000 *    1.000 *   420.328) + =     511.800

Total of 2 streams to confluence:
Flow rates before confluence point:
     111.199     420.328
Maximum flow rates at confluence using above data:
      421.721      511.800
Area of streams before confluence:
       56.520      266.660
Results of confluence:
Total flow rate =    511.800(CFS)
Time of concentration =    16.620 min.
Effective stream area after confluence =    323.180(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   680.300(Ft.)
Downstream point elevation =   675.500(Ft.)
Channel length thru subarea  =   497.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =  20.000
Estimated mean flow rate at midpoint of channel =    511.847(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    511.847(CFS)
Depth of flow =   2.217(Ft.), Average velocity =   5.209(Ft/s)
Channel flow top width =   88.663(Ft.)
Flow Velocity =    5.21(Ft/s)
Travel time  =    1.59 min.
Time of concentration =   18.21 min.
Critical depth =      2.094(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.121(In/Hr) for a   100.0 year storm
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
The area added to the existing stream causes a
a lower flow rate of Q =    488.191(CFS)
therefore the upstream flow rate of Q =    511.800(CFS) is being used
Rainfall intensity =      4.121(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =    118.471
Subarea runoff =      0.000(CFS) for     15.310(Ac.)
Total runoff =    511.800(CFS)      Total area =     338.490(Ac.)
Depth of flow =   2.216(Ft.), Average velocity =   5.209(Ft/s)
Critical depth =      2.094(Ft.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    338.490(Ac.)
Runoff from this stream =    511.800(CFS)
Time of concentration =   18.21 min.
Rainfall intensity =     4.121(In/Hr)


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Process from Point/Station       17.000 to Point/Station       18.000
**** 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  = 2362.000(Ft.)
Highest elevation = 1020.300(Ft.)
Lowest elevation =  684.000(Ft.)
Elevation difference =  336.300(Ft.) Slope = 14.238 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  14.24 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.57 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  14.238^(1/3)]=   5.57
The initial area total distance of 2362.00 (Ft.) entered leaves a
remaining distance of 2262.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   6.33 minutes
for a distance of 2262.00 (Ft.) and a slope of 14.24 %
with an elevation difference of 322.06(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    6.331 Minutes
Tt=[(11.9*0.4284^3)/(322.06)]^.385=  6.33
Total initial area Ti =   5.57 minutes from Figure 3-3 formula plus
  6.33 minutes from the Figure 3-4 formula =  11.90 minutes
Rainfall intensity (I) =      5.422(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     69.431(CFS)
Total initial stream area =       36.590(Ac.)


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Process from Point/Station       18.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   684.000(Ft.)
Downstream point elevation =   675.500(Ft.)
```

```
Channel length thru subarea  =   694.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =  20.000
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     69.431(CFS)
Depth of flow =   1.002(Ft.), Average velocity =   3.456(Ft/s)
Channel flow top width =   40.091(Ft.)
Flow Velocity =    3.46(Ft/s)
Travel time  =    3.35 min.
Time of concentration =   15.25 min.
Critical depth =      0.945(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     36.590(Ac.)
Runoff from this stream =     69.431(CFS)
Time of concentration =   15.25 min.
Rainfall intensity =     4.621(In/Hr)
Summary of stream data:

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


1      511.800     18.21               4.121
2       69.431     15.25               4.621
Qmax(1) =
         1.000 *    1.000 *   511.800) +
         0.892 *    1.000 *    69.431) + =     573.720
Qmax(2) =
         1.000 *    0.837 *   511.800) +
         1.000 *    1.000 *    69.431) + =     497.986

Total of 2 streams to confluence:
Flow rates before confluence point:
     511.800      69.431
Maximum flow rates at confluence using above data:
      573.720      497.986
Area of streams before confluence:
      338.490       36.590
Results of confluence:
Total flow rate =    573.720(CFS)
Time of concentration =    18.210 min.
Effective stream area after confluence =    375.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
```

```
In Main Stream number: 1
Stream flow area =    375.080(Ac.)
Runoff from this stream =    573.720(CFS)
Time of concentration =   18.21 min.
Rainfall intensity =     4.121(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** 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  = 1411.000(Ft.)
Highest elevation = 1020.300(Ft.)
Lowest elevation =  787.000(Ft.)
Elevation difference =  233.300(Ft.) Slope = 16.534 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  16.53 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.30 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  16.534^(1/3)]=   5.30
The initial area total distance of 1411.00 (Ft.) entered leaves a
remaining distance of 1311.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.93 minutes
for a distance of 1311.00 (Ft.) and a slope of 16.53 %
with an elevation difference of 216.76(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.927 Minutes
Tt=[(11.9*0.2483^3)/(216.76)]^.385=  3.93
Total initial area Ti =   5.30 minutes from Figure 3-3 formula plus
  3.93 minutes from the Figure 3-4 formula =   9.23 minutes
Rainfall intensity (I) =      6.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     13.730(CFS)
Total initial stream area =        6.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****
----------------------------------------------------------------------
Upstream point elevation =   787.000(Ft.)
Downstream point elevation =   650.500(Ft.)
Channel length thru subarea  =   166.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   2.000
```

```
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.016
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     13.730(CFS)
Depth of flow =   0.369(Ft.), Average velocity =  30.004(Ft/s)
Channel flow top width =    1.978(Ft.)
Flow Velocity =   30.00(Ft/s)
Travel time  =    0.09 min.
Time of concentration =    9.32 min.
Critical depth =      1.109(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   650.500(Ft.)
Downstream point elevation =   624.000(Ft.)
Channel length thru subarea  =  1116.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =  20.000
Estimated mean flow rate at midpoint of channel =     50.273(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     50.273(CFS)
Depth of flow =   0.784(Ft.), Average velocity =   4.086(Ft/s)
Channel flow top width =   31.373(Ft.)
Flow Velocity =    4.09(Ft/s)
Travel time  =    4.55 min.
Time of concentration =   13.87 min.
Critical depth =      0.828(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.912(In/Hr) for a   100.0 year storm
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
Rainfall intensity =      4.912(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =     17.661
Subarea runoff =     73.014(CFS) for     44.320(Ac.)
Total runoff =     86.744(CFS)      Total area =      50.460(Ac.)
Depth of flow =   0.962(Ft.), Average velocity =   4.683(Ft/s)
Critical depth =      1.023(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
```

```
Stream flow area =     50.460(Ac.)
Runoff from this stream =     86.744(CFS)
Time of concentration =   13.87 min.
Rainfall intensity =     4.912(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       31.000
**** 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  = 1131.000(Ft.)
Highest elevation = 1015.000(Ft.)
Lowest elevation =  700.000(Ft.)
Elevation difference =  315.000(Ft.) Slope = 27.851 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.85 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
The initial area total distance of 1131.00 (Ft.) entered leaves a
remaining distance of 1031.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.67 minutes
for a distance of 1031.00 (Ft.) and a slope of 27.85 %
with an elevation difference of 287.14(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.670 Minutes
Tt=[(11.9*0.1953^3)/(287.14)]^.385=  2.67
Total initial area Ti =   6.90 minutes from Table 3-2 plus
  2.67 minutes from the Figure 3-4 formula =   9.57 minutes
Rainfall intensity (I) =      6.240(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     56.915(CFS)
Total initial stream area =       26.060(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station       32.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   700.000(Ft.)
Downstream point elevation =   605.000(Ft.)
Channel length thru subarea  =  1399.000(Ft.)
Channel base width      =    3.000(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 =     56.940(CFS)
```

```
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     56.940(CFS)
Depth of flow =   1.076(Ft.), Average velocity =  10.270(Ft/s)
Channel flow top width =    7.305(Ft.)
Flow Velocity =   10.27(Ft/s)
Travel time  =    2.27 min.
Time of concentration =   11.84 min.
Critical depth =      1.594(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.439(In/Hr) for a   100.0 year storm
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
The area added to the existing stream causes a
a lower flow rate of Q =     55.343(CFS)
therefore the upstream flow rate of Q =     56.915(CFS) is being used
Rainfall intensity =      5.439(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =     10.174
Subarea runoff =      0.000(CFS) for      3.010(Ac.)
Total runoff =     56.915(CFS)      Total area =      29.070(Ac.)
Depth of flow =   1.076(Ft.), Average velocity =  10.269(Ft/s)
Critical depth =      1.594(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station       32.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 3 in normal stream number 1
Stream flow area =     29.070(Ac.)
Runoff from this stream =     56.915(CFS)
Time of concentration =   11.84 min.
Rainfall intensity =     5.439(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       34.000
**** 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  = 1383.000(Ft.)
Highest elevation =  653.000(Ft.)
Lowest elevation =  572.000(Ft.)
```

```
Elevation difference =   81.000(Ft.) Slope =  5.857 %
Top of Initial Area Slope adjusted by User to 26.570 %
Bottom of Initial Area Slope adjusted by User to  1.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  26.57 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.52 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  26.570^(1/3)]=   4.52
The initial area total distance of 1383.00 (Ft.) entered leaves a
remaining distance of 1283.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   9.99 minutes
for a distance of 1283.00 (Ft.) and a slope of  1.40 %
with an elevation difference of  17.96(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    9.992 Minutes
Tt=[(11.9*0.2430^3)/( 17.96)]^.385=  9.99
Total initial area Ti =   4.52 minutes from Figure 3-3 formula plus
  9.99 minutes from the Figure 3-4 formula =  14.52 minutes
Rainfall intensity (I) =      4.770(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     64.570(CFS)
Total initial stream area =       38.680(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       34.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 3 in normal stream number 2
Stream flow area =     38.680(Ac.)
Runoff from this stream =     64.570(CFS)
Time of concentration =   14.52 min.
Rainfall intensity =     4.770(In/Hr)
Summary of stream data:

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


1       56.915     11.84               5.439
2       64.570     14.52               4.770
Qmax(1) =
         1.000 *    1.000 *    56.915) +
         1.000 *    0.816 *    64.570) + =     109.582
Qmax(2) =
         0.877 *    1.000 *    56.915) +
         1.000 *    1.000 *    64.570) + =     114.475

Total of 2 streams to confluence:
Flow rates before confluence point:
      56.915      64.570
Maximum flow rates at confluence using above data:
      109.582      114.475
Area of streams before confluence:
```

```
       29.070       38.680
Results of confluence:
Total flow rate =    114.475(CFS)
Time of concentration =    14.517 min.
Effective stream area after confluence =     67.750(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       34.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =     67.750(Ac.)
Runoff from this stream =    114.475(CFS)
Time of concentration =   14.52 min.
Rainfall intensity =     4.770(In/Hr)
Summary of stream data:

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


1      573.720     18.21               4.121
2       86.744     13.87               4.912
3      114.475     14.52               4.770
Qmax(1) =
         1.000 *    1.000 *   573.720) +
         0.839 *    1.000 *    86.744) +
         0.864 *    1.000 *   114.475) + =     745.400
Qmax(2) =
         1.000 *    0.762 *   573.720) +
         1.000 *    1.000 *    86.744) +
         1.000 *    0.955 *   114.475) + =     633.128
Qmax(3) =
         1.000 *    0.797 *   573.720) +
         0.971 *    1.000 *    86.744) +
         1.000 *    1.000 *   114.475) + =     656.065

Total of 3 main streams to confluence:
Flow rates before confluence point:
     573.720      86.744     114.475
Maximum flow rates at confluence using above data:
      745.400      633.128      656.065
Area of streams before confluence:
      375.080       50.460       67.750


Results of confluence:
Total flow rate =    745.400(CFS)
Time of concentration =    18.210 min.
Effective stream area after confluence  =    493.290(Ac.)
End of computations, total study area =         493.290 (Ac.)
```

APPENDIX B

100-YEAR DETENTION ANALYSIS

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   20JAN12  TIME  15:19:54   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (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

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

                       *DIAGRAM
*** FREE ***
              1        ID   OTAY HILLS QUARRY
              2        ID   100-YEAR DETENTION ANALYSIS
              3        ID   NORTHWEST OUTFLOW LOCATION
              4        IT       1 01JAN90    1200     400

              5        KK   BASIN
              6        KM   RATIONAL METHOD HYDROGRAPH PROGRAM
              7        KM   6-HOUR RAINFALL IS 3.4 INCHES
              8        KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.35
              9        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 18.21 MINUTES
             10        BA  0.5861
             11        IN      18 01JAN90    1157
             12        QI       0    26.9    28.8      30    32.6    34.1    37.8    40.1      46    49.9
             13        QI    60.9    69.4   101.9    84.7   573.7    81.7    54.7    42.8    35.8    31.2
             14        QI    27.8       0       0       0       0       0       0       0       0       0
             15        QI       0       0

             16        KK  DETAIN
             17        RS       1    STOR      -1
             18        SV       0     0.6
             19        SQ       0     559
             20        SE     100     101
             21        ZZ
```

```
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    5       BASIN
              V
              V
   16      DETAIN

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   20JAN12  TIME  15:19:54   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
```

OTAY HILLS QUARRY
100-YEAR DETENTION ANALYSIS
NORTHWEST OUTFLOW LOCATION

```
    IT          HYDROGRAPH TIME DATA
                      NMIN          1  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1JAN90  STARTING DATE
                     ITIME        1200  STARTING TIME
                        NQ         400  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1JAN90  ENDING DATE
                     NDTIME        1839  ENDING TIME
                     ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL     .02 HOURS
                        TOTAL TIME BASE    6.65 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
```

*** ***

```
            **************
            *            *
  5 KK      *     BASIN  *
            *            *
            **************
```

RATIONAL METHOD HYDROGRAPH PROGRAM
6-HOUR RAINFALL IS 3.4 INCHES
RATIONAL METHOD RUNOFF COEFFICIENT IS 0.35
RATIONAL METHOD TIME OF CONCENTRATION IS 18.21 MINUTES

```
  11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         18  TIME INTERVAL IN MINUTES
                     JXDATE      1JAN90  STARTING DATE
                     JXTIME        1157  STARTING TIME

               SUBBASIN RUNOFF DATA

  10 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .59  SUBBASIN AREA
```

***

HYDROGRAPH AT STATION   BASIN

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1	JAN	1200	1	4.	1	JAN	1340	101	37.	1	JAN	1520	201	78.	1	JAN	1700	301	45.
1	JAN	1201	2	6.	1	JAN	1341	102	37.	1	JAN	1521	202	80.	1	JAN	1701	302	44.
1	JAN	1202	3	7.	1	JAN	1342	103	37.	1	JAN	1522	203	82.	1	JAN	1702	303	43.
1	JAN	1203	4	9.	1	JAN	1343	104	37.	1	JAN	1523	204	84.	1	JAN	1703	304	43.
1	JAN	1204	5	10.	1	JAN	1344	105	38.	1	JAN	1524	205	86.	1	JAN	1704	305	42.
1	JAN	1205	6	12.	1	JAN	1345	106	38.	1	JAN	1525	206	87.	1	JAN	1705	306	42.
1	JAN	1206	7	13.	1	JAN	1346	107	38.	1	JAN	1526	207	89.	1	JAN	1706	307	42.
1	JAN	1207	8	15.	1	JAN	1347	108	38.	1	JAN	1527	208	91.	1	JAN	1707	308	41.
1	JAN	1208	9	16.	1	JAN	1348	109	38.	1	JAN	1528	209	93.	1	JAN	1708	309	41.
1	JAN	1209	10	18.	1	JAN	1349	110	38.	1	JAN	1529	210	95.	1	JAN	1709	310	40.
1	JAN	1210	11	19.	1	JAN	1350	111	38.	1	JAN	1530	211	96.	1	JAN	1710	311	40.
1	JAN	1211	12	21.	1	JAN	1351	112	39.	1	JAN	1531	212	98.	1	JAN	1711	312	40.
1	JAN	1212	13	22.	1	JAN	1352	113	39.	1	JAN	1532	213	100.	1	JAN	1712	313	39.
1	JAN	1213	14	24.	1	JAN	1353	114	39.	1	JAN	1533	214	102.	1	JAN	1713	314	39.
1	JAN	1214	15	25.	1	JAN	1354	115	39.	1	JAN	1534	215	101.	1	JAN	1714	315	39.
1	JAN	1215	16	27.	1	JAN	1355	116	39.	1	JAN	1535	216	100.	1	JAN	1715	316	38.
1	JAN	1216	17	27.	1	JAN	1356	117	39.	1	JAN	1536	217	99.	1	JAN	1716	317	38.
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1	JAN	1223	24	28.	1	JAN	1403	124	40.	1	JAN	1543	224	92.	1	JAN	1723	324	35.
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1	JAN	1235	36	29.	1	JAN	1415	136	44.	1	JAN	1555	236	193.	1	JAN	1735	336	32.
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1	JAN	1301	62	31.	1	JAN	1441	162	51.	1	JAN	1621	262	246.	1	JAN	1801	362	22.
1	JAN	1302	63	32.	1	JAN	1442	163	52.	1	JAN	1622	263	218.	1	JAN	1802	363	20.
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1	JAN	1304	65	32.	1	JAN	1444	165	53.	1	JAN	1624	265	164.	1	JAN	1804	365	17.
1	JAN	1305	66	32.	1	JAN	1445	166	54.	1	JAN	1625	266	136.	1	JAN	1805	366	15.
1	JAN	1306	67	32.	1	JAN	1446	167	54.	1	JAN	1626	267	109.	1	JAN	1806	367	14.
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  1 JAN 1311   72      33.  *   1 JAN 1451  172      57.  *   1 JAN 1631  272      76.  *   1 JAN 1811  372       6.
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  1 JAN 1321   82      34.  *   1 JAN 1501  182      63.  *   1 JAN 1641  282      61.  *   1 JAN 1821  382       0.
  1 JAN 1322   83      34.  *   1 JAN 1502  183      63.  *   1 JAN 1642  283      59.  *   1 JAN 1822  383       0.
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  1 JAN 1325   86      34.  *   1 JAN 1505  186      65.  *   1 JAN 1645  286      55.  *   1 JAN 1825  386       0.
  1 JAN 1326   87      34.  *   1 JAN 1506  187      65.  *   1 JAN 1646  287      54.  *   1 JAN 1826  387       0.
  1 JAN 1327   88      34.  *   1 JAN 1507  188      66.  *   1 JAN 1647  288      53.  *   1 JAN 1827  388       0.
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  1 JAN 1333   94      35.  *   1 JAN 1513  194      68.  *   1 JAN 1653  294      49.  *   1 JAN 1833  394       0.
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  1 JAN 1335   96      36.  *   1 JAN 1515  196      69.  *   1 JAN 1655  296      48.  *   1 JAN 1835  396       0.
  1 JAN 1336   97      36.  *   1 JAN 1516  197      71.  *   1 JAN 1656  297      47.  *   1 JAN 1836  397       0.
  1 JAN 1337   98      36.  *   1 JAN 1517  198      73.  *   1 JAN 1657  298      47.  *   1 JAN 1837  398       0.
  1 JAN 1338   99      36.  *   1 JAN 1518  199      75.  *   1 JAN 1658  299      46.  *   1 JAN 1838  399       0.
  1 JAN 1339  100      37.  *   1 JAN 1519  200      77.  *   1 JAN 1659  300      45.  *   1 JAN 1839  400       0.
                            *                                *                                *
**************************************************************************************************************************

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR      6.65-HR
 +   (CFS)      (HR)
                              (CFS)
 +     574.     4.15                       74.          67.         67.          67.
                           (INCHES)      1.177        1.182       1.182        1.182
                            (AC-FT)        37.          37.         37.          37.

                            CUMULATIVE AREA =     .59 SQ MI



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
   16 KK     *   DETAIN   *
             *            *
             **************

                HYDROGRAPH ROUTING DATA

   17 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

   18 SV            STORAGE           .0         .6

   19 SQ          DISCHARGE           0.       559.

   20 SE          ELEVATION       100.00     101.00
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HYDROGRAPH AT STATION DETAIN

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	4.	.0	100.0	1	JAN	1414	135	43.	.0	100.1	1	JAN	1628	269	86.	.1	100.2
1	JAN	1201	2	5.	.0	100.0	1	JAN	1415	136	44.	.0	100.1	1	JAN	1629	270	81.	.1	100.1
1	JAN	1202	3	6.	.0	100.0	1	JAN	1416	137	44.	.0	100.1	1	JAN	1630	271	79.	.1	100.1
1	JAN	1203	4	8.	.0	100.0	1	JAN	1417	138	44.	.0	100.1	1	JAN	1631	272	77.	.1	100.1
1	JAN	1204	5	9.	.0	100.0	1	JAN	1418	139	45.	.0	100.1	1	JAN	1632	273	75.	.1	100.1
1	JAN	1205	6	11.	.0	100.0	1	JAN	1419	140	45.	.0	100.1	1	JAN	1633	274	74.	.1	100.1
1	JAN	1206	7	12.	.0	100.0	1	JAN	1420	141	45.	.0	100.1	1	JAN	1634	275	72.	.1	100.1
1	JAN	1207	8	14.	.0	100.0	1	JAN	1421	142	46.	.0	100.1	1	JAN	1635	276	71.	.1	100.1
1	JAN	1208	9	15.	.0	100.0	1	JAN	1422	143	46.	.0	100.1	1	JAN	1636	277	69.	.1	100.1
1	JAN	1209	10	17.	.0	100.0	1	JAN	1423	144	46.	.0	100.1	1	JAN	1637	278	68.	.1	100.1
1	JAN	1210	11	18.	.0	100.0	1	JAN	1424	145	46.	.0	100.1	1	JAN	1638	279	66.	.1	100.1
1	JAN	1211	12	20.	.0	100.0	1	JAN	1425	146	47.	.1	100.1	1	JAN	1639	280	65.	.1	100.1
1	JAN	1212	13	21.	.0	100.0	1	JAN	1426	147	47.	.1	100.1	1	JAN	1640	281	63.	.1	100.1
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1	JAN	1216	17	27.	.0	100.0	1	JAN	1430	151	48.	.1	100.1	1	JAN	1644	285	57.	.1	100.1
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1	JAN	1219	20	27.	.0	100.0	1	JAN	1433	154	48.	.1	100.1	1	JAN	1647	288	54.	.1	100.1
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1	JAN	1251	52	30.	.0	100.1	1	JAN	1505	186	64.	.1	100.1	1	JAN	1719	320	37.	.0	100.1
1	JAN	1252	53	30.	.0	100.1	1	JAN	1506	187	65.	.1	100.1	1	JAN	1720	321	36.	.0	100.1
1	JAN	1253	54	30.	.0	100.1	1	JAN	1507	188	65.	.1	100.1	1	JAN	1721	322	36.	.0	100.1
1	JAN	1254	55	30.	.0	100.1	1	JAN	1508	189	66.	.1	100.1	1	JAN	1722	323	36.	.0	100.1
1	JAN	1255	56	30.	.0	100.1	1	JAN	1509	190	66.	.1	100.1	1	JAN	1723	324	35.	.0	100.1
1	JAN	1256	57	31.	.0	100.1	1	JAN	1510	191	67.	.1	100.1	1	JAN	1724	325	35.	.0	100.1
1	JAN	1257	58	31.	.0	100.1	1	JAN	1511	192	67.	.1	100.1	1	JAN	1725	326	35.	.0	100.1
1	JAN	1258	59	31.	.0	100.1	1	JAN	1512	193	68.	.1	100.1	1	JAN	1726	327	35.	.0	100.1
1	JAN	1259	60	31.	.0	100.1	1	JAN	1513	194	68.	.1	100.1	1	JAN	1727	328	34.	.0	100.1
1	JAN	1300	61	31.	.0	100.1	1	JAN	1514	195	69.	.1	100.1	1	JAN	1728	329	34.	.0	100.1

1	JAN	1301	62	31.	.0	100.1	*	1	JAN	1515	196	69.	.1	100.1	*	1	JAN	1729	330	34.	.0	100.1
1	JAN	1302	63	31.	.0	100.1	*	1	JAN	1516	197	70.	.1	100.1	*	1	JAN	1730	331	34.	.0	100.1
1	JAN	1303	64	32.	.0	100.1	*	1	JAN	1517	198	72.	.1	100.1	*	1	JAN	1731	332	33.	.0	100.1
1	JAN	1304	65	32.	.0	100.1	*	1	JAN	1518	199	73.	.1	100.1	*	1	JAN	1732	333	33.	.0	100.1
1	JAN	1305	66	32.	.0	100.1	*	1	JAN	1519	200	75.	.1	100.1	*	1	JAN	1733	334	33.	.0	100.1
1	JAN	1306	67	32.	.0	100.1	*	1	JAN	1520	201	77.	.1	100.1	*	1	JAN	1734	335	33.	.0	100.1
1	JAN	1307	68	32.	.0	100.1	*	1	JAN	1521	202	79.	.1	100.1	*	1	JAN	1735	336	32.	.0	100.1
1	JAN	1308	69	32.	.0	100.1	*	1	JAN	1522	203	81.	.1	100.1	*	1	JAN	1736	337	32.	.0	100.1
1	JAN	1309	70	32.	.0	100.1	*	1	JAN	1523	204	82.	.1	100.1	*	1	JAN	1737	338	32.	.0	100.1
1	JAN	1310	71	33.	.0	100.1	*	1	JAN	1524	205	84.	.1	100.2	*	1	JAN	1738	339	32.	.0	100.1
1	JAN	1311	72	33.	.0	100.1	*	1	JAN	1525	206	86.	.1	100.2	*	1	JAN	1739	340	31.	.0	100.1
1	JAN	1312	73	33.	.0	100.1	*	1	JAN	1526	207	88.	.1	100.2	*	1	JAN	1740	341	31.	.0	100.1
1	JAN	1313	74	33.	.0	100.1	*	1	JAN	1527	208	90.	.1	100.2	*	1	JAN	1741	342	31.	.0	100.1
1	JAN	1314	75	33.	.0	100.1	*	1	JAN	1528	209	91.	.1	100.2	*	1	JAN	1742	343	31.	.0	100.1
1	JAN	1315	76	33.	.0	100.1	*	1	JAN	1529	210	93.	.1	100.2	*	1	JAN	1743	344	31.	.0	100.1
1	JAN	1316	77	33.	.0	100.1	*	1	JAN	1530	211	95.	.1	100.2	*	1	JAN	1744	345	30.	.0	100.1
1	JAN	1317	78	33.	.0	100.1	*	1	JAN	1531	212	97.	.1	100.2	*	1	JAN	1745	346	30.	.0	100.1
1	JAN	1318	79	33.	.0	100.1	*	1	JAN	1532	213	99.	.1	100.2	*	1	JAN	1746	347	30.	.0	100.1
1	JAN	1319	80	33.	.0	100.1	*	1	JAN	1533	214	100.	.1	100.2	*	1	JAN	1747	348	30.	.0	100.1
1	JAN	1320	81	33.	.0	100.1	*	1	JAN	1534	215	101.	.1	100.2	*	1	JAN	1748	349	30.	.0	100.1
1	JAN	1321	82	34.	.0	100.1	*	1	JAN	1535	216	101.	.1	100.2	*	1	JAN	1749	350	29.	.0	100.1
1	JAN	1322	83	34.	.0	100.1	*	1	JAN	1536	217	100.	.1	100.2	*	1	JAN	1750	351	29.	.0	100.1
1	JAN	1323	84	34.	.0	100.1	*	1	JAN	1537	218	99.	.1	100.2	*	1	JAN	1751	352	29.	.0	100.1
1	JAN	1324	85	34.	.0	100.1	*	1	JAN	1538	219	98.	.1	100.2	*	1	JAN	1752	353	29.	.0	100.1
1	JAN	1325	86	34.	.0	100.1	*	1	JAN	1539	220	97.	.1	100.2	*	1	JAN	1753	354	29.	.0	100.1
1	JAN	1326	87	34.	.0	100.1	*	1	JAN	1540	221	96.	.1	100.2	*	1	JAN	1754	355	29.	.0	100.1
1	JAN	1327	88	34.	.0	100.1	*	1	JAN	1541	222	95.	.1	100.2	*	1	JAN	1755	356	28.	.0	100.1
1	JAN	1328	89	34.	.0	100.1	*	1	JAN	1542	223	94.	.1	100.2	*	1	JAN	1756	357	28.	.0	100.1
1	JAN	1329	90	34.	.0	100.1	*	1	JAN	1543	224	93.	.1	100.2	*	1	JAN	1757	358	28.	.0	100.0
1	JAN	1330	91	35.	.0	100.1	*	1	JAN	1544	225	92.	.1	100.2	*	1	JAN	1758	359	27.	.0	100.0
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1	JAN	1332	93	35.	.0	100.1	*	1	JAN	1546	227	90.	.1	100.2	*	1	JAN	1800	361	24.	.0	100.0
1	JAN	1333	94	35.	.0	100.1	*	1	JAN	1547	228	89.	.1	100.2	*	1	JAN	1801	362	23.	.0	100.0
1	JAN	1334	95	35.	.0	100.1	*	1	JAN	1548	229	88.	.1	100.2	*	1	JAN	1802	363	21.	.0	100.0
1	JAN	1335	96	36.	.0	100.1	*	1	JAN	1549	230	87.	.1	100.2	*	1	JAN	1803	364	20.	.0	100.0
1	JAN	1336	97	36.	.0	100.1	*	1	JAN	1550	231	86.	.1	100.2	*	1	JAN	1804	365	18.	.0	100.0
1	JAN	1337	98	36.	.0	100.1	*	1	JAN	1551	232	85.	.1	100.2	*	1	JAN	1805	366	17.	.0	100.0
1	JAN	1338	99	36.	.0	100.1	*	1	JAN	1552	233	95.	.1	100.2	*	1	JAN	1806	367	15.	.0	100.0
1	JAN	1339	100	36.	.0	100.1	*	1	JAN	1553	234	119.	.1	100.2	*	1	JAN	1807	368	14.	.0	100.0
1	JAN	1340	101	37.	.0	100.1	*	1	JAN	1554	235	145.	.2	100.3	*	1	JAN	1808	369	12.	.0	100.0
1	JAN	1341	102	37.	.0	100.1	*	1	JAN	1555	236	172.	.2	100.3	*	1	JAN	1809	370	10.	.0	100.0
1	JAN	1342	103	37.	.0	100.1	*	1	JAN	1556	237	199.	.2	100.4	*	1	JAN	1810	371	9.	.0	100.0
1	JAN	1343	104	37.	.0	100.1	*	1	JAN	1557	238	227.	.2	100.4	*	1	JAN	1811	372	7.	.0	100.0
1	JAN	1344	105	37.	.0	100.1	*	1	JAN	1558	239	254.	.3	100.5	*	1	JAN	1812	373	6.	.0	100.0
1	JAN	1345	106	38.	.0	100.1	*	1	JAN	1559	240	281.	.3	100.5	*	1	JAN	1813	374	4.	.0	100.0
1	JAN	1346	107	38.	.0	100.1	*	1	JAN	1600	241	308.	.3	100.6	*	1	JAN	1814	375	3.	.0	100.0
1	JAN	1347	108	38.	.0	100.1	*	1	JAN	1601	242	335.	.4	100.6	*	1	JAN	1815	376	1.	.0	100.0
1	JAN	1348	109	38.	.0	100.1	*	1	JAN	1602	243	362.	.4	100.6	*	1	JAN	1816	377	0.	.0	100.0
1	JAN	1349	110	38.	.0	100.1	*	1	JAN	1603	244	390.	.4	100.7	*	1	JAN	1817	378	0.	.0	100.0
1	JAN	1350	111	38.	.0	100.1	*	1	JAN	1604	245	417.	.4	100.7	*	1	JAN	1818	379	0.	.0	100.0
1	JAN	1351	112	38.	.0	100.1	*	1	JAN	1605	246	444.	.5	100.8	*	1	JAN	1819	380	0.	.0	100.0
1	JAN	1352	113	39.	.0	100.1	*	1	JAN	1606	247	471.	.5	100.8	*	1	JAN	1820	381	0.	.0	100.0
1	JAN	1353	114	39.	.0	100.1	*	1	JAN	1607	248	498.	.5	100.9	*	1	JAN	1821	382	0.	.0	100.0
1	JAN	1354	115	39.	.0	100.1	*	1	JAN	1608	249	525.	.6	100.9	*	1	JAN	1822	383	0.	.0	100.0
1	JAN	1355	116	39.	.0	100.1	*	1	JAN	1609	250	553.	.6	101.0	*	1	JAN	1823	384	0.	.0	100.0
1	JAN	1356	117	39.	.0	100.1	*	1	JAN	1610	251	558.	.6	101.0	*	1	JAN	1824	385	0.	.0	100.0
1	JAN	1357	118	39.	.0	100.1	*	1	JAN	1611	252	538.	.6	101.0	*	1	JAN	1825	386	0.	.0	100.0
1	JAN	1358	119	39.	.0	100.1	*	1	JAN	1612	253	513.	.6	100.9	*	1	JAN	1826	387	0.	.0	100.0
1	JAN	1359	120	39.	.0	100.1	*	1	JAN	1613	254	486.	.5	100.9	*	1	JAN	1827	388	0.	.0	100.0
1	JAN	1400	121	40.	.0	100.1	*	1	JAN	1614	255	458.	.5	100.8	*	1	JAN	1828	389	0.	.0	100.0
1	JAN	1401	122	40.	.0	100.1	*	1	JAN	1615	256	431.	.5	100.8	*	1	JAN	1829	390	0.	.0	100.0
1	JAN	1402	123	40.	.0	100.1	*	1	JAN	1616	257	404.	.4	100.7	*	1	JAN	1830	391	0.	.0	100.0
1	JAN	1403	124	40.	.0	100.1	*	1	JAN	1617	258	376.	.4	100.7	*	1	JAN	1831	392	0.	.0	100.0
1	JAN	1404	125	40.	.0	100.1	*	1	JAN	1618	259	349.	.4	100.6	*	1	JAN	1832	393	0.	.0	100.0
1	JAN	1405	126	41.	.0	100.1	*	1	JAN	1619	260	322.	.3	100.6	*	1	JAN	1833	394	0.	.0	100.0
1	JAN	1406	127	41.	.0	100.1	*	1	JAN	1620	261	294.	.3	100.5	*	1	JAN	1834	395	0.	.0	100.0
1	JAN	1407	128	41.	.0	100.1	*	1	JAN	1621	262	267.	.3	100.5	*	1	JAN	1835	396	0.	.0	100.0
1	JAN	1408	129	41.	.0	100.1	*	1	JAN	1622	263	240.	.3	100.4	*	1	JAN	1836	397	0.	.0	100.0
1	JAN	1409	130	42.	.0	100.1	*	1	JAN	1623	264	212.	.2	100.4	*	1	JAN	1837	398	0.	.0	100.0
1	JAN	1410	131	42.	.0	100.1	*	1	JAN	1624	265	185.	.2	100.3	*	1	JAN	1838	399	0.	.0	100.0
1	JAN	1411	132	42.	.0	100.1	*	1	JAN	1625	266	158.	.2	100.3	*	1	JAN	1839	400	0.	.0	100.0

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  1 JAN 1412 133      43.       .0   100.1 *  1 JAN 1626 267     130.       .1   100.2 *
  1 JAN 1413 134      43.       .0   100.1 *  1 JAN 1627 268     103.       .1   100.2 *
                                             *                                          *
 ********************************************************************************************************************************************

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR      6.65-HR
+   (CFS)       (HR)
                        (CFS)
+     558.      4.17                74.         67.         67.          67.
                       (INCHES)    1.177       1.182       1.182        1.182
                       (AC-FT)      37.         37.         37.          37.

  PEAK STORAGE  TIME                      MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR      6.65-HR
+  (AC-FT)      (HR)
        1.      4.17                 0.          0.          0.           0.

  PEAK STAGE    TIME                      MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR      6.65-HR
+   (FEET)      (HR)
    101.00      4.17              100.13      100.12      100.12       100.12

                          CUMULATIVE AREA =     .59 SQ MI
```
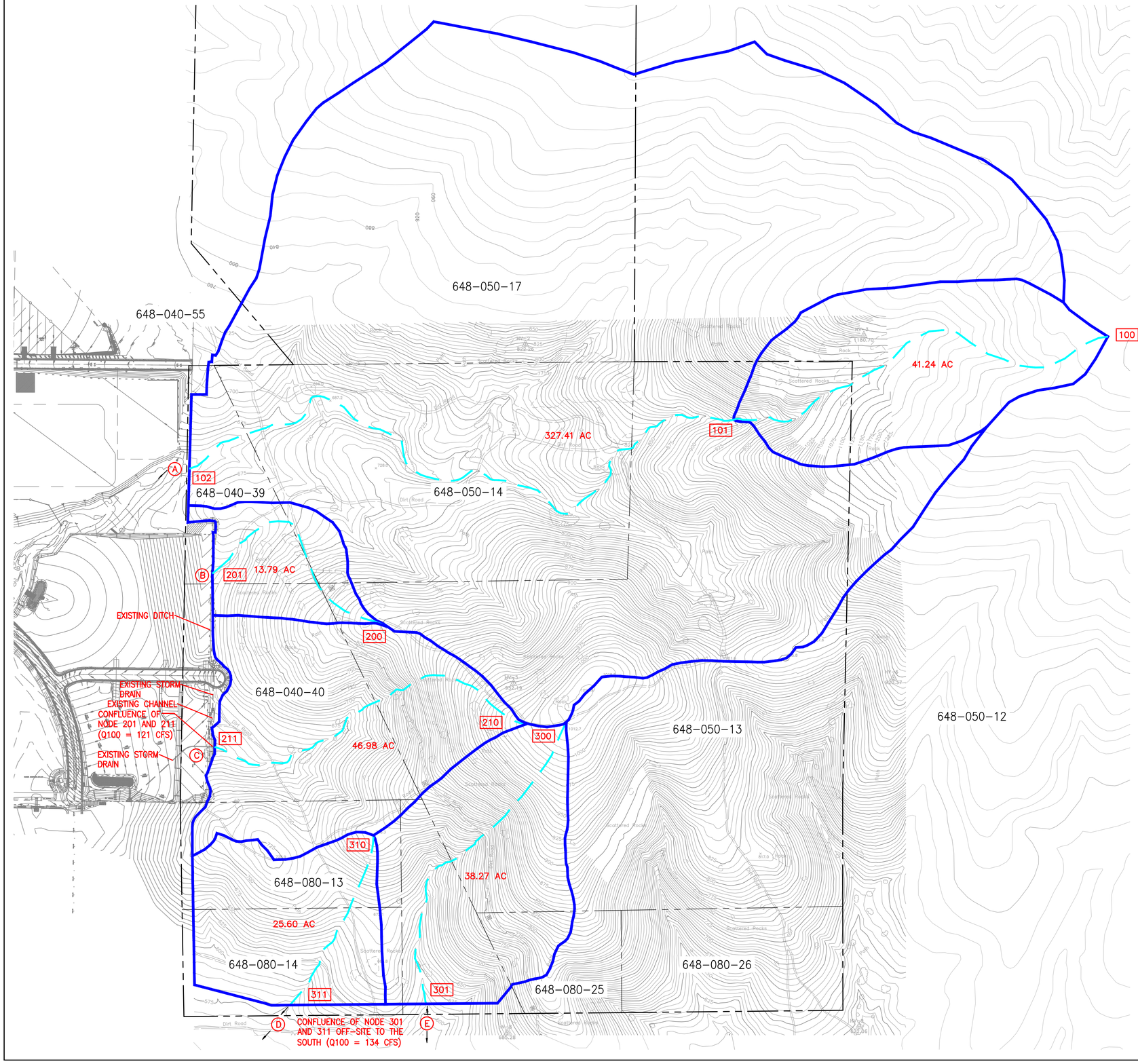

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	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	BASIN	574.	4.15	74.	67.	67.	.59		
+	ROUTED TO	DETAIN	558.	4.17	74.	67.	67.	.59		
+									101.00	4.17

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



GRAPHIC SCALE

300 0 300 600 1200

(IN FEET)

1 INCH = 300 FEET

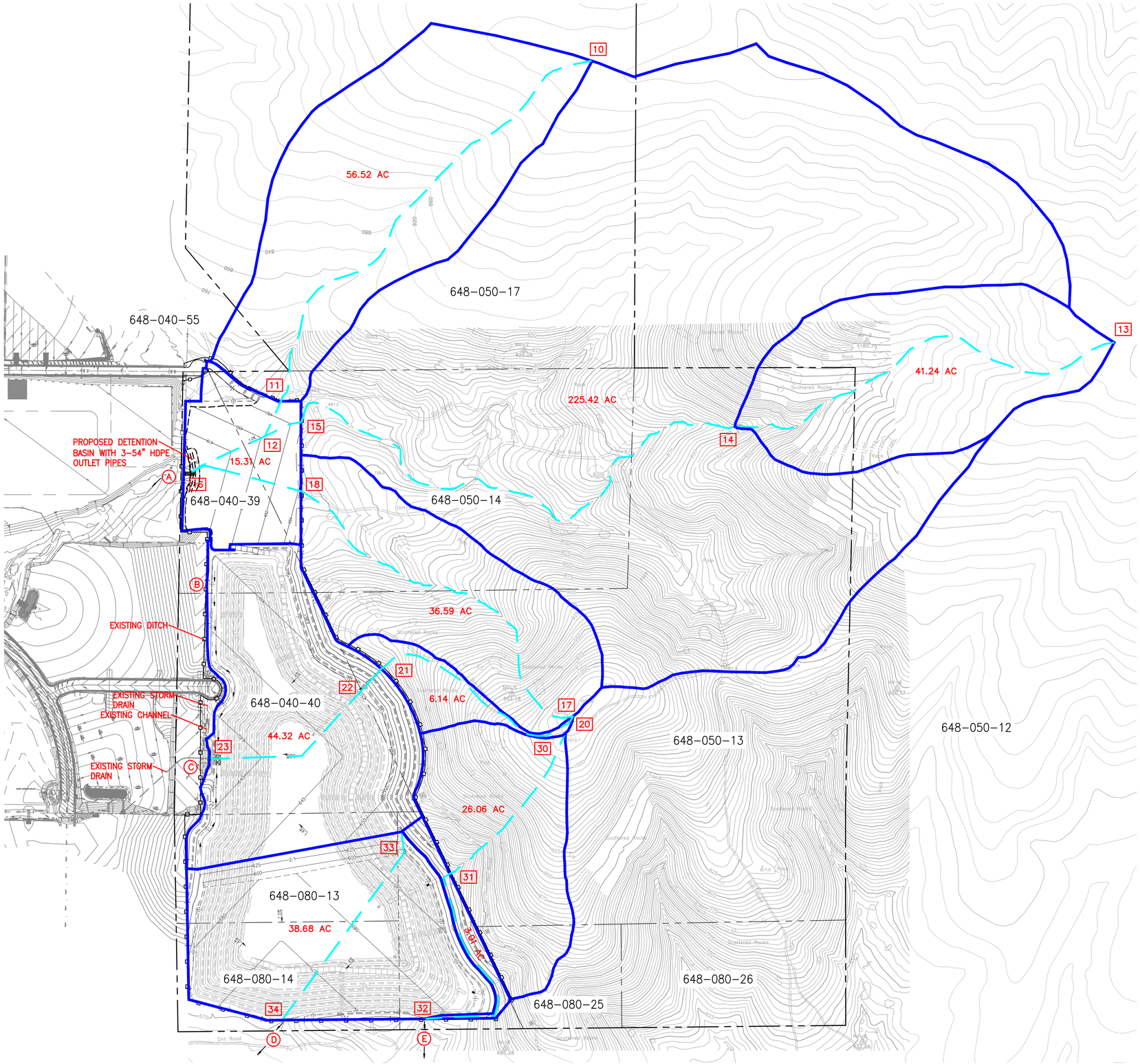
Discharge Location	Tributary Area	100-Year Flow, cfs
A	368.65	559
B	13.79	28
C	46.98	94
D	25.60	58
E	38.27	80

LEGEND:

- PARCEL BOUNDARIES
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC — DRAINAGE BASIN AREA
- 100 — RATIONAL METHOD NODE NUMBER
- (A) — SITE DISCHARGE LOCATION

EXISTING CONDITION

RATIONAL METHOD WORK MAP



GRAPHIC SCALE

300 0 300 600 1200

(IN FEET)

1 INCH = 300 FEET

Discharge Location	Tributary Area	100-Year Flow, cfs
A	375.08	574
B	---	---
C	50.46	87
D	29.07	57
E	38.68	65

LEGEND:

- PARCEL BOUNDARIES
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC — DRAINAGE BASIN AREA
- 100 — RATIONAL METHOD NODE NUMBER
- (A) — SITE DISCHARGE LOCATION

PROPOSED CONDITION

RATIONAL METHOD WORK MAP