PRELIMINARY DRAINAGE STUDY
for

Beyer Park
San Diego, CA 92173

Project Tracking No.: ….
APN: 6380-70-7100, 6381-70-1800, 6381-70-1900

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1. Purpose

The purpose of this drainage study is to analyze the existing and proposed drainage patterns, and peak flow rates for the Beyer Park site in the City of San Diego, California. This study also provides recommendation(s) to manage stormwater runoff in the proposed condition. Project site will be designed to decrease or match the pre-development peak flow rates.

To determine the impacts of the proposed development on the existing drainage patterns, the pre- and post- development peak flow rates are analyzed and compared for the 100 year storm event using the Rational Method. The report has been prepared in accordance with the requirements of the City of San Diego Drainage Design Manual (2017). See Appendix E for excerpts from the drainage design manual.

2. Background

This project is located in Region number 9, Tijuana Hydrologic Unit, Tijuana Valley Hydrologic Area and San Ysidro Hydrologic Subarea (HSA 911.11) as defined in the Regional Water Quality Control Board's Water Quality Control Plan. The site runoff discharges ultimately into the Pacific Ocean.

The Federal Emergency Management Agency (FEMA) categorizes the project site as Zone X, where Zone X is area determined to be outside 500-year floodplain. Appendix F illustrates the FEMA floodplain mapping within the vicinity of the project site.

Project does not include any activity that would result in the placement of structures or dredge or fill material into Waters of United States. Therefore, the site is not subject to the Regional Water Quality Control Board requirements under the Federal Clean Water Act section 401 or 404.

3. Existing Condition

The proposed Beyer Park site is situated at the intersection of Beyer Blvd and Enright Drive, in the City of San Diego, California. (See Appendix A for Vicinity Map)

The existing 43.613 ac site comprised of a natural terrain with sparse vegetation. Site topography includes moderate to steep slopes with an elevation ranges from 388 to 150 ft from mean sea level. The site runoff generally drains to the west and north. Stormwater runoff from the site including run-on from offsite areas travels across the site via an existing small water courses, gullies and concrete ditches. Portion of the southwesterly area including run-on from easterly portion of the site flows to an existing inlet situated within the terrace ditch prior to discharging offsite. Portion of the northwesterly site area discharges to Filoi Avenue via an existing concrete ditch. The runoff originating from the northerly side of the site surface flows to Delany and Enright Avenues. Runoff from remainder of the northerly site area surface flows directly to Moody Canyon which is situated at the northerly side of the site. Moody Canyon reach situated upstream to the park site is comprised of a natural channel but, the flow is conveyed through an underground storm drain system downstream of this site.

Runoff originating from the site ultimately flows to the Pacific Ocean by way of Tijuana River.

The hydrology of the site area can be generally analyzed and compared at five analysis points as described below:

Discharge Point #1: The runoff originating from majority of the site area (basin A) discharges offsite through discharge point 1. Discharge point 1 is situated at the southwesterly corner of the site. Easterly offsite area also discharges through this point.

Discharge Point #2: The runoff originating from northwesterly area (basin B) discharges offsite through discharge point 2. Discharge point 2 is situated at the northwesterly corner of the site. The runoff discharges to Fioli Avenue via an existing concrete ditch.

Discharge Point #3: The runoff originating from site area (basin C) discharges offsite through discharge point 3. Discharge point 3 is situated at the cul-de-sac at Delany Drive. The runoff discharges to this point via an existing concrete ditch.

Discharge Point #4: The runoff originating from northerly site area (basin D) discharges offsite through discharge point 4. Discharge point 4 is situated at the cul-de-sac at Enright Drive. The runoff surface flows to this point via an existing water course.

Discharge Point #5: The runoff originating from (basin E) discharges offsite through discharge point 5. Discharge point 5 is situated within the existing canyon and adjacent to cul-de-sac at Enright Drive. The runoff surface flows to this point via an existing water course. The runoff then discharges to Moody Canyon through this point.

(See Appendix B for Existing Condition Hydrology Map & Runoff Discharge Points)

4. Proposed Improvements

The major development activities include, but are not limited to, clearing & grubbing, construction of a new picnic area, parking, driveway, walkways, skate park, dog park and landscaping.

The project will also include drainage improvements and construction of Best Management Practices (BMPs). Multiple biofiltration BMPs are proposed to control pollutants, as well as peak flow rates due to the development. These BMPs are proposed because the site must comply with both the requirements for hydromodification and peak flow rate control. Runoff from the site does not discharge to an exempt system.

The on-site drainage pattern has altered slightly to accommodate the proposed development and facilitate the conveyance of the stormwater runoff from the site. The majority of site runoff is directed to the proposed biofiltration BMPs situated strategically throughout the site for quality and quantity control. Additional, control is provided through an underground detention system where mitigation from biofiltration bmps alone is not

adequate. Outflow from the proposed BMPs is discharged to an existing conveyance system such as concrete ditch and dirt swales as in the existing condition. The run-on from the existing areas situated easterly side of the site, is bypassed the onsite BMPs. Bypassed flow is routed to the original discharge location to minimize the downstream drainage impacts due to the development. Because the peak flow rate from the site is mitigated in the proposed condition, the development will not create drainage impacts to the existing receiving storm drain system.

In the proposed condition site will have only four discharge points. Existing discharge points 1, 2, 4 and 5 are maintained in the proposed condition. Discharge point 3 is eliminated in the proposed condition due to site constraint.

Basin F is not analyzed. The runoff from this drainage area will be smaller than the existing condition because the area decreased.

(See Appendix C for Proposed Conditions Hydrology Map)

5. Soil Characteristics

Per the City of San Diego Drainage Design Manual Section A.1.2, “Type D” soil is to be used for the site. Therefore, the hydrologic analysis is performed by utilizing soil type D.

6. Methodology

Rational Method: A rational method analysis was utilized to perform hydrologic calculations in this study.

Rational Equation: Q = C * I * A

Where;
Q = Peak discharge, cfs
C = Rational method runoff coefficient
I = Rainfall intensity, inch/hour
A = Drainage area, acre

A computer model CivilD is used to automate the hydrology analysis process. This computer version of the rational method analysis allows user to develop a node-link model of the watershed. CivilD computer program has the capability of performing calculations utilizing mathematical functions. These functions are assigned code numbers, which appear in the printed results. The code numbers and their corresponding functions are described below.
Sub area Hydrologic Processes:

Code 1 - INITIAL subarea input, top of stream
Code 2 - STREET flow through subarea, includes subarea runoff
Code 3 - ADDITION of runoff from subarea to stream
Code 4 - STREET INLET + parallel street & pipe flow + area
Code 5 - PIPEFLOW travel time (program estimated pipe size)**
Code 6 - PIPEFLOW travel time (user specified pipe size)
Code 7 - IMPROVED channel travel time (open or box)**
Code 8 - IRREGULAR channel travel time**
Code 9 - USER specified entry of data at a point
Code 10 - CONFLUENCE at downstream point in current stream
Code 11 - CONFLUENCE of mainstreams
**NOTE: These options do not include subarea runoff
**NOTE: (#) - Required pipe size determined by the hydrology program

7. Calculations

a. Impervious and Pervious Areas

The impervious and pervious areas are calculated for both the existing and proposed site conditions. Areas comparison is made only for the disturbed portion of the site.

Table 7-1 Summary of Areas

	Area (Acres)			Percent Impervious Area	Percent Pervious Area
	Total	**Impervious (Ai)**	**Pervious (Ap)**		
Existing	16.00	0.16	15.84	1.0%	99.0%
Proposed	16.00	2.72	13.28	17.0%	83.0%
Percentage Change		**1600.0%**	**-16.2%**		

b. Runoff Coefficient

The project site is predominantly in the natural state therefore, runoff coefficient of 0.35 is selected to be used for the existing condition hydrology analysis. This runoff coefficient is equivalent to soil type D with 0% imperviousness per table 3-1 of the County of San Diego hydrology manual. Proposed condition runoff coefficients are determined by utilizing Table A-1 of the City of San Diego Drainage Design Manual by assuming commercial type land use. But, the undisturbed drainage areas are assigned a 'c' value of 0.35 in the proposed condition for consistency.

Since the percent impervious in the proposed condition deviates from the standard 80% imperviousness for commercial type land use, the revised C value is calculated by using the following equation provided in Section A.1.2 of the City of San Diego Drainage Design Manual.

The "Revised C" value =

$$\frac{\text{(Actual Percentage of Impervious Area)}}{(80\%)} \times (0.85)$$

In the existing condition, the time of concentration for the initial basin is determined by adding 10 minutes to the calculated time of concentration by assuming natural watershed.

See Appendices B and C respectively for existing and proposed conditions runoff coefficient calculations.

c. Peak Flow Rates

The rational method is used to perform the hydrologic analysis. The software program CivilD, which utilizes the rational method of analysis, is used to determine peak flow rates from the site.

The peak flow rates for the 100 year design storm event are calculated for both existing and proposed condition and the results are summarized in Table 7-2. The detailed calculations/results for existing and proposed conditions analyses are located in Appendices B and C respectively.

Table 7-2 Existing and Proposed Conditions Peak Flow Rates Summary

		Drainage Area (acres)		100 Yr Flow (cfs)			% Change from Existing Condition
Analysis Point	**Discharge Point**	**Existing Condition**	**Proposed Condition**	**Existing Condition**	**Proposed Condition**	**Mitigated Condition**	
A	**#1**	24.75	26.70	25.00	30.40	23.87	**-4.5**
B	**#2**	5.56	5.00	5.77	9.30	6.43	**11.4**
	#3	0.90	0.00	1.00	0.00	0.00	**-100.0**
Sub-Total		**6.46**	**5.00**	**6.77**	**9.30**	**6.43**	**-5.0**
C	**#4**	1.82	3.12	1.94	5.86	3.19	**64.4**
	#5	4.70	3.24	5.20	3.90	3.90	**-25.0**
Sub-Total		**6.52**	**6.36**	**7.14**	**9.76**	**7.09**	**-0.7**
	#6	1.17	0.84	**Not Analyzed**			
Total		**38.90**	**38.90**	**38.91**	**49.46**	**37.39**	**-3.9**

In the proposed condition, the unmitigated peak flow rate due to the 100 year storm event is anticipated to increase by 10.55 cfs. The increase in peak flow rate in the unmitigated condition is mainly due to the increase in impervious area and runoff coefficient factor.

Proposed storm drain system including detention basin will be designed to convey the peak 100 year flow rate.

See appendix D for details.

d. Detention & Mitigated Flow Rates

The detention basins (biofiltration & underground vault) are designed to control the peak flow rate as well as hydromodification impact due to the redevelopment. Eight detention basins are proposed for this purpose. These basins are located throughout the site as shown in the proposed condition hydrology exhibit.

Peak flow rate mitigation is achieved by routing the flow through multiple detention basins. The hydraflow/hydrograph extension for AutoCAD Civil 3D is utilized for tis purpose. The total 100 year peak flow rate from the site is attenuated from 49.5 cfs to 37.4 cfs. The result of the detention analysis is summarized in the table below. See Appendix D for the results.

	Detention Flow Rate (cfs)			**Approximate Detention Volume Provided (cf)**
	Inflow	**Outflow**	**Detained**	
Detention #1 (BMP #1)	9.42	5.42	4.00	5,339
Detention #2 (BMP #2)	3.50	2.36	1.14	2,054
Detention #3 (BMP #3)	3.90	2.51	1.39	1,036
Detention #4 (BMP #4)	0.79	0.04	0.75	1,070
Detention #5 (BMP #5)	2.75	1.81	0.94	1,470
Detention #6 (BMP #6)	3.10	1.13	1.97	3,178
Detention #7 (BMP #7)	2.02	1.32	0.70	1,470
Detention #8 (BMP #8)	2.12	0.94	1.18	2,940
Total	**27.60**	**15.53**	**12.07**	**18,557**

Approximately, 12.0 cfs is detained through the proposed eight detention basins. Biofiltration basins are analyzed utilizing above ground storage volume only.

8. Downstream Drainage Impact Analysis

The existing onsite drainage pattern has changed but the existing discharge points are maintained to the maximum extent feasible. The runoff from majority of the site area is conveyed offsite through the existing discharge points.

The proposed condition peak flow rates are reduced from the existing condition peak flow rates at each outlet location. Therefore, negative downstream drainage impacts are not anticipated from the development.

9. Conclusion

Storm water runoff from the site is collected and conveyed by a system of swales, inlets, storm drain pipes, and detention basin. The site is designed to mitigate the drainage impacts due to the development. The new storm drain system is designed to convey the runoff from the site. Eight detention basins (7 biofiltration basins and 1 underground vault) are also designed to control the peak flow rate from the site.

The existing onsite drainage pattern needed to be changed slightly in order to accommodate the proposed development. Four existing drainage discharge points are maintained in the proposed condition. The majority of the site runoff is directed to biofiltration basins as opposed to surface flow in the existing condition.

In the proposed condition, the site is designed to reduce the overall 100 year peak flow rate from 38.90 to 37.39 cfs (=1.52 cfs reduction). The capacity of the existing receiving storm drain system will not be impacted due to this development because the peak flow rate is reduced in the proposed condition.

The offsite hydrology and hydraulic analysis of the existing Moody Canyon/Creek and existing culvert is not performed in this study. It is determined that the existing storm drain system is adequately sized to convey the peak flow runoff originating from offsite, as well as onsite tributary drainage areas.

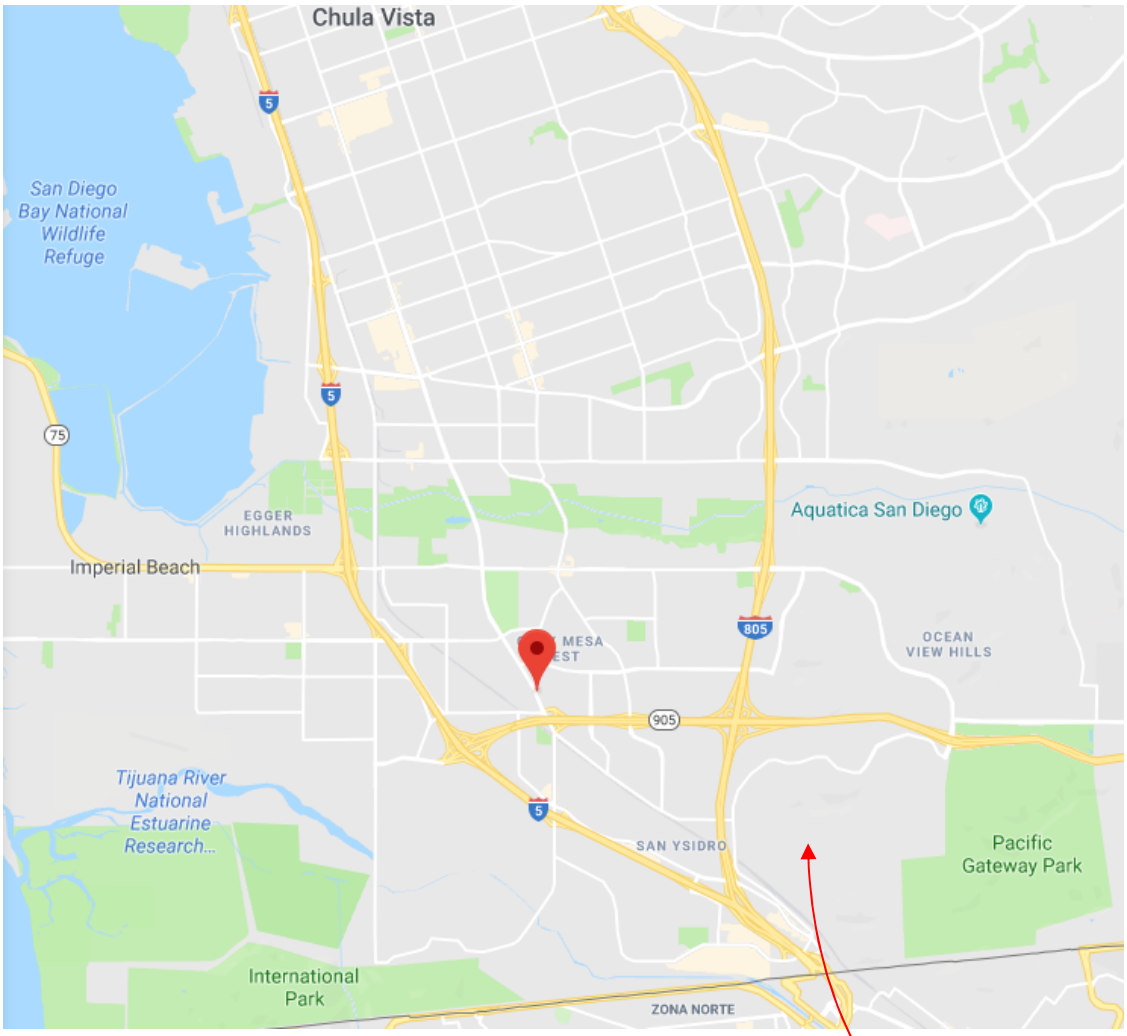
The project should not create any negative impacts to downstream properties.

10. References

- City of San Diego Drainage design Manual, 2017
- County of San Diego Hydrology Manual, 2003
- Project's Storm Water Quality Management Plan (SWQMP)

APPENDIX A:

Site Vicinity Map
Site Imagery Map



VICINITY MAP


Otay Mesa
Beyer Blvd
Moody Canyon
Mesa Ave
E Beyer Blvd
Delany Dr
805
805
805
SDIV Access
Hill St
merica Center
Sidro Blvd
E Beyer Blvd
Taqueria Revolución
San Ysidro Blvd
Jacob Dek
Border Village
Denny's

IMAGERY MAP

APPENDIX B:

Existing Conditions Runoff Coefficient Calculations
Existing Condition Hydrology Calculations
Existing Conditions Hydrology Map

Runoff Coefficient Calculation (Existing Condition)

Project: Beyer Park

Natural Watershed

Description	Area (Acres)		Actual % Imperviousness	*Use Runoff Coef. (C)
	Area (ac)	Imp. Area (Ai)		
Existing Condition	16.00	0.16	1.00%	0.35

*C value of 0.35 is selected for natural watershed per table 3-1 of County Hydrology Manual

Note: Only the disturbed area is included in the calculation

12820EX100YR1

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/17/18

EXISTING CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 1_INCLUDING OFFSITE AREA

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   100.000 to Point/Station   101.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.350 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance = 245.000(Ft.)
Highest elevation = 436.200(Ft.)
Lowest elevation = 388.000(Ft.)
Elevation difference =   48.200(Ft.)
TC=[(11.9*0.0464^3)/(48.20)]^.385= 1.01 + 10 min. =   11.01 min.

```
Rainfall intensity (I) =      3.259(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.776(CFS)
Total initial stream area =        0.680(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      101.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    11.01 min.
Rainfall intensity =      3.259(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.342(CFS) for    0.300(Ac.)
Total runoff =      1.118(CFS)  Total area =        0.98(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.091(CFS)
Depth of flow =   0.227(Ft.), Average velocity =   3.604(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.30
        2              5.00              0.00
        3             10.00              0.30
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      3.091(CFS)
  '     '        flow top width =      7.561(Ft.)
  '     '    velocity=    3.604(Ft/s)
  '     '        area =      0.858(Sq.Ft)
  '     '        Froude number =     1.886

Upstream point elevation =   388.000(Ft.)
Downstream point elevation =   366.000(Ft.)
Flow length =   512.000(Ft.)
Travel time  =    2.37 min.
Time of concentration =   13.38 min.
Depth of flow =   0.227(Ft.)
Average velocity =   3.604(Ft/s)
Total irregular channel flow =     3.091(CFS)
Irregular channel normal depth above invert elev. =   0.227(Ft.)
```

```
Average velocity of channel(s) =   3.604(Ft/s)

Sub-Channel No. 1 Critical depth =      0.293(Ft.)
  '     '       '     Critical flow top width =      9.766(Ft.)
  '     '       '     Critical flow velocity=    2.161(Ft/s)
  '     '       '     Critical flow area =      1.431(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.034(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      3.674(CFS) for    3.460(Ac.)
Total runoff =      4.792(CFS)  Total area =        4.44(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    13.38 min.
Rainfall intensity =      3.034(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.221(CFS) for    1.150(Ac.)
Total runoff =      6.013(CFS)  Total area =        5.59(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      6.320(CFS)
Depth of flow =   0.240(Ft.), Average velocity =   6.570(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.30
        2              5.00              0.00
        3             10.00              0.30
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      6.320(CFS)
  '     '         flow top width =      8.008(Ft.)
  '     '    velocity=    6.570(Ft/s)
  '     '         area =      0.962(Sq.Ft)
  '     '         Froude number =     3.341
```

```
Upstream point elevation =   373.000(Ft.)
Downstream point elevation =   352.500(Ft.)
Flow length =   155.000(Ft.)
Travel time  =    0.39 min.
Time of concentration =   13.77 min.
Depth of flow =   0.240(Ft.)
Average velocity =   6.570(Ft/s)
Total irregular channel flow =     6.320(CFS)
Irregular channel normal depth above invert elev. =   0.240(Ft.)
Average velocity of channel(s) =   6.570(Ft/s)

Sub-Channel No. 1 Critical depth =      0.383(Ft.)
  '     '       '     Critical flow top width =     10.000(Ft.)
  '     '       '     Critical flow velocity=    2.714(Ft/s)
  '     '       '     Critical flow area =      2.328(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.001(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.599(CFS) for    0.570(Ac.)
Total runoff =      6.612(CFS)  Total area =        6.16(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    13.77 min.
Rainfall intensity =      3.001(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.492(CFS) for    1.420(Ac.)
Total runoff =      8.103(CFS)  Total area =        7.58(Ac.)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Process from Point/Station      103.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      8.472(CFS)
Depth of flow =   0.487(Ft.), Average velocity =   7.158(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              5.00              0.00
```

```
        3             10.00              1.00
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      8.472(CFS)
  '     '        flow top width =      4.865(Ft.)
  '     '    velocity=    7.158(Ft/s)
  '     '        area =      1.184(Sq.Ft)
  '     '        Froude number =     2.558

Upstream point elevation =   352.500(Ft.)
Downstream point elevation =   336.500(Ft.)
Flow length =   255.000(Ft.)
Travel time  =    0.59 min.
Time of concentration =   14.36 min.
Depth of flow =   0.487(Ft.)
Average velocity =   7.158(Ft/s)
Total irregular channel flow =     8.472(CFS)
Irregular channel normal depth above invert elev. =   0.487(Ft.)
Average velocity of channel(s) =   7.158(Ft/s)

Sub-Channel No. 1 Critical depth =      0.711(Ft.)
  '     '       '     Critical flow top width =      7.109(Ft.)
  '     '       '     Critical flow velocity=    3.352(Ft/s)
  '     '       '     Critical flow area =      2.527(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.954(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.713(CFS) for    0.690(Ac.)
Total runoff =      8.817(CFS)  Total area =        8.27(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
_________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    14.36 min.
Rainfall intensity =      2.954(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.848(CFS) for    0.820(Ac.)
Total runoff =      9.664(CFS)  Total area =        9.09(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
```

```
Estimated mean flow rate at midpoint of channel =      9.850(CFS)
Depth of flow =   0.458(Ft.), Average velocity =   9.377(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              5.00              0.00
        3             10.00              1.00
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      9.851(CFS)
  '     '        flow top width =      4.584(Ft.)
  '     '    velocity=    9.377(Ft/s)
  '     '        area =      1.050(Sq.Ft)
  '     '        Froude number =     3.452

Upstream point elevation =   336.500(Ft.)
Downstream point elevation =   314.000(Ft.)
Flow length =   193.000(Ft.)
Travel time  =    0.34 min.
Time of concentration =   14.71 min.
Depth of flow =   0.458(Ft.)
Average velocity =   9.377(Ft/s)
Total irregular channel flow =     9.850(CFS)
Irregular channel normal depth above invert elev. =   0.458(Ft.)
Average velocity of channel(s) =   9.377(Ft/s)

Sub-Channel No. 1 Critical depth =      0.750(Ft.)
  '     '       '     Critical flow top width =      7.500(Ft.)
  '     '       '     Critical flow velocity=    3.502(Ft/s)
  '     '       '     Critical flow area =      2.813(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.927(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.359(CFS) for    0.350(Ac.)
Total runoff =     10.023(CFS)  Total area =        9.44(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
-----------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     11.042(CFS)
Depth of flow =   0.442(Ft.), Average velocity =  11.288(Ft/s)
```

```
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2              5.00              0.00
       3             10.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =     11.042(CFS)
  '     '        flow top width =      4.423(Ft.)
  '     '    velocity=   11.288(Ft/s)
  '     '        area =      0.978(Sq.Ft)
  '     '        Froude number =     4.230

Upstream point elevation =   314.000(Ft.)
Downstream point elevation =   252.000(Ft.)
Flow length =   350.000(Ft.)
Travel time  =    0.52 min.
Time of concentration =   15.22 min.
Depth of flow =   0.442(Ft.)
Average velocity =  11.288(Ft/s)
Total irregular channel flow =    11.042(CFS)
Irregular channel normal depth above invert elev. =   0.442(Ft.)
Average velocity of channel(s) =  11.288(Ft/s)

Sub-Channel No. 1 Critical depth =      0.789(Ft.)
  '     '       '     Critical flow top width =      7.891(Ft.)
  '     '       '     Critical flow velocity=    3.547(Ft/s)
  '     '       '     Critical flow area =      3.113(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.888(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.941(CFS) for    1.920(Ac.)
Total runoff =     11.964(CFS)  Total area =       11.36(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    15.22 min.
Rainfall intensity =      2.888(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.163(CFS) for    1.150(Ac.)
```

```
Total runoff =     13.127(CFS)  Total area =       12.51(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     14.087(CFS)
Depth of flow =   0.742(Ft.), Average velocity =  12.786(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2              4.00              0.00
        3              8.00              2.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =     14.087(CFS)
  '     '        flow top width =      2.969(Ft.)
  '     '    velocity=   12.786(Ft/s)
  '     '        area =      1.102(Sq.Ft)
  '     '        Froude number =     3.699

Upstream point elevation =   252.000(Ft.)
Downstream point elevation =   231.900(Ft.)
Flow length =   156.000(Ft.)
Travel time  =    0.20 min.
Time of concentration =   15.43 min.
Depth of flow =   0.742(Ft.)
Average velocity =  12.786(Ft/s)
Total irregular channel flow =    14.087(CFS)
Irregular channel normal depth above invert elev. =   0.742(Ft.)
Average velocity of channel(s) =  12.786(Ft/s)

Sub-Channel No. 1 Critical depth =      1.250(Ft.)
  '     '       '     Critical flow top width =      5.000(Ft.)
  '     '       '     Critical flow velocity=    4.508(Ft/s)
  '     '       '     Critical flow area =      3.125(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.873(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.840(CFS) for    1.830(Ac.)
Total runoff =     14.967(CFS)  Total area =       14.34(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     15.400(CFS)
Depth of flow =   0.652(Ft.), Average velocity =   7.256(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              5.00              0.00
        3             10.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =     15.400(CFS)
  '     '        flow top width =      6.515(Ft.)
  '     '    velocity=    7.256(Ft/s)
  '     '        area =      2.122(Sq.Ft)
  '     '        Froude number =     2.240

Upstream point elevation =   231.900(Ft.)
Downstream point elevation =   206.000(Ft.)
Flow length =   593.000(Ft.)
Travel time  =    1.36 min.
Time of concentration =   16.79 min.
Depth of flow =   0.652(Ft.)
Average velocity =   7.256(Ft/s)
Total irregular channel flow =    15.400(CFS)
Irregular channel normal depth above invert elev. =   0.652(Ft.)
Average velocity of channel(s) =   7.256(Ft/s)

Sub-Channel No. 1 Critical depth =      0.898(Ft.)
  '     '       '     Critical flow top width =      8.984(Ft.)
  '     '       '     Critical flow velocity=    3.816(Ft/s)
  '     '       '     Critical flow area =      4.036(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.779(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.807(CFS) for    0.830(Ac.)
Total runoff =     15.774(CFS)  Total area =       15.17(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** SUBAREA FLOW ADDITION ****
```

```
User specified 'C' value of 0.350 given for subarea
Time of concentration =    16.79 min.
Rainfall intensity =      2.779(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      3.015(CFS) for    3.100(Ac.)
Total runoff =     18.789(CFS)  Total area =       18.27(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     19.457(CFS)
Depth of flow =   0.805(Ft.), Average velocity =   6.006(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              5.00              0.00
        3             10.00              1.00
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =     19.457(CFS)
  '     '        flow top width =      8.050(Ft.)
  '     '    velocity=    6.006(Ft/s)
  '     '        area =      3.240(Sq.Ft)
  '     '        Froude number =     1.668

Upstream point elevation =   206.000(Ft.)
Downstream point elevation =   200.200(Ft.)
Flow length =   257.000(Ft.)
Travel time  =    0.71 min.
Time of concentration =   17.50 min.
Depth of flow =   0.805(Ft.)
Average velocity =   6.006(Ft/s)
Total irregular channel flow =    19.457(CFS)
Irregular channel normal depth above invert elev. =   0.805(Ft.)
Average velocity of channel(s) =   6.006(Ft/s)

Sub-Channel No. 1 Critical depth =      0.984(Ft.)
  '     '       '     Critical flow top width =      9.844(Ft.)
  '     '       '     Critical flow velocity=    4.016(Ft/s)
  '     '       '     Critical flow area =      4.845(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
```

```
Rainfall intensity =      2.732(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.243(CFS) for    1.300(Ac.)
Total runoff =     20.032(CFS)  Total area =       19.57(Ac.)


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Process from Point/Station      109.000 to Point/Station      109.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    17.50 min.
Rainfall intensity =      2.732(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      2.237(CFS) for    2.340(Ac.)
Total runoff =     22.269(CFS)  Total area =       21.91(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     22.493(CFS)
Depth of flow =   0.775(Ft.), Average velocity =   7.490(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              5.00              0.00
        3             10.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =     22.493(CFS)
  '     '        flow top width =      7.750(Ft.)
  '     '    velocity=    7.490(Ft/s)
  '     '        area =      3.003(Sq.Ft)
  '     '        Froude number =     2.120

Upstream point elevation =   200.200(Ft.)
Downstream point elevation =   195.400(Ft.)
Flow length =   130.000(Ft.)
Travel time  =    0.29 min.
Time of concentration =   17.79 min.
Depth of flow =   0.775(Ft.)
Average velocity =   7.490(Ft/s)
Total irregular channel flow =    22.493(CFS)
Irregular channel normal depth above invert elev. =   0.775(Ft.)
```

```
Average velocity of channel(s) =   7.490(Ft/s)

Sub-Channel No. 1 Critical depth =      1.039(Ft.)
  '     '       '     Critical flow top width =     10.000(Ft.)
  '     '       '     Critical flow velocity=    4.173(Ft/s)
  '     '       '     Critical flow area =      5.391(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.713(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.418(CFS) for    0.440(Ac.)
Total runoff =     22.687(CFS)  Total area =       22.35(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   190.000(Ft.)
Downstream point/station elevation =   150.000(Ft.)
Pipe length  =   155.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.687(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    22.687(CFS)
Normal flow depth in pipe =    9.18(In.)
Flow top width inside pipe =   14.62(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.86(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    17.88 min.


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Process from Point/Station      111.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    17.88 min.
Rainfall intensity =      2.708(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      2.274(CFS) for    2.400(Ac.)
Total runoff =     24.961(CFS)  Total area =       24.75(Ac.)
End of computations, total study area =          24.750 (Ac.)
```

12820EX100YR2

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/16/18

EXISTING CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 2

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   200.000 to Point/Station   201.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.350 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance = 108.000(Ft.)
Highest elevation = 253.200(Ft.)
Lowest elevation = 235.000(Ft.)
Elevation difference =   18.200(Ft.)
TC=[(11.9*0.0205^3)/(18.20)]^.385= 0.57 + 10 min. =   10.57 min.

```
Rainfall intensity (I) =      3.307(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.116(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.463(CFS)
Depth of flow =   0.201(Ft.), Average velocity =   2.861(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2              2.00              0.00
        3              4.00              0.50
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      0.463(CFS)
  '     '        flow top width =      1.609(Ft.)
  '     '    velocity=    2.861(Ft/s)
  '     '        area =      0.162(Sq.Ft)
  '     '        Froude number =     1.590

Upstream point elevation =   235.000(Ft.)
Downstream point elevation =   225.000(Ft.)
Flow length =   303.000(Ft.)
Travel time  =    1.77 min.
Time of concentration =   12.34 min.
Depth of flow =   0.201(Ft.)
Average velocity =   2.861(Ft/s)
Total irregular channel flow =     0.463(CFS)
Irregular channel normal depth above invert elev. =   0.201(Ft.)
Average velocity of channel(s) =   2.861(Ft/s)

Sub-Channel No. 1 Critical depth =      0.242(Ft.)
  '     '       '     Critical flow top width =      1.938(Ft.)
  '     '       '     Critical flow velocity=    1.973(Ft/s)
  '     '       '     Critical flow area =      0.235(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.126(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.657(CFS) for    0.600(Ac.)
```

```
Total runoff =      0.772(CFS)  Total area =        0.70(Ac.)


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Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    12.34 min.
Rainfall intensity =      3.126(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.711(CFS) for    0.650(Ac.)
Total runoff =      1.484(CFS)  Total area =        1.35(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.769(CFS)
Depth of flow =   0.200(Ft.), Average velocity =   3.534(Ft/s)
!!Warning: Water is above left or right bank elevations
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.20
        2              2.50              0.00
        3              5.00              0.20
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      1.769(CFS)
  '     '        flow top width =      5.000(Ft.)
  '     '    velocity=    3.535(Ft/s)
  '     '        area =      0.501(Sq.Ft)
  '     '        Froude number =     1.969

Upstream point elevation =   225.000(Ft.)
Downstream point elevation =   209.600(Ft.)
Flow length =   315.000(Ft.)
Travel time  =    1.49 min.
Time of concentration =   13.82 min.
Depth of flow =   0.200(Ft.)
Average velocity =   3.534(Ft/s)
Total irregular channel flow =     1.769(CFS)
Irregular channel normal depth above invert elev. =   0.200(Ft.)
Average velocity of channel(s) =   3.534(Ft/s)
!!Warning: Water is above left or right bank elevations
```

```
Sub-Channel No. 1 Critical depth =      0.258(Ft.)
  '     '       '     Critical flow top width =      5.000(Ft.)
  '     '       '     Critical flow velocity=    2.242(Ft/s)
  '     '       '     Critical flow area =      0.789(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.997(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.545(CFS) for    0.520(Ac.)
Total runoff =      2.029(CFS)  Total area =        1.87(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.245(Ft.), Average velocity =   4.073(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.30
        2              2.50              0.00
        3              5.00              0.30
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      2.029(CFS)
  '     '        flow top width =      4.075(Ft.)
  '     '    velocity=    4.073(Ft/s)
  '     '        area =      0.498(Sq.Ft)
  '     '        Froude number =     2.053

Upstream point elevation =   209.600(Ft.)
Downstream point elevation =   205.000(Ft.)
Flow length =    92.000(Ft.)
Travel time  =    0.38 min.
Time of concentration =   14.20 min.
Depth of flow =   0.245(Ft.)
Average velocity =   4.073(Ft/s)
Total irregular channel flow =     2.029(CFS)
Irregular channel normal depth above invert elev. =   0.245(Ft.)
Average velocity of channel(s) =   4.073(Ft/s)

Sub-Channel No. 1 Critical depth =      0.322(Ft.)
  '     '       '     Critical flow top width =      5.000(Ft.)
  '     '       '     Critical flow velocity=    2.356(Ft/s)
```

```
  '     '       '     Critical flow area =      0.861(Sq.Ft)


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Process from Point/Station      204.000 to Point/Station      205.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.551(Ft.), Average velocity =   6.682(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.00              0.00
        3              2.00              1.00
Manning's 'N' friction factor =   0.014
------------------------------------------------------------------
Sub-Channel flow  =      2.029(CFS)
  '     '        flow top width =      1.102(Ft.)
  '     '    velocity=    6.682(Ft/s)
  '     '        area =      0.304(Sq.Ft)
  '     '        Froude number =     2.243

Upstream point elevation =   204.500(Ft.)
Downstream point elevation =   202.500(Ft.)
Flow length =    57.000(Ft.)
Travel time  =    0.14 min.
Time of concentration =   14.34 min.
Depth of flow =   0.551(Ft.)
Average velocity =   6.682(Ft/s)
Total irregular channel flow =     2.029(CFS)
Irregular channel normal depth above invert elev. =   0.551(Ft.)
Average velocity of channel(s) =   6.682(Ft/s)

Sub-Channel No. 1 Critical depth =      0.762(Ft.)
  '     '       '     Critical flow top width =      1.523(Ft.)
  '     '       '     Critical flow velocity=    3.497(Ft/s)
  '     '       '     Critical flow area =      0.580(Sq.Ft)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.164(Ft.), Average velocity =   4.546(Ft/s)
        ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.30
        2              5.00              0.00
        3             10.00              0.30
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      2.029(CFS)
  '     '        flow top width =      5.455(Ft.)
  '     '    velocity=    4.546(Ft/s)
  '     '        area =      0.446(Sq.Ft)
  '     '        Froude number =     2.801

Upstream point elevation =   202.500(Ft.)
Downstream point elevation =   195.000(Ft.)
Flow length =    71.000(Ft.)
Travel time  =    0.26 min.
Time of concentration =   14.60 min.
Depth of flow =   0.164(Ft.)
Average velocity =   4.546(Ft/s)
Total irregular channel flow =     2.029(CFS)
Irregular channel normal depth above invert elev. =   0.164(Ft.)
Average velocity of channel(s) =   4.546(Ft/s)

Sub-Channel No. 1 Critical depth =      0.246(Ft.)
  '     '       '     Critical flow top width =      8.203(Ft.)
  '     '       '     Critical flow velocity=    2.010(Ft/s)
  '     '       '     Critical flow area =      1.009(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
__________________________________________________________________
Estimated mean flow rate at midpoint of channel =      2.756(CFS)
Depth of flow =   0.484(Ft.), Average velocity =   7.845(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
------------------------------------------------------------------
Sub-Channel flow  =      2.756(CFS)
```

```
  '     '        flow top width =      1.452(Ft.)
  '     '    velocity=    7.845(Ft/s)
  '     '        area =      0.351(Sq.Ft)
  '     '        Froude number =     2.811

Upstream point elevation =   194.000(Ft.)
Downstream point elevation =   186.500(Ft.)
Flow length =   162.000(Ft.)
Travel time  =    0.34 min.
Time of concentration =   14.94 min.
Depth of flow =   0.484(Ft.)
Average velocity =   7.845(Ft/s)
Total irregular channel flow =     2.756(CFS)
Irregular channel normal depth above invert elev. =   0.484(Ft.)
Average velocity of channel(s) =   7.845(Ft/s)

Sub-Channel No. 1 Critical depth =      0.734(Ft.)
  '     '       '     Critical flow top width =      2.203(Ft.)
  '     '       '     Critical flow velocity=    3.407(Ft/s)
  '     '       '     Critical flow area =      0.809(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.909(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.364(CFS) for    1.340(Ac.)
Total runoff =      3.393(CFS)  Total area =        3.21(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      208.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.205(Ft.), Average velocity =   4.868(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.30
        2              5.00              0.00
        3             10.00              0.30
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      3.393(CFS)
  '     '        flow top width =      6.817(Ft.)
  '     '    velocity=    4.868(Ft/s)
  '     '        area =      0.697(Sq.Ft)
  '     '        Froude number =     2.683
```

```
Upstream point elevation =   186.500(Ft.)
Downstream point elevation =   182.000(Ft.)
Flow length =    50.000(Ft.)
Travel time  =    0.17 min.
Time of concentration =   15.12 min.
Depth of flow =   0.205(Ft.)
Average velocity =   4.868(Ft/s)
Total irregular channel flow =     3.393(CFS)
Irregular channel normal depth above invert elev. =   0.205(Ft.)
Average velocity of channel(s) =   4.868(Ft/s)

Sub-Channel No. 1 Critical depth =      0.303(Ft.)
  '     '       '     Critical flow top width =     10.000(Ft.)
  '     '       '     Critical flow velocity=    2.222(Ft/s)
  '     '       '     Critical flow area =      1.527(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      209.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.906(CFS)
Depth of flow =   0.492(Ft.), Average velocity =  10.746(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
------------------------------------------------------------------
Sub-Channel flow  =      3.906(CFS)
  '     '        flow top width =      1.477(Ft.)
  '     '    velocity=   10.746(Ft/s)
  '     '        area =      0.363(Sq.Ft)
  '     '        Froude number =     3.817

Upstream point elevation =   182.000(Ft.)
Downstream point elevation =   177.500(Ft.)
Flow length =    53.000(Ft.)
Travel time  =    0.08 min.
Time of concentration =   15.20 min.
Depth of flow =   0.492(Ft.)
Average velocity =  10.746(Ft/s)
Total irregular channel flow =     3.906(CFS)
```

```
Irregular channel normal depth above invert elev. =   0.492(Ft.)
Average velocity of channel(s) =  10.746(Ft/s)

Sub-Channel No. 1 Critical depth =      0.844(Ft.)
  '     '       '     Critical flow top width =      2.531(Ft.)
  '     '       '     Critical flow velocity=    3.658(Ft/s)
  '     '       '     Critical flow area =      1.068(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.890(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.981(CFS) for    0.970(Ac.)
Total runoff =      4.375(CFS)  Total area =        4.18(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      209.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    15.20 min.
Rainfall intensity =      2.890(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.526(CFS) for    0.520(Ac.)
Total runoff =      4.901(CFS)  Total area =        4.70(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      210.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      5.041(CFS)
Depth of flow =   0.501(Ft.), Average velocity =  13.398(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
------------------------------------------------------------------
Sub-Channel flow  =      5.041(CFS)
  '     '        flow top width =      1.503(Ft.)
  '     '    velocity=   13.398(Ft/s)
  '     '        area =      0.376(Sq.Ft)
  '     '        Froude number =     4.718
```

```
Upstream point elevation =   177.500(Ft.)
Downstream point elevation =   150.800(Ft.)
Flow length =   207.000(Ft.)
Travel time  =    0.26 min.
Time of concentration =   15.45 min.
Depth of flow =   0.501(Ft.)
Average velocity =  13.398(Ft/s)
Total irregular channel flow =     5.041(CFS)
Irregular channel normal depth above invert elev. =   0.501(Ft.)
Average velocity of channel(s) =  13.398(Ft/s)

Sub-Channel No. 1 Critical depth =      0.930(Ft.)
  '     '       '     Critical flow top width =      2.789(Ft.)
  '     '       '     Critical flow velocity=    3.889(Ft/s)
  '     '       '     Critical flow area =      1.296(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.871(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.271(CFS) for    0.270(Ac.)
Total runoff =      5.172(CFS)  Total area =        4.97(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      210.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    15.45 min.
Rainfall intensity =      2.871(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.593(CFS) for    0.590(Ac.)
Total runoff =      5.765(CFS)  Total area =        5.56(Ac.)
End of computations, total study area =          5.560 (Ac.)
```

12820EX100YR3

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/17/18

EXISTING CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 3

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   300.000 to Point/Station   301.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.350 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance = 160.000(Ft.)
Highest elevation = 225.200(Ft.)
Lowest elevation = 213.000(Ft.)
Elevation difference =   12.200(Ft.)
TC=[(11.9*0.0303^3)/(12.20)]^.385= 1.05 + 10 min. =   11.05 min.

```
Rainfall intensity (I) =      3.255(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.319(CFS)
Total initial stream area =        0.280(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.121(Ft.), Average velocity =  14.535(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
------------------------------------------------------------------
Sub-Channel flow  =      0.319(CFS)
  '     '        flow top width =      0.363(Ft.)
  '     '    velocity=   14.535(Ft/s)
  '     '        area =      0.022(Sq.Ft)
  '     '        Froude number =    10.416

Upstream point elevation =   213.000(Ft.)
Downstream point elevation =   106.000(Ft.)
Flow length =   106.000(Ft.)
Travel time  =    0.12 min.
Time of concentration =   11.17 min.
Depth of flow =   0.121(Ft.)
Average velocity =  14.535(Ft/s)
Total irregular channel flow =     0.319(CFS)
Irregular channel normal depth above invert elev. =   0.121(Ft.)
Average velocity of channel(s) =  14.535(Ft/s)

Sub-Channel No. 1 Critical depth =      0.309(Ft.)
  '     '       '     Critical flow top width =      0.926(Ft.)
  '     '       '     Critical flow velocity=    2.233(Ft/s)
  '     '       '     Critical flow area =      0.143(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      302.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
```

```
User specified 'C' value of 0.350 given for subarea
Time of concentration =    11.17 min.
Rainfall intensity =      3.242(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.374(CFS) for    0.330(Ac.)
Total runoff =      0.693(CFS)  Total area =        0.61(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    11.17 min.
Rainfall intensity =      3.242(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.329(CFS) for    0.290(Ac.)
Total runoff =      1.022(CFS)  Total area =        0.90(Ac.)
End of computations, total study area =           0.900 (Ac.)
```

12820EX100YR4

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/17/18

EXISTING CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 4

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   400.000 to Point/Station   401.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.350 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance = 152.000(Ft.)
Highest elevation = 257.000(Ft.)
Lowest elevation = 251.000(Ft.)
Elevation difference =   6.000(Ft.)
TC=[(11.9*0.0288^3)/(6.00)]^.385= 1.30 + 10 min. =   11.30 min.

```
Rainfall intensity (I) =      3.228(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.158(CFS)
Total initial stream area =        0.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.254(CFS)
Depth of flow =   0.082(Ft.), Average velocity =   3.754(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2              5.00              0.00
        3             10.00              0.50
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      0.254(CFS)
  '     '        flow top width =      1.646(Ft.)
  '     '    velocity=    3.754(Ft/s)
  '     '        area =      0.068(Sq.Ft)
  '     '        Froude number =     3.262

Upstream point elevation =   251.000(Ft.)
Downstream point elevation =   232.000(Ft.)
Flow length =   105.000(Ft.)
Travel time  =    0.47 min.
Time of concentration =   11.76 min.
Depth of flow =   0.082(Ft.)
Average velocity =   3.754(Ft/s)
Total irregular channel flow =     0.254(CFS)
Irregular channel normal depth above invert elev. =   0.082(Ft.)
Average velocity of channel(s) =   3.754(Ft/s)

Sub-Channel No. 1 Critical depth =      0.132(Ft.)
  '     '       '     Critical flow top width =      2.637(Ft.)
  '     '       '     Critical flow velocity=    1.463(Ft/s)
  '     '       '     Critical flow area =      0.174(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.181(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.189(CFS) for    0.170(Ac.)
```

```
Total runoff =      0.347(CFS)  Total area =        0.31(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      403.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.796(CFS)
Depth of flow =   0.283(Ft.), Average velocity =   3.319(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              3.00              0.00
        3              6.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      0.796(CFS)
  '     '        flow top width =      1.696(Ft.)
  '     '    velocity=    3.319(Ft/s)
  '     '        area =      0.240(Sq.Ft)
  '     '        Froude number =     1.555

Upstream point elevation =   232.000(Ft.)
Downstream point elevation =   222.700(Ft.)
Flow length =   320.000(Ft.)
Travel time  =    1.61 min.
Time of concentration =   13.37 min.
Depth of flow =   0.283(Ft.)
Average velocity =   3.319(Ft/s)
Total irregular channel flow =     0.796(CFS)
Irregular channel normal depth above invert elev. =   0.283(Ft.)
Average velocity of channel(s) =   3.319(Ft/s)

Sub-Channel No. 1 Critical depth =      0.338(Ft.)
  '     '       '     Critical flow top width =      2.027(Ft.)
  '     '       '     Critical flow velocity=    2.323(Ft/s)
  '     '       '     Critical flow area =      0.343(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.035(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.850(CFS) for    0.800(Ac.)
Total runoff =      1.197(CFS)  Total area =        1.11(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      404.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.332(CFS)
Depth of flow =   0.269(Ft.), Average velocity =   3.674(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2              2.50              0.00
        3              5.00              0.50
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      1.332(CFS)
  '     '        flow top width =      2.693(Ft.)
  '     '    velocity=    3.674(Ft/s)
  '     '        area =      0.363(Sq.Ft)
  '     '        Froude number =     1.764

Upstream point elevation =   222.700(Ft.)
Downstream point elevation =   215.500(Ft.)
Flow length =   198.000(Ft.)
Travel time  =    0.90 min.
Time of concentration =   14.27 min.
Depth of flow =   0.269(Ft.)
Average velocity =   3.674(Ft/s)
Total irregular channel flow =     1.332(CFS)
Irregular channel normal depth above invert elev. =   0.269(Ft.)
Average velocity of channel(s) =   3.674(Ft/s)

Sub-Channel No. 1 Critical depth =      0.338(Ft.)
  '     '       '     Critical flow top width =      3.379(Ft.)
  '     '       '     Critical flow velocity=    2.333(Ft/s)
  '     '       '     Critical flow area =      0.571(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.961(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.259(CFS) for    0.250(Ac.)
Total runoff =      1.456(CFS)  Total area =        1.36(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      404.000
**** SUBAREA FLOW ADDITION ****
```

User specified 'C' value of 0.350 given for subarea
Time of concentration = 14.27 min.
Rainfall intensity = 2.961(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff = 0.477(CFS) for 0.460(Ac.)
Total runoff = 1.933(CFS) Total area = 1.82(Ac.)
End of computations, total study area = 1.820 (Ac.)

12820EX100YR5

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/20/18

EXISTING CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 5

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   500.000 to Point/Station   501.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.350 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance =   74.000(Ft.)
Highest elevation = 347.500(Ft.)
Lowest elevation = 337.000(Ft.)
Elevation difference =   10.500(Ft.)
TC=[(11.9*0.0140^3)/(10.50)]^.385= 0.46 + 10 min. =   10.46 min.

```
Rainfall intensity (I) =      3.320(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.139(CFS)
Total initial stream area =        0.120(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.488(CFS)
Depth of flow =   0.105(Ft.), Average velocity =   4.419(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2              5.00              0.00
        3             10.00              0.50
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      0.488(CFS)
  '     '        flow top width =      2.102(Ft.)
  '     '    velocity=    4.419(Ft/s)
  '     '        area =      0.110(Sq.Ft)
  '     '        Froude number =     3.397

Upstream point elevation =   337.000(Ft.)
Downstream point elevation =   284.000(Ft.)
Flow length =   293.000(Ft.)
Travel time  =    1.11 min.
Time of concentration =   11.56 min.
Depth of flow =   0.105(Ft.)
Average velocity =   4.419(Ft/s)
Total irregular channel flow =     0.488(CFS)
Irregular channel normal depth above invert elev. =   0.105(Ft.)
Average velocity of channel(s) =   4.419(Ft/s)

Sub-Channel No. 1 Critical depth =      0.172(Ft.)
  '     '       '     Critical flow top width =      3.438(Ft.)
  '     '       '     Critical flow velocity=    1.652(Ft/s)
  '     '       '     Critical flow area =      0.295(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.201(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.672(CFS) for    0.600(Ac.)
```

```
Total runoff =      0.812(CFS)  Total area =        0.72(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      503.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.330(CFS)
Depth of flow =   0.390(Ft.), Average velocity =   8.749(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2              2.00              0.00
        3              4.00              2.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      1.330(CFS)
  '     '        flow top width =      0.780(Ft.)
  '     '    velocity=    8.749(Ft/s)
  '     '        area =      0.152(Sq.Ft)
  '     '        Froude number =     3.492

Upstream point elevation =   284.000(Ft.)
Downstream point elevation =   225.200(Ft.)
Flow length =   302.000(Ft.)
Travel time  =    0.58 min.
Time of concentration =   12.14 min.
Depth of flow =   0.390(Ft.)
Average velocity =   8.749(Ft/s)
Total irregular channel flow =     1.330(CFS)
Irregular channel normal depth above invert elev. =   0.390(Ft.)
Average velocity of channel(s) =   8.749(Ft/s)

Sub-Channel No. 1 Critical depth =      0.641(Ft.)
  '     '       '     Critical flow top width =      1.281(Ft.)
  '     '       '     Critical flow velocity=    3.242(Ft/s)
  '     '       '     Critical flow area =      0.410(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.145(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.013(CFS) for    0.920(Ac.)
Total runoff =      1.824(CFS)  Total area =        1.64(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      503.000 to Point/Station      504.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      2.447(CFS)
Depth of flow =   0.353(Ft.), Average velocity =   6.556(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              3.00              0.00
        3              6.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      2.448(CFS)
  '     '        flow top width =      2.117(Ft.)
  '     '    velocity=    6.556(Ft/s)
  '     '        area =      0.373(Sq.Ft)
  '     '        Froude number =     2.751

Upstream point elevation =   253.500(Ft.)
Downstream point elevation =   228.000(Ft.)
Flow length =   302.000(Ft.)
Travel time  =    0.77 min.
Time of concentration =   12.90 min.
Depth of flow =   0.353(Ft.)
Average velocity =   6.556(Ft/s)
Total irregular channel flow =     2.447(CFS)
Irregular channel normal depth above invert elev. =   0.353(Ft.)
Average velocity of channel(s) =   6.556(Ft/s)

Sub-Channel No. 1 Critical depth =      0.527(Ft.)
  '     '       '     Critical flow top width =      3.164(Ft.)
  '     '       '     Critical flow velocity=    2.934(Ft/s)
  '     '       '     Critical flow area =      0.834(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.075(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.205(CFS) for    1.120(Ac.)
Total runoff =      3.030(CFS)  Total area =        2.76(Ac.)

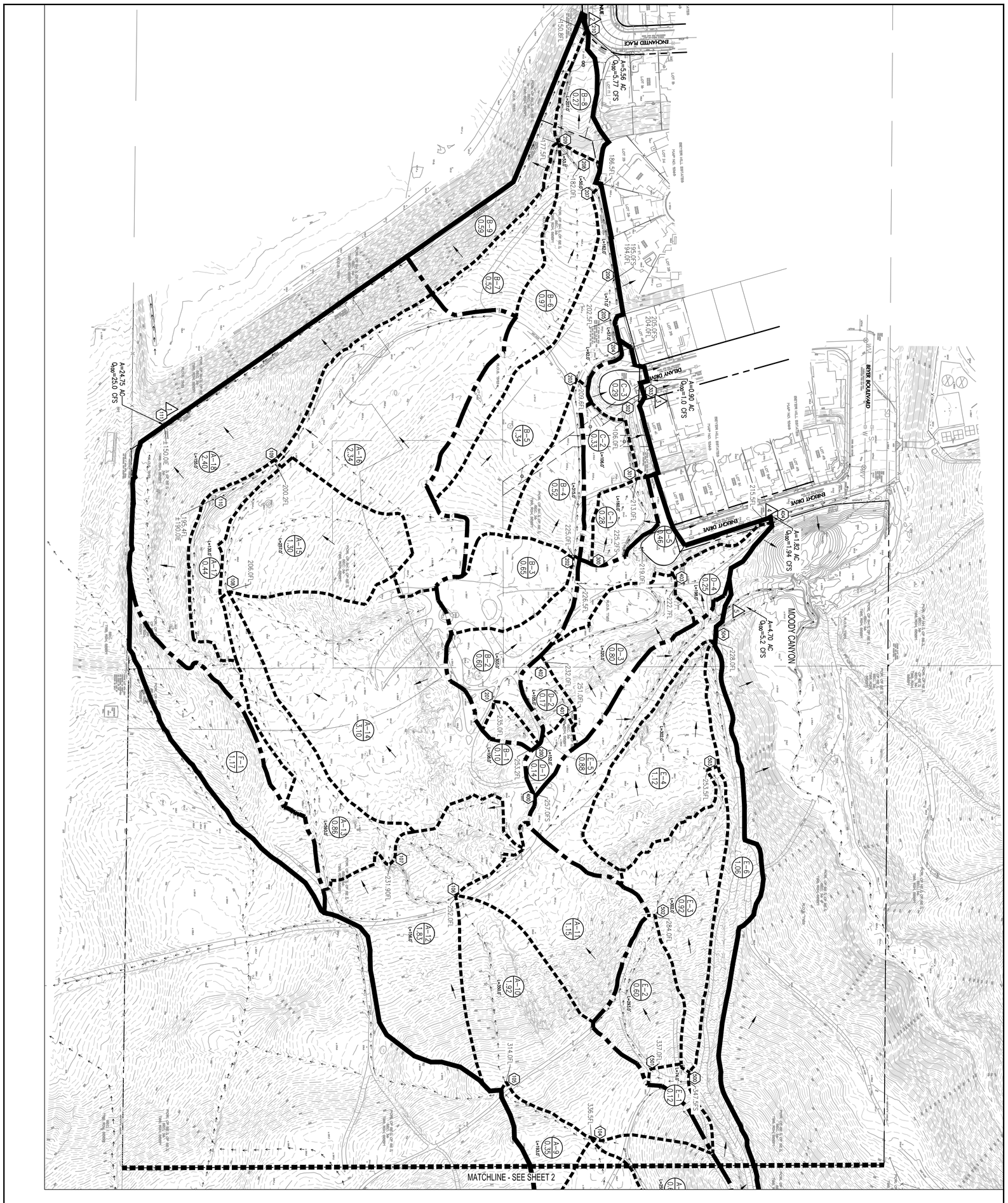

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      504.000
**** SUBAREA FLOW ADDITION ****
```

User specified 'C' value of 0.350 given for subarea
Time of concentration = 12.90 min.
Rainfall intensity = 3.075(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff = 0.947(CFS) for 0.880(Ac.)
Total runoff = 3.977(CFS) Total area = 3.64(Ac.)

++
Process from Point/Station 504.000 to Point/Station 504.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.350 given for subarea
Time of concentration = 12.90 min.
Rainfall intensity = 3.075(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff = 1.141(CFS) for 1.060(Ac.)
Total runoff = 5.118(CFS) Total area = 4.70(Ac.)
End of computations, total study area = 4.700 (Ac.)

PLOT: \\BWE-FIVE\CAD\PROJECTS\12500\12820U.1.00 BEYER PARK\DWGS\EXHIBITS\DRAINAGE\12820U.1.00 EXIST-HYDRO.DWG Mm GC 8/21/2018 2:07 PM



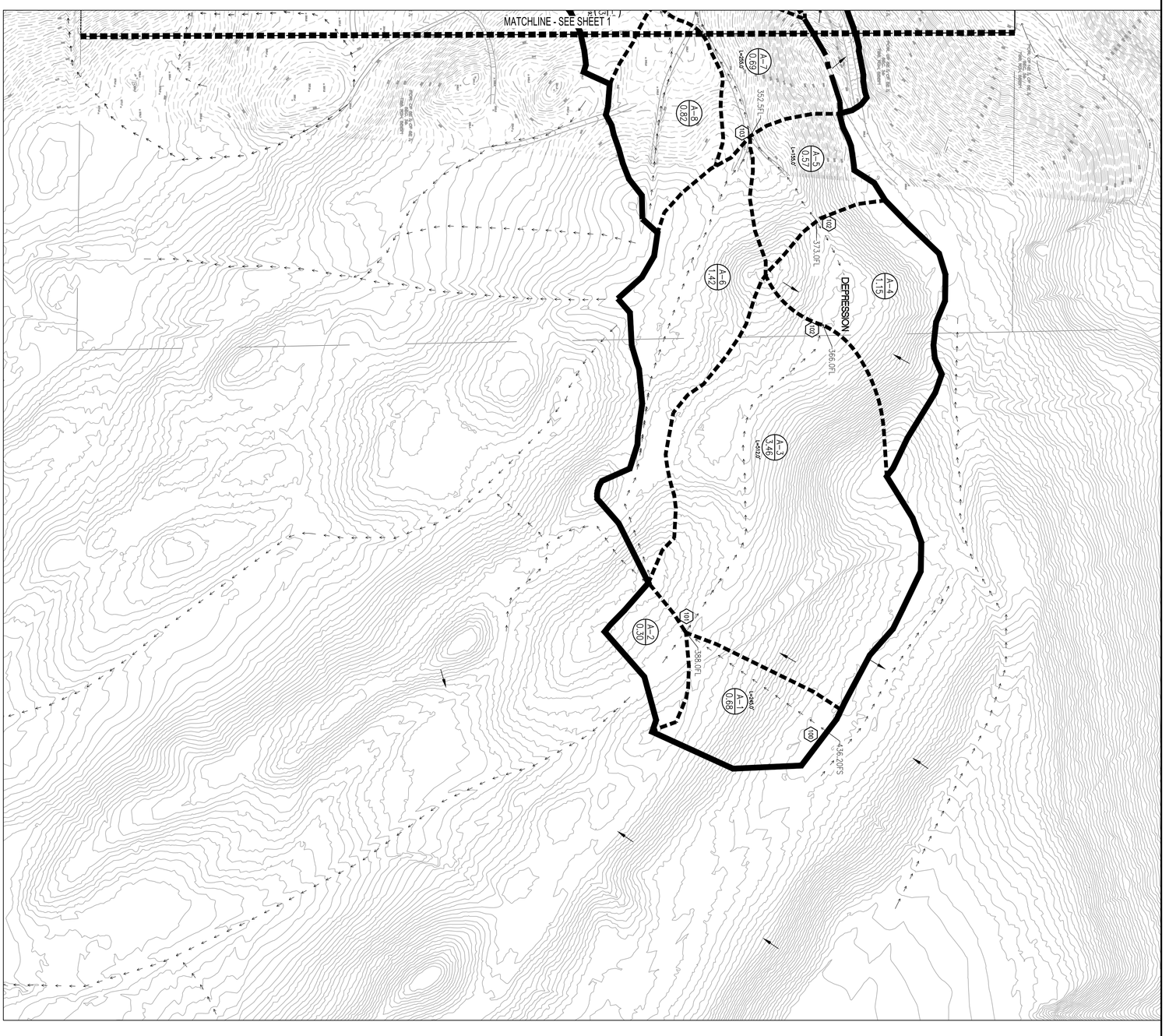
LEGEND

SYMBOL	
	OUTER BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	MINOR BASIN BOUNDARY
SD	EXISTING STORM DRAIN
XX	EXISTING CONTOUR
	FLOW DIRECTION
	FLOW PATH
L=XX.X'	FLOW LENGTH
313.00FL 310.00IE	NODE ELEVATION
200	HYDROLOGY NODE
	ANALYSIS/EXIT POINT
A-3 X.XX	DRAINAGE BASIN MARKER & AREA (AC)

SCALE IN FEET
1 inch = 80 ft.
40 0 80 160

PROJECT	SHEET TITLE	ISSUE DATE:	SYM	DESCRIPTION	DATE	APPR
ESCAYA PARK CHULA VISTA, CA	EXISTING CONDITION HYDROLOGY EXHIBIT	DRAWN BY:				
		CHECKED BY:				
		BWE JOB NUMBER:				
		CLIENT JOB NUMBER:				
SITE ADDRESS		MUNICIPALITY PROJECT NUMBER:				
	SHEET 1 OF 2					

BWE
WWW.BWESD.COM 619.299.5550



LEGEND

SYMBOL	
	OUTER BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	MINOR BASIN BOUNDARY
SD	EXISTING STORM DRAIN
XX	EXISTING CONTOUR
	FLOW DIRECTION
	FLOW PATH
L=XXX'	FLOW LENGTH
313.00FL 310.00IE	NODE/CONTOUR ELEVATION
200	HYDROLOGY NODE
	ANALYSIS/EXIT POINT
A-3 X.XX	DRAINAGE BASIN MARKER & AREA (AC)

SCALE IN FEET
1 inch = 80 ft.
40 0 80 160

N

PROJECT	SHEET TITLE	ISSUE DATE:	SYM	DESCRIPTION	DATE	APPR
ESCAYA PARK CHULA VISTA, CA	EXISTING CONDITION HYDROLOGY EXHIBIT	DRAWN BY:				
		CHECKED BY:				
		BWE JOB NUMBER:				
		CLIENT JOB NUMBER:				
SITE ADDRESS		MUNICIPALITY PROJECT NUMBER:				
	SHEET 2 OF 2					

BWE
WWW.BWESD.COM 619.299.5550

APPENDIX C:

Proposed Conditions Runoff Coefficient Calculations
Proposed Condition Hydrology/Hydraulic Calculations
Proposed Conditions Hydrology Map

Runoff Coefficient Calculation for (Proposed Condition)

Project: Beyer Park

Similar to commercial development

C = 0.85 (Per Table A-1, Soil Class D, Drainage Design Manual)

% imperviousness= 80% (Tabulated Imperviousness per Table A-1)

Revised C= (Actual % Imp./Tabulated % Imp.)*0.85

Description	Area (Acres)		Actual % Imperviousness	Revised Runoff Coef. (C)	*Use Runoff Coef. (C)
	Total Area	Imp. Area (Ai)			
Proposed Condition	16.00	2.72	17.00%	0.18	0.50

*C value for commercial development shall not be less than = 0.5

Note: Only the disturbed area is included in the calculation

12820PR100YR1

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/20/18

PROPOSED CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 1_INCLUDING OFFSITE AREA

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   107.000 to Point/Station   107.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
_____
User specified 'C' value of 0.350 given for subarea
Rainfall intensity (I) =   2.875(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC = 15.40 min. Rain intensity =   2.88(In/Hr)
Total area =   14.320(Ac.) Total runoff =   14.400(CFS)

++
Process from Point/Station   107.000 to Point/Station   108.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 14.817(CFS)
Depth of flow = 0.644(Ft.), Average velocity = 7.149(Ft/s)

******* Irregular Channel Data **********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	1.00
2	5.00	0.00
3	10.00	1.00

Manning's 'N' friction factor = 0.020

Sub-Channel flow = 14.817(CFS)
' ' flow top width = 6.438(Ft.)
' ' velocity= 7.149(Ft/s)
' ' area = 2.073(Sq.Ft)
' ' Froude number = 2.221

Upstream point elevation = 235.000(Ft.)
Downstream point elevation = 221.000(Ft.)
Flow length = 325.000(Ft.)
Travel time = 0.76 min.
Time of concentration = 16.16 min.
Depth of flow = 0.644(Ft.)
Average velocity = 7.149(Ft/s)
Total irregular channel flow = 14.817(CFS)
Irregular channel normal depth above invert elev. = 0.644(Ft.)
Average velocity of channel(s) = 7.149(Ft/s)

Sub-Channel No. 1 Critical depth = 0.883(Ft.)
' ' ' Critical flow top width = 8.828(Ft.)
' ' ' Critical flow velocity= 3.802(Ft/s)
' ' ' Critical flow area = 3.897(Sq.Ft)

Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity = 2.822(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff = 0.820(CFS) for 0.830(Ac.)
Total runoff = 15.220(CFS) Total area = 15.15(Ac.)

++

Process from Point/Station 108.000 to Point/Station 109.000

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 217.000(Ft.)

```
Downstream point/station elevation =   200.000(Ft.)
Pipe length  =   386.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.220(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    15.220(CFS)
Normal flow depth in pipe =   10.99(In.)
Flow top width inside pipe =   17.55(In.)
Critical Depth =   16.92(In.)
Pipe flow velocity =     13.46(Ft/s)
Travel time through pipe =    0.48 min.
Time of concentration (TC) =    16.64 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     15.150(Ac.)
Runoff from this stream =     15.220(CFS)
Time of concentration =   16.64 min.
Rainfall intensity =     2.789(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Initial subarea flow distance  =   52.000(Ft.)
Highest elevation =  251.000(Ft.)
Lowest elevation =  239.000(Ft.)
Elevation difference =   12.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     2.74 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5000)*(  52.000^.5)/(  23.077^(1/3)]=   2.74
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
Subarea runoff =      0.219(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
```

```
Estimated mean flow rate at midpoint of channel =      0.647(CFS)
Depth of flow =   0.148(Ft.), Average velocity =   5.939(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              5.00              0.00
        3             10.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      0.647(CFS)
  '     '        flow top width =      1.477(Ft.)
  '     '    velocity=    5.939(Ft/s)
  '     '        area =      0.109(Sq.Ft)
  '     '        Froude number =     3.852

Upstream point elevation =   239.000(Ft.)
Downstream point elevation =   221.000(Ft.)
Flow length =    85.000(Ft.)
Travel time  =    0.24 min.
Time of concentration =    5.24 min.
Depth of flow =   0.148(Ft.)
Average velocity =   5.939(Ft/s)
Total irregular channel flow =     0.647(CFS)
Irregular channel normal depth above invert elev. =   0.148(Ft.)
Average velocity of channel(s) =   5.939(Ft/s)

Sub-Channel No. 1 Critical depth =      0.254(Ft.)
  '     '       '     Critical flow top width =      2.539(Ft.)
  '     '       '     Critical flow velocity=    2.008(Ft/s)
  '     '       '     Critical flow area =      0.322(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.500 given for subarea
Rainfall intensity =      4.307(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.840(CFS) for    0.390(Ac.)
Total runoff =      1.059(CFS)  Total area =        0.49(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      115.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   217.000(Ft.)
Downstream point/station elevation =   213.000(Ft.)
Pipe length  =   427.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     1.059(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.059(CFS)
Normal flow depth in pipe =    5.34(In.)
Flow top width inside pipe =    8.84(In.)
Critical Depth =    5.67(In.)
Pipe flow velocity =      3.87(Ft/s)
Travel time through pipe =    1.84 min.
Time of concentration (TC) =     7.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      115.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.08 min.
Rainfall intensity =      3.831(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      2.433(CFS) for    1.270(Ac.)
Total runoff =      3.492(CFS)  Total area =        1.76(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      116.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   213.000(Ft.)
Downstream point/station elevation =   204.500(Ft.)
Pipe length  =    90.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.492(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.492(CFS)
Normal flow depth in pipe =    5.48(In.)
Flow top width inside pipe =    8.78(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.40(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     7.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      116.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.20 min.
Rainfall intensity =      3.806(In/Hr) for a   100.0 year storm
```

```
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.247(CFS) for    0.130(Ac.)
Total runoff =      3.739(CFS)  Total area =        1.89(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      117.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   204.500(Ft.)
Downstream point/station elevation =   204.000(Ft.)
Pipe length  =    82.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.739(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.739(CFS)
Normal flow depth in pipe =    9.61(In.)
Flow top width inside pipe =   14.39(In.)
Critical Depth =    9.38(In.)
Pipe flow velocity =      4.50(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     7.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      117.000 to Point/Station      109.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.50 min.
Rainfall intensity =      3.748(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      1.312(CFS) for    0.700(Ac.)
Total runoff =      5.051(CFS)  Total area =        2.59(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      109.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.50 min.
Rainfall intensity =      3.748(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      2.680(CFS) for    1.430(Ac.)
Total runoff =      7.731(CFS)  Total area =        4.02(Ac.)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```
Process from Point/Station      109.000 to Point/Station      109.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.50 min.
Rainfall intensity =      3.748(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      1.687(CFS) for    0.900(Ac.)
Total runoff =      9.417(CFS)  Total area =        4.92(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.920(Ac.)
Runoff from this stream =      9.417(CFS)
Time of concentration =    7.50 min.
Rainfall intensity =     3.748(In/Hr)
Summary of stream data:

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


1       15.220     16.64                2.789
2        9.417      7.50                3.748
Qmax(1) =
           1.000 *    1.000 *    15.220) +
           0.744 *    1.000 *     9.417) + =      22.227
Qmax(2) =
           1.000 *    0.451 *    15.220) +
           1.000 *    1.000 *     9.417) + =      16.280

Total of 2 streams to confluence:
Flow rates before confluence point:
      15.220       9.417
Maximum flow rates at confluence using above data:
       22.227       16.280
Area of streams before confluence:
       15.150        4.920
Results of confluence:
Total flow rate =     22.227(CFS)
Time of concentration =    16.636 min.
Effective stream area after confluence =     20.070(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   200.000(Ft.)
Downstream point/station elevation =   199.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.227(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    22.227(CFS)
Normal flow depth in pipe =   17.06(In.)
Flow top width inside pipe =   16.39(In.)
Critical Depth =   19.70(In.)
Pipe flow velocity =     10.62(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    16.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     22.709(CFS)
Depth of flow =   0.700(Ft.), Average velocity =  11.580(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              4.00              0.00
        3              8.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =     22.709(CFS)
  '     '        flow top width =      5.602(Ft.)
  '     '    velocity=   11.580(Ft/s)
  '     '        area =      1.961(Sq.Ft)
  '     '        Froude number =     3.449

Upstream point elevation =   199.000(Ft.)
Downstream point elevation =   158.000(Ft.)
Flow length =   400.000(Ft.)
Travel time  =    0.58 min.
Time of concentration =   17.29 min.
Depth of flow =   0.700(Ft.)
Average velocity =  11.580(Ft/s)
Total irregular channel flow =    22.709(CFS)
Irregular channel normal depth above invert elev. =   0.700(Ft.)
```

```
Average velocity of channel(s) =  11.580(Ft/s)

Sub-Channel No. 1 Critical depth =      1.133(Ft.)
  '     '       '     Critical flow top width =      8.000(Ft.)
  '     '       '     Critical flow velocity=    4.486(Ft/s)
  '     '       '     Critical flow area =      5.063(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.746(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.836(CFS) for    0.870(Ac.)
Total runoff =     23.063(CFS)  Total area =       20.94(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =    17.29 min.
Rainfall intensity =      2.746(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      3.899(CFS) for    2.840(Ac.)
Total runoff =     26.962(CFS)  Total area =       23.78(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =    17.29 min.
Rainfall intensity =      2.746(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      2.100(CFS) for    1.530(Ac.)
Total runoff =     29.062(CFS)  Total area =       25.31(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =    17.29 min.
Rainfall intensity =      2.746(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      1.336(CFS) for    1.390(Ac.)
```

12820PR100YR1

Total runoff = 30.398(CFS) Total area = 26.70(Ac.)

End of computations, total study area = 26.700 (Ac.)

12820PR100YR2

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/18/18

PROPOSED CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 2

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   200.000 to Point/Station   201.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.500 given for subarea
Initial subarea flow distance =   77.000(Ft.)
Highest elevation = 237.100(Ft.)
Lowest elevation = 228.000(Ft.)
Elevation difference =   9.100(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =   4.16 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5000)*(77.000^.5)/(11.818^(1/3)]=   4.16

```
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
Subarea runoff =      0.593(CFS)
Total initial stream area =        0.270(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   225.000(Ft.)
Downstream point/station elevation =   223.400(Ft.)
Pipe length  =    78.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.593(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.593(CFS)
Normal flow depth in pipe =    3.83(In.)
Flow top width inside pipe =    5.76(In.)
Critical Depth =    4.70(In.)
Pipe flow velocity =      4.48(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =     5.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     5.29 min.
Rainfall intensity =      4.290(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.493(CFS) for    0.230(Ac.)
Total runoff =      1.086(CFS)  Total area =        0.50(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   223.400(Ft.)
Downstream point/station elevation =   216.900(Ft.)
Pipe length  =   218.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.086(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.086(CFS)
Normal flow depth in pipe =    3.85(In.)
```

```
Flow top width inside pipe =    8.90(In.)
Critical Depth =    5.74(In.)
Pipe flow velocity =      6.02(Ft/s)
Travel time through pipe =    0.60 min.
Time of concentration (TC) =     5.89 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     5.89 min.
Rainfall intensity =      4.109(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.760(CFS) for    0.370(Ac.)
Total runoff =      1.846(CFS)  Total area =        0.87(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   216.900(Ft.)
Downstream point/station elevation =   212.000(Ft.)
Pipe length  =   165.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.846(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.846(CFS)
Normal flow depth in pipe =    5.27(In.)
Flow top width inside pipe =    8.87(In.)
Critical Depth =    7.45(In.)
Pipe flow velocity =      6.86(Ft/s)
Travel time through pipe =    0.40 min.
Time of concentration (TC) =     6.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     6.29 min.
Rainfall intensity =      4.006(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.901(CFS) for    0.450(Ac.)
Total runoff =      2.747(CFS)  Total area =        1.32(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   209.000(Ft.)
Downstream point/station elevation =   207.000(Ft.)
Pipe length  =   102.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.747(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.747(CFS)
Normal flow depth in pipe =    6.36(In.)
Flow top width inside pipe =   11.98(In.)
Critical Depth =    8.52(In.)
Pipe flow velocity =      6.51(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =     6.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     6.56 min.
Rainfall intensity =      3.943(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.789(CFS) for    0.400(Ac.)
Total runoff =      3.536(CFS)  Total area =        1.72(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   207.000(Ft.)
Downstream point/station elevation =   200.000(Ft.)
Pipe length  =   107.50(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.536(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.536(CFS)
Normal flow depth in pipe =    6.30(In.)
Flow top width inside pipe =    8.24(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.70(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     6.72 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      206.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     6.72 min.
Rainfall intensity =      3.906(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.918(CFS) for    0.470(Ac.)
Total runoff =      4.454(CFS)  Total area =        2.19(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      206.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     6.72 min.
Rainfall intensity =      3.906(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      1.172(CFS) for    0.600(Ac.)
Total runoff =      5.625(CFS)  Total area =        2.79(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   200.000(Ft.)
Downstream point/station elevation =   199.000(Ft.)
Pipe length  =    56.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.625(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.625(CFS)
Normal flow depth in pipe =    8.82(In.)
Flow top width inside pipe =   14.76(In.)
Critical Depth =   11.52(In.)
Pipe flow velocity =      7.49(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     6.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      208.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      5.837(CFS)
```

```
Depth of flow =   0.608(Ft.), Average velocity =  10.513(Ft/s)
        ******* Irregular Channel Data ***********
--------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
--------------------------------------------------------------
Sub-Channel flow  =      5.837(CFS)
  '     '        flow top width =      1.825(Ft.)
  '     '    velocity=   10.513(Ft/s)
  '     '        area =      0.555(Sq.Ft)
  '     '        Froude number =     3.359

Upstream point elevation =   199.000(Ft.)
Downstream point elevation =   186.500(Ft.)
Flow length =   204.000(Ft.)
Travel time  =    0.32 min.
Time of concentration =    7.17 min.
Depth of flow =   0.608(Ft.)
Average velocity =  10.513(Ft/s)
Total irregular channel flow =     5.837(CFS)
Irregular channel normal depth above invert elev. =   0.608(Ft.)
Average velocity of channel(s) =  10.513(Ft/s)

Sub-Channel No. 1 Critical depth =      0.984(Ft.)
  '     '       '     Critical flow top width =      2.953(Ft.)
  '     '       '     Critical flow velocity=    4.016(Ft/s)
  '     '       '     Critical flow area =      1.453(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.500 given for subarea
Rainfall intensity =      3.812(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.400(CFS) for    0.210(Ac.)
Total runoff =      6.026(CFS)  Total area =        3.00(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      209.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.254(Ft.), Average velocity =   5.620(Ft/s)
        ******* Irregular Channel Data ***********
--------------------------------------------------------------
Information entered for subchannel number 1 :
```

```
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.30
        2              5.00              0.00
        3             10.00              0.30
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      6.026(CFS)
  '     '        flow top width =      8.455(Ft.)
  '     '    velocity=    5.620(Ft/s)
  '     '        area =      1.072(Sq.Ft)
  '     '        Froude number =     2.781

Upstream point elevation =   186.500(Ft.)
Downstream point elevation =   182.000(Ft.)
Flow length =    50.000(Ft.)
Travel time  =    0.15 min.
Time of concentration =    7.32 min.
Depth of flow =   0.254(Ft.)
Average velocity =   5.620(Ft/s)
Total irregular channel flow =     6.026(CFS)
Irregular channel normal depth above invert elev. =   0.254(Ft.)
Average velocity of channel(s) =   5.620(Ft/s)

Sub-Channel No. 1 Critical depth =      0.375(Ft.)
  '     '       '     Critical flow top width =     10.000(Ft.)
  '     '       '     Critical flow velocity=    2.678(Ft/s)
  '     '       '     Critical flow area =      2.250(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      210.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      6.458(CFS)
Depth of flow =   0.594(Ft.), Average velocity =  12.185(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
-----------------------------------------------------------------
Sub-Channel flow  =      6.458(CFS)
  '     '        flow top width =      1.783(Ft.)
  '     '    velocity=   12.185(Ft/s)
```

```
  '     '        area =      0.530(Sq.Ft)
  '     '        Froude number =     3.939

Upstream point elevation =   182.000(Ft.)
Downstream point elevation =   177.500(Ft.)
Flow length =    53.000(Ft.)
Travel time  =    0.07 min.
Time of concentration =    7.39 min.
Depth of flow =   0.594(Ft.)
Average velocity =  12.185(Ft/s)
Total irregular channel flow =     6.458(CFS)
Irregular channel normal depth above invert elev. =   0.594(Ft.)
Average velocity of channel(s) =  12.185(Ft/s)

Sub-Channel No. 1 Critical depth =      1.023(Ft.)
  '     '       '     Critical flow top width =      3.000(Ft.)
  '     '       '     Critical flow velocity=    4.112(Ft/s)
  '     '       '     Critical flow area =      1.570(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.500 given for subarea
Rainfall intensity =      3.769(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.810(CFS) for    0.430(Ac.)
Total runoff =      6.836(CFS)  Total area =        3.43(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      210.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.39 min.
Rainfall intensity =      3.769(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      1.338(CFS) for    0.710(Ac.)
Total runoff =      8.174(CFS)  Total area =        4.14(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      8.440(CFS)
Depth of flow =   0.608(Ft.), Average velocity =  15.240(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
```

```
                          12820PR100YR2
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              1.50              0.00
        3              3.00              1.00
Manning's 'N' friction factor =   0.014
-----------------------------------------------------------------
Sub-Channel flow  =      8.440(CFS)
  '     '        flow top width =      1.823(Ft.)
  '     '    velocity=   15.240(Ft/s)
  '     '        area =      0.554(Sq.Ft)
  '     '        Froude number =     4.873

Upstream point elevation =   177.500(Ft.)
Downstream point elevation =   150.800(Ft.)
Flow length =   207.000(Ft.)
Travel time  =    0.23 min.
Time of concentration =    7.62 min.
Depth of flow =   0.608(Ft.)
Average velocity =  15.240(Ft/s)
Total irregular channel flow =     8.440(CFS)
Irregular channel normal depth above invert elev. =   0.608(Ft.)
Average velocity of channel(s) =  15.240(Ft/s)

Sub-Channel No. 1 Critical depth =      1.125(Ft.)
  '     '       '     Critical flow top width =      3.000(Ft.)
  '     '       '     Critical flow velocity=    4.502(Ft/s)
  '     '       '     Critical flow area =      1.875(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.727(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.352(CFS) for    0.270(Ac.)
Total runoff =      8.526(CFS)  Total area =        4.41(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      211.000 to Point/Station      211.000
**** SUBAREA FLOW ADDITION ****
_________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =     7.62 min.
Rainfall intensity =      3.727(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.770(CFS) for    0.590(Ac.)
Total runoff =      9.295(CFS)  Total area =        5.00(Ac.)
End of computations, total study area =          5.000 (Ac.)
```

12820PR100YR4

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/18/18

PROPOSED CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 4

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   400.000 to Point/Station   401.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.500 given for subarea
Initial subarea flow distance =   97.000(Ft.)
Highest elevation = 255.400(Ft.)
Lowest elevation = 251.000(Ft.)
Elevation difference =   4.400(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =   6.43 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5000)*(97.000^.5)/(4.536^(1/3)]=   6.43

```
Rainfall intensity (I) =      3.974(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
Subarea runoff =      0.656(CFS)
Total initial stream area =        0.330(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   248.000(Ft.)
Downstream point/station elevation =   245.000(Ft.)
Pipe length  =   147.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.656(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.656(CFS)
Normal flow depth in pipe =    4.13(In.)
Flow top width inside pipe =    5.56(In.)
Critical Depth =    4.92(In.)
Pipe flow velocity =      4.55(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =     6.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      402.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     6.96 min.
Rainfall intensity =      3.854(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.597(CFS) for    0.310(Ac.)
Total runoff =      1.253(CFS)  Total area =        0.64(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      403.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   245.000(Ft.)
Downstream point/station elevation =   222.500(Ft.)
Pipe length  =   144.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.253(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.253(CFS)
Normal flow depth in pipe =    3.23(In.)
Flow top width inside pipe =    5.98(In.)
```

```
Critical depth could not be calculated.
Pipe flow velocity =     11.64(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =     7.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      403.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.17 min.
Rainfall intensity =      3.812(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.419(CFS) for    0.220(Ac.)
Total runoff =      1.672(CFS)  Total area =        0.86(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      404.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   222.500(Ft.)
Downstream point/station elevation =   222.000(Ft.)
Pipe length  =    20.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.672(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.672(CFS)
Normal flow depth in pipe =    5.23(In.)
Flow top width inside pipe =    8.88(In.)
Critical Depth =    7.13(In.)
Pipe flow velocity =      6.28(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     7.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      404.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.500 given for subarea
Time of concentration =     7.22 min.
Rainfall intensity =      3.801(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      1.425(CFS) for    0.750(Ac.)
Total runoff =      3.098(CFS)  Total area =        1.61(Ac.)
```

++
Process from Point/Station 404.000 to Point/Station 405.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 219.000(Ft.)
Downstream point/station elevation = 214.000(Ft.)
Pipe length = 145.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 3.098(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 3.098(CFS)
Normal flow depth in pipe = 5.78(In.)
Flow top width inside pipe = 11.99(In.)
Critical Depth = 9.05(In.)
Pipe flow velocity = 8.29(Ft/s)
Travel time through pipe = 0.29 min.
Time of concentration (TC) = 7.51 min.

++
Process from Point/Station 405.000 to Point/Station 405.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.500 given for subarea
Time of concentration = 7.51 min.
Rainfall intensity = 3.745(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff = 1.405(CFS) for 0.750(Ac.)
Total runoff = 4.502(CFS) Total area = 2.36(Ac.)

++
Process from Point/Station 405.000 to Point/Station 405.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.500 given for subarea
Time of concentration = 7.51 min.
Rainfall intensity = 3.745(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff = 0.618(CFS) for 0.330(Ac.)
Total runoff = 5.120(CFS) Total area = 2.69(Ac.)

++
Process from Point/Station 405.000 to Point/Station 405.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.500 given for subarea
Time of concentration = 7.51 min.

```
Rainfall intensity =      3.745(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      0.599(CFS) for    0.320(Ac.)
Total runoff =      5.720(CFS)  Total area =        3.01(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      405.000 to Point/Station      406.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   214.000(Ft.)
Downstream point/station elevation =   213.000(Ft.)
Pipe length  =    82.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.720(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.720(CFS)
Normal flow depth in pipe =   10.17(In.)
Flow top width inside pipe =   14.02(In.)
Critical Depth =   11.61(In.)
Pipe flow velocity =      6.46(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =     7.73 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      406.000 to Point/Station      406.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
User specified 'C' value of 0.350 given for subarea
Time of concentration =     7.73 min.
Rainfall intensity =      3.707(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.143(CFS) for    0.110(Ac.)
Total runoff =      5.862(CFS)  Total area =        3.12(Ac.)
End of computations, total study area =           3.120 (Ac.)
```

12820PR100YR5

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.5

Rational method hydrology program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study   Date: 08/20/18

PROPOSED CONDITION HYDROLOGY ANALYSIS
BEYER PARK
DISCHARGE POINT 5

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

Program License Serial Number 6116

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity) = 1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method

++
Process from Point/Station   500.000 to Point/Station   501.000
**** INITIAL AREA EVALUATION ****
_____
User specified 'C' value of 0.350 given for subarea
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance =   74.000(Ft.)
Highest elevation = 347.500(Ft.)
Lowest elevation = 337.000(Ft.)
Elevation difference =   10.500(Ft.)
TC=[(11.9*0.0140^3)/(10.50)]^.385= 0.46 + 10 min. =   10.46 min.

```
Rainfall intensity (I) =      3.320(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.139(CFS)
Total initial stream area =        0.120(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.488(CFS)
Depth of flow =   0.105(Ft.), Average velocity =   4.419(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2              5.00              0.00
        3             10.00              0.50
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      0.488(CFS)
  '     '        flow top width =      2.102(Ft.)
  '     '    velocity=    4.419(Ft/s)
  '     '        area =      0.110(Sq.Ft)
  '     '        Froude number =     3.397

Upstream point elevation =   337.000(Ft.)
Downstream point elevation =   284.000(Ft.)
Flow length =   293.000(Ft.)
Travel time  =    1.11 min.
Time of concentration =   11.56 min.
Depth of flow =   0.105(Ft.)
Average velocity =   4.419(Ft/s)
Total irregular channel flow =     0.488(CFS)
Irregular channel normal depth above invert elev. =   0.105(Ft.)
Average velocity of channel(s) =   4.419(Ft/s)

Sub-Channel No. 1 Critical depth =      0.172(Ft.)
  '     '       '     Critical flow top width =      3.438(Ft.)
  '     '       '     Critical flow velocity=    1.652(Ft/s)
  '     '       '     Critical flow area =      0.295(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      3.201(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff =      0.672(CFS) for    0.600(Ac.)
```

Total runoff = 0.812(CFS) Total area = 0.72(Ac.)

++
Process from Point/Station 502.000 to Point/Station 503.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel = 1.330(CFS)
Depth of flow = 0.390(Ft.), Average velocity = 8.749(Ft/s)
******* Irregular Channel Data **********

Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 2.00
2 2.00 0.00
3 4.00 2.00
Manning's 'N' friction factor = 0.020

Sub-Channel flow = 1.330(CFS)
' ' flow top width = 0.780(Ft.)
' ' velocity= 8.749(Ft/s)
' ' area = 0.152(Sq.Ft)
' ' Froude number = 3.492

Upstream point elevation = 284.000(Ft.)
Downstream point elevation = 225.200(Ft.)
Flow length = 302.000(Ft.)
Travel time = 0.58 min.
Time of concentration = 12.14 min.
Depth of flow = 0.390(Ft.)
Average velocity = 8.749(Ft/s)
Total irregular channel flow = 1.330(CFS)
Irregular channel normal depth above invert elev. = 0.390(Ft.)
Average velocity of channel(s) = 8.749(Ft/s)

Sub-Channel No. 1 Critical depth = 0.641(Ft.)
' ' ' Critical flow top width = 1.281(Ft.)
' ' ' Critical flow velocity= 3.242(Ft/s)
' ' ' Critical flow area = 0.410(Sq.Ft)

Adding area flow to channel
User specified 'C' value of 0.350 given for subarea
Rainfall intensity = 3.145(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff = 1.013(CFS) for 0.920(Ac.)
Total runoff = 1.824(CFS) Total area = 1.64(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      503.000 to Point/Station      504.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      2.203(CFS)
Depth of flow =   0.350(Ft.), Average velocity =   5.997(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2              3.00              0.00
        3              6.00              1.00
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      2.203(CFS)
  '     '        flow top width =      2.099(Ft.)
  '     '    velocity=    5.997(Ft/s)
  '     '        area =      0.367(Sq.Ft)
  '     '        Froude number =     2.527

Upstream point elevation =   249.500(Ft.)
Downstream point elevation =   247.000(Ft.)
Flow length =    35.000(Ft.)
Travel time  =    0.10 min.
Time of concentration =   12.23 min.
Depth of flow =   0.350(Ft.)
Average velocity =   5.997(Ft/s)
Total irregular channel flow =     2.203(CFS)
Irregular channel normal depth above invert elev. =   0.350(Ft.)
Average velocity of channel(s) =   5.997(Ft/s)

Sub-Channel No. 1 Critical depth =      0.508(Ft.)
  '     '       '     Critical flow top width =      3.047(Ft.)
  '     '       '     Critical flow velocity=    2.847(Ft/s)
  '     '       '     Critical flow area =      0.774(Sq.Ft)

 Adding area flow to channel
User specified 'C' value of 0.500 given for subarea
Rainfall intensity =      3.136(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.500
Subarea runoff =      1.066(CFS) for    0.680(Ac.)
Total runoff =      2.891(CFS)  Total area =        2.32(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      504.000
**** SUBAREA FLOW ADDITION ****
```

User specified 'C' value of 0.350 given for subarea
Time of concentration = 12.23 min.
Rainfall intensity = 3.136(In/Hr) for a 100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.350
Subarea runoff = 1.010(CFS) for 0.920(Ac.)
Total runoff = 3.900(CFS) Total area = 3.24(Ac.)

++
Process from Point/Station 504.000 to Point/Station 505.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 243.000(Ft.)
Downstream point/station elevation = 224.000(Ft.)
Pipe length = 181.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 3.900(CFS)
Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 3.900(CFS)
Normal flow depth in pipe = 5.70(In.)
Flow top width inside pipe = 8.68(In.)
Critical depth could not be calculated.
Pipe flow velocity = 13.23(Ft/s)
Travel time through pipe = 0.23 min.
Time of concentration (TC) = 12.46 min.

++
Process from Point/Station 505.000 to Point/Station 506.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 224.000(Ft.)
Downstream point/station elevation = 222.000(Ft.)
Pipe length = 45.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 3.900(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 3.900(CFS)
Normal flow depth in pipe = 6.13(In.)
Flow top width inside pipe = 12.00(In.)
Critical Depth = 10.06(In.)
Pipe flow velocity = 9.65(Ft/s)
Travel time through pipe = 0.08 min.
Time of concentration (TC) = 12.54 min.
End of computations, total study area = 3.240 (Ac.)

PEAK FLOW RATE SUMMARY

Analysis Point	Discharge Point	Drainage Area (acres)		100 Yr Flow (cfs)			% Change from Existing Condition
		Existing Condition	Proposed Condition	Existing Condition	Proposed Condition	Mitigated Condition	
A	#1	24.75	26.70	25.00	30.40	23.87	-4.5
B	#2	5.56	5.00	5.77	9.30	6.43	11.4
	#3	0.90	0.00	1.00	0.00	0.00	-100.0
Sub-Total		6.46	5.00	6.77	9.30	6.43	-5.0
C	#4	1.82	3.12	1.94	5.86	3.19	64.4
	#5	4.70	3.24	5.20	3.90	3.90	-25.0
Sub-Total		6.52	6.36	7.14	9.76	7.09	-0.7
	#6	1.17	0.84	Not Analyzed			
Total		38.90	38.90	38.91	49.46	37.39	-3.9

LEGEND

	SYMBOL
OUTER BASIN BOUNDARY	
MAJOR BASIN BOUNDARY	
MINOR BASIN BOUNDARY	
EXISTING STORM DRAIN	SD
NEW STORM DRAIN	SD
EXISTING CONTOUR	XXX
NEW CONTOUR	XXX
FLOW DIRECTION	
FLOW PATH	
FLOW LENGTH	L=XX.X'
NODE/CONTOUR ELEVATION	307.85FL 304.35IE
HYDROLOGY NODE	200
DISCHARGE POINT	1
DRAINAGE BASIN MARKER & AREA (AC)	B-X X.XX
ANALYSIS POINT	D

40 0 80 160
SCALE IN FEET
1 inch = 80 ft.

BWE
619.299.5550
WWW.BWESD.COM

SYM	DESCRIPTION	DATE	APPR

ISSUE DATE:
DRAWN BY:
CHECKED BY:
BWE JOB NUMBER:
CLIENT JOB NUMBER:
MUNICIPALITY
PROJECT NUMBER:

SHEET TITLE

PROPOSED CONDITION HYDROLOGY EXHIBIT

SHEET 1 OF 2

PROJECT

BEYER PARK

SITE ADDRESS
BEYER PARK
SAN DIEGO, CA 92173

PLOT: \\BWE-FIVE\CAD\PROJECTS\12500\12820U.1.00 BEYER PARK\DWGS\EXHIBITS\DRAINAGE\12820U.1.00 PROP-HYDRO.DWG Mon Oc 8/21/2018 1:52 PM

APPENDIX D

Hydraulic Analysis

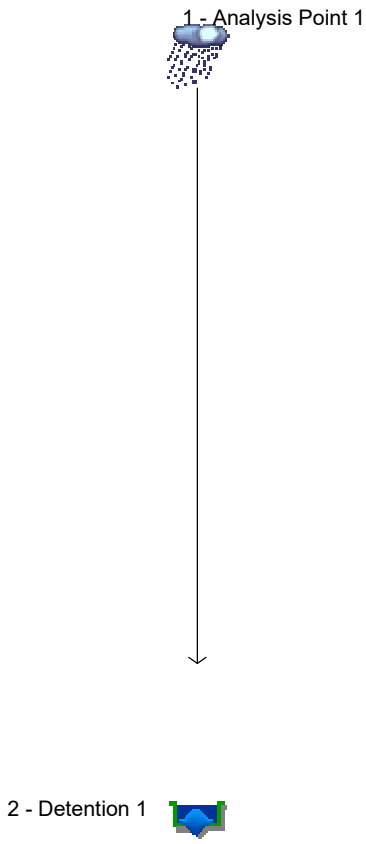
RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 8 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 4.92 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 9.42 CFS

DETENTION #1 ANALYSIS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 8	DISCHARGE (CFS) = 0.3
TIME (MIN) = 16	DISCHARGE (CFS) = 0.3
TIME (MIN) = 24	DISCHARGE (CFS) = 0.3
TIME (MIN) = 32	DISCHARGE (CFS) = 0.3
TIME (MIN) = 40	DISCHARGE (CFS) = 0.3
TIME (MIN) = 48	DISCHARGE (CFS) = 0.3
TIME (MIN) = 56	DISCHARGE (CFS) = 0.3
TIME (MIN) = 64	DISCHARGE (CFS) = 0.3
TIME (MIN) = 72	DISCHARGE (CFS) = 0.4
TIME (MIN) = 80	DISCHARGE (CFS) = 0.4
TIME (MIN) = 88	DISCHARGE (CFS) = 0.4
TIME (MIN) = 96	DISCHARGE (CFS) = 0.4
TIME (MIN) = 104	DISCHARGE (CFS) = 0.4
TIME (MIN) = 112	DISCHARGE (CFS) = 0.4
TIME (MIN) = 120	DISCHARGE (CFS) = 0.4
TIME (MIN) = 128	DISCHARGE (CFS) = 0.5
TIME (MIN) = 136	DISCHARGE (CFS) = 0.5
TIME (MIN) = 144	DISCHARGE (CFS) = 0.5
TIME (MIN) = 152	DISCHARGE (CFS) = 0.5
TIME (MIN) = 160	DISCHARGE (CFS) = 0.6
TIME (MIN) = 168	DISCHARGE (CFS) = 0.6
TIME (MIN) = 176	DISCHARGE (CFS) = 0.6
TIME (MIN) = 184	DISCHARGE (CFS) = 0.7
TIME (MIN) = 192	DISCHARGE (CFS) = 0.7
TIME (MIN) = 200	DISCHARGE (CFS) = 0.9
TIME (MIN) = 208	DISCHARGE (CFS) = 0.9
TIME (MIN) = 216	DISCHARGE (CFS) = 1.1
TIME (MIN) = 224	DISCHARGE (CFS) = 1.3
TIME (MIN) = 232	DISCHARGE (CFS) = 1.9
TIME (MIN) = 240	DISCHARGE (CFS) = 2.8
TIME (MIN) = 248	DISCHARGE (CFS) = 9.42
TIME (MIN) = 256	DISCHARGE (CFS) = 1.5
TIME (MIN) = 264	DISCHARGE (CFS) = 1
TIME (MIN) = 272	DISCHARGE (CFS) = 0.8
TIME (MIN) = 280	DISCHARGE (CFS) = 0.7
TIME (MIN) = 288	DISCHARGE (CFS) = 0.6
TIME (MIN) = 296	DISCHARGE (CFS) = 0.5
TIME (MIN) = 304	DISCHARGE (CFS) = 0.5
TIME (MIN) = 312	DISCHARGE (CFS) = 0.4
TIME (MIN) = 320	DISCHARGE (CFS) = 0.4
TIME (MIN) = 328	DISCHARGE (CFS) = 0.4
TIME (MIN) = 336	DISCHARGE (CFS) = 0.4
TIME (MIN) = 344	DISCHARGE (CFS) = 0.3
TIME (MIN) = 352	DISCHARGE (CFS) = 0.3
TIME (MIN) = 360	DISCHARGE (CFS) = 0.3
TIME (MIN) = 368	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

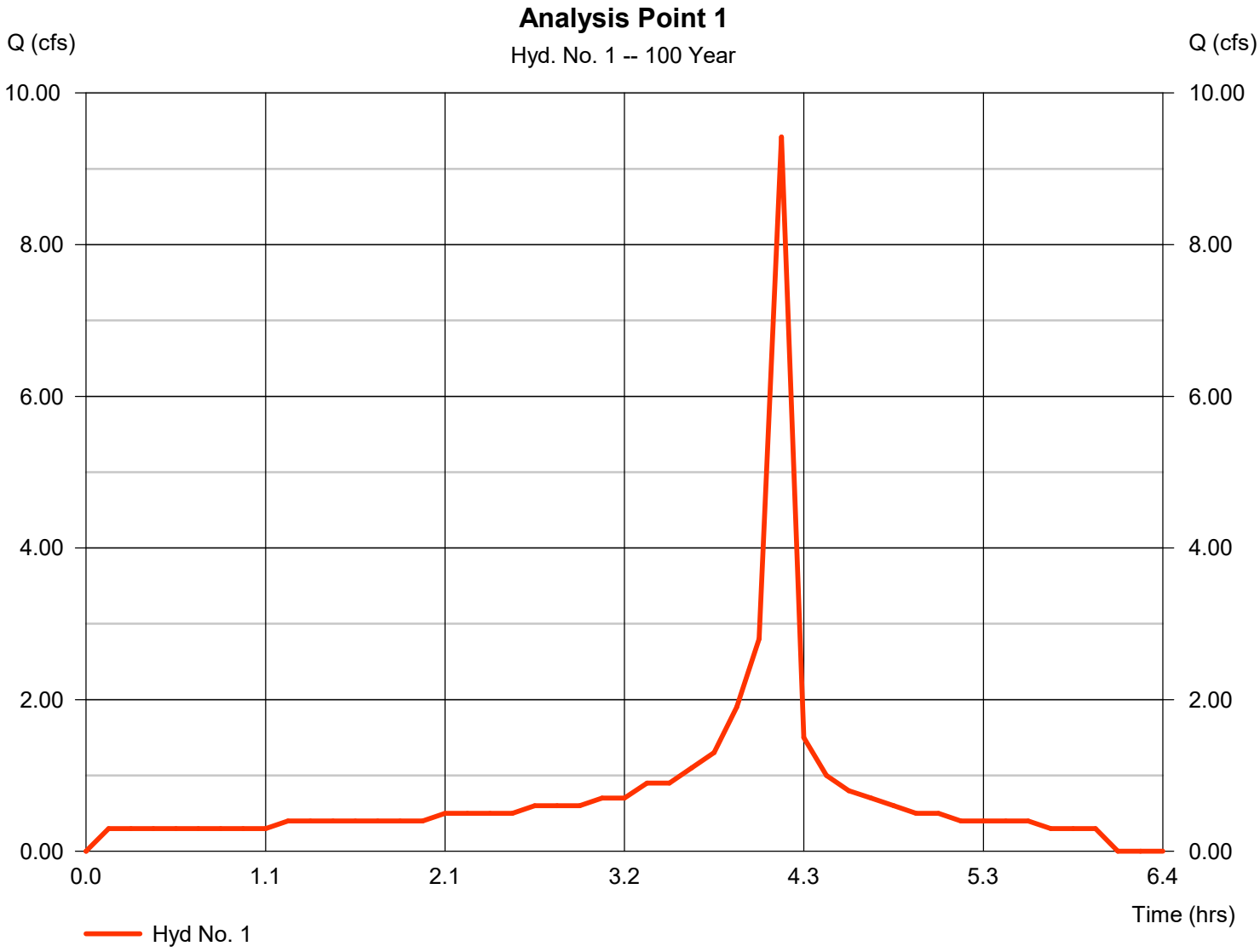
Hyd.	Origin	Description
1	Manual	Analysis Point 1
2	Reservoir	Detention 1

Hydrograph Report

Hyd. No. 1

Analysis Point 1

Hydrograph type	= Manual	Peak discharge	= 9.420 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.13 hrs
Time interval	= 8 min	Hyd. volume	= 17,674 cuft



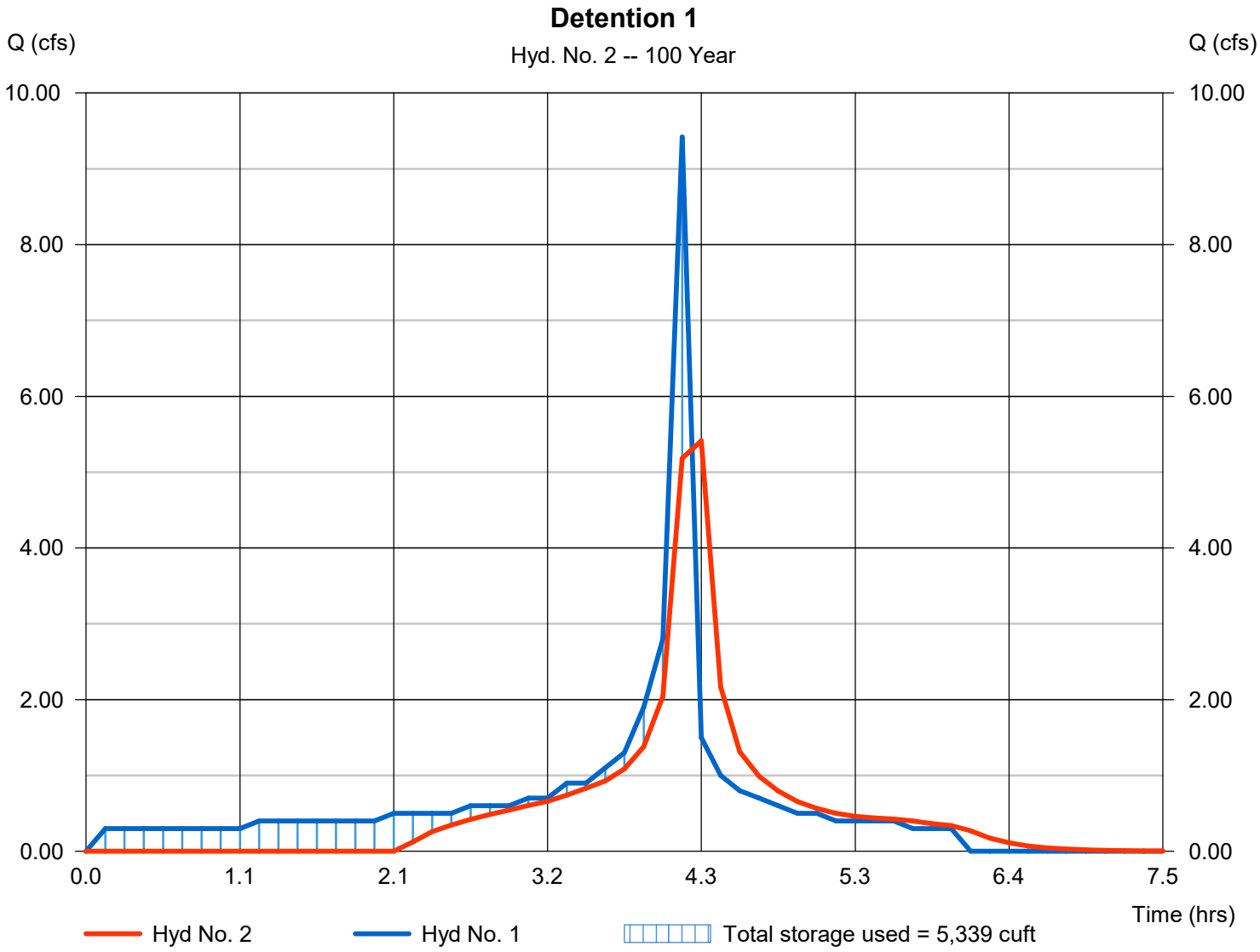
Hydrograph Report

Hyd. No. 2

Detention 1

Hydrograph type	=	Reservoir	Peak discharge	=	5.412 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.27 hrs
Time interval	=	8 min	Hyd. volume	=	14,980 cuft
Inflow hyd. No.	=	1 - Analysis Point 1	Max. Elevation	=	205.00 ft
Reservoir name	=	bmp #1	Max. Storage	=	5,339 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	4,650	0	0
1.00	205.00	6,120	5,385	5,385

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	Inactive
Span (in)	= 18.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.71	Inactive	Inactive	Inactive
Crest El. (ft)	= 204.50	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	5,385	205.00	9.15 oc	0.00	0.00	0.00	5.55	0.00	---	---	---	---	5.545

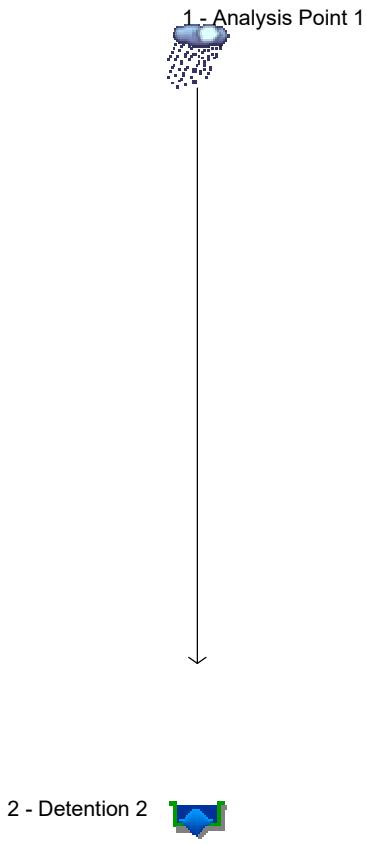
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #2 ANALYSIS

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 1.76 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 3.5 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0.1
TIME (MIN) = 14	DISCHARGE (CFS) = 0.1
TIME (MIN) = 21	DISCHARGE (CFS) = 0.1
TIME (MIN) = 28	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 42	DISCHARGE (CFS) = 0.1
TIME (MIN) = 49	DISCHARGE (CFS) = 0.1
TIME (MIN) = 56	DISCHARGE (CFS) = 0.1
TIME (MIN) = 63	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 91	DISCHARGE (CFS) = 0.1
TIME (MIN) = 98	DISCHARGE (CFS) = 0.1
TIME (MIN) = 105	DISCHARGE (CFS) = 0.1
TIME (MIN) = 112	DISCHARGE (CFS) = 0.2
TIME (MIN) = 119	DISCHARGE (CFS) = 0.2
TIME (MIN) = 126	DISCHARGE (CFS) = 0.2
TIME (MIN) = 133	DISCHARGE (CFS) = 0.2
TIME (MIN) = 140	DISCHARGE (CFS) = 0.2
TIME (MIN) = 147	DISCHARGE (CFS) = 0.2
TIME (MIN) = 154	DISCHARGE (CFS) = 0.2
TIME (MIN) = 161	DISCHARGE (CFS) = 0.2
TIME (MIN) = 168	DISCHARGE (CFS) = 0.2
TIME (MIN) = 175	DISCHARGE (CFS) = 0.2
TIME (MIN) = 182	DISCHARGE (CFS) = 0.2
TIME (MIN) = 189	DISCHARGE (CFS) = 0.3
TIME (MIN) = 196	DISCHARGE (CFS) = 0.3
TIME (MIN) = 203	DISCHARGE (CFS) = 0.3
TIME (MIN) = 210	DISCHARGE (CFS) = 0.4
TIME (MIN) = 217	DISCHARGE (CFS) = 0.4
TIME (MIN) = 224	DISCHARGE (CFS) = 0.5
TIME (MIN) = 231	DISCHARGE (CFS) = 0.7
TIME (MIN) = 238	DISCHARGE (CFS) = 1.3
TIME (MIN) = 245	DISCHARGE (CFS) = 3.5
TIME (MIN) = 252	DISCHARGE (CFS) = 0.6
TIME (MIN) = 259	DISCHARGE (CFS) = 0.4
TIME (MIN) = 266	DISCHARGE (CFS) = 0.3
TIME (MIN) = 273	DISCHARGE (CFS) = 0.3
TIME (MIN) = 280	DISCHARGE (CFS) = 0.2
TIME (MIN) = 287	DISCHARGE (CFS) = 0.2
TIME (MIN) = 294	DISCHARGE (CFS) = 0.2
TIME (MIN) = 301	DISCHARGE (CFS) = 0.2
TIME (MIN) = 308	DISCHARGE (CFS) = 0.2
TIME (MIN) = 315	DISCHARGE (CFS) = 0.1
TIME (MIN) = 322	DISCHARGE (CFS) = 0.1
TIME (MIN) = 329	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 343	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 357	DISCHARGE (CFS) = 0.1
TIME (MIN) = 364	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

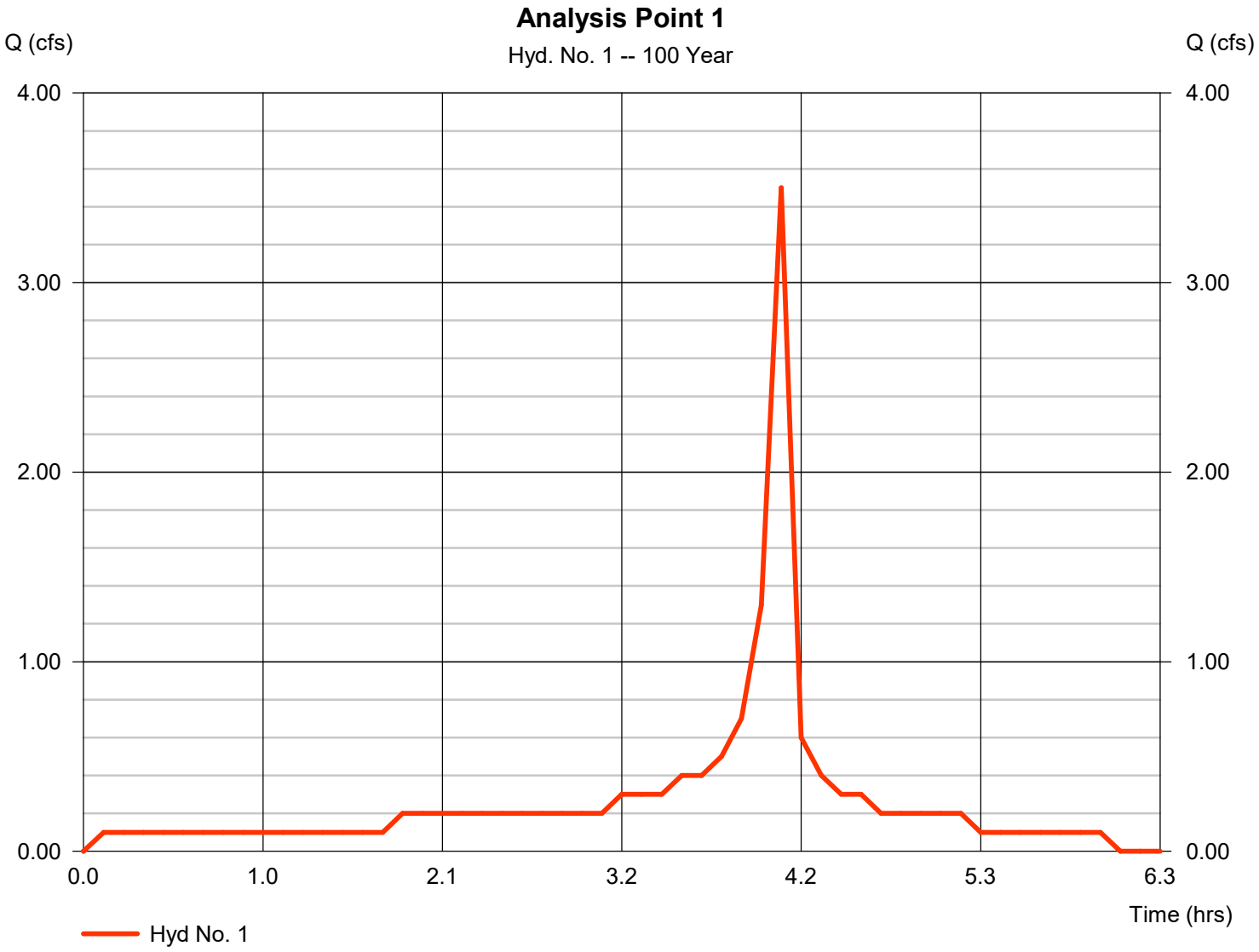
Hyd.	Origin	Description
1	Manual	Analysis Point 1
2	Reservoir	Detention 2

Hydrograph Report

Hyd. No. 1

Analysis Point 1

Hydrograph type	= Manual	Peak discharge	= 3.500 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 7 min	Hyd. volume	= 6,174 cuft



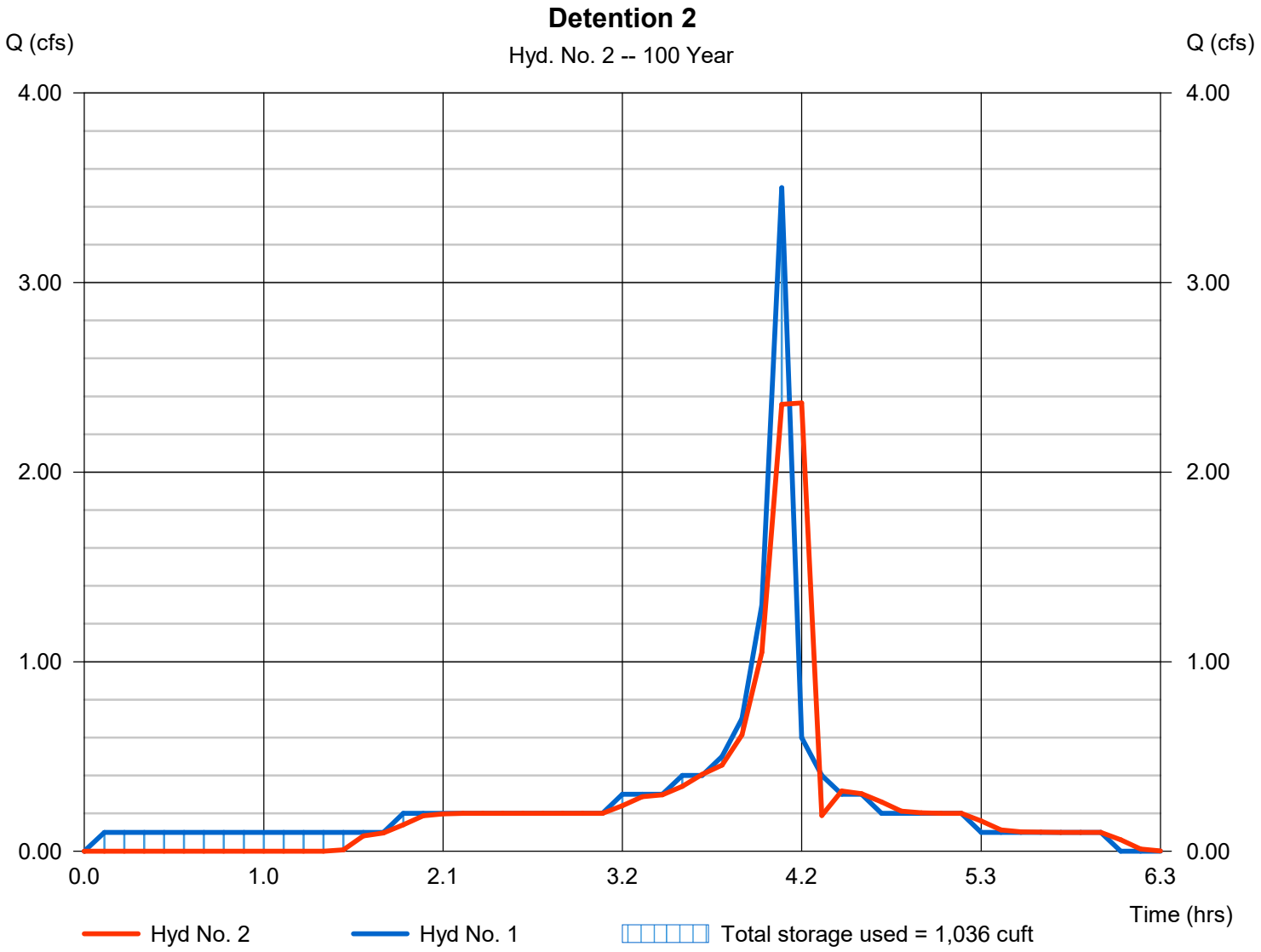
Hydrograph Report

Hyd. No. 2

Detention 2

Hydrograph type	=	Reservoir	Peak discharge	=	2.365 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.20 hrs
Time interval	=	7 min	Hyd. volume	=	5,652 cuft
Inflow hyd. No.	=	1 - Analysis Point 1	Max. Elevation	=	205.00 ft
Reservoir name	=	bmp #2	Max. Storage	=	1,036 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	765	0	0
1.00	205.00	1,320	1,043	1,043

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	Inactive	Inactive	Inactive
Span (in)	= 12.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.14	Inactive	Inactive	Inactive
Crest El. (ft)	= 204.50	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	1,043	205.00	4.42 oc	0.00	0.00	0.00	2.34 ic	0.00	---	---	---	---	2.343

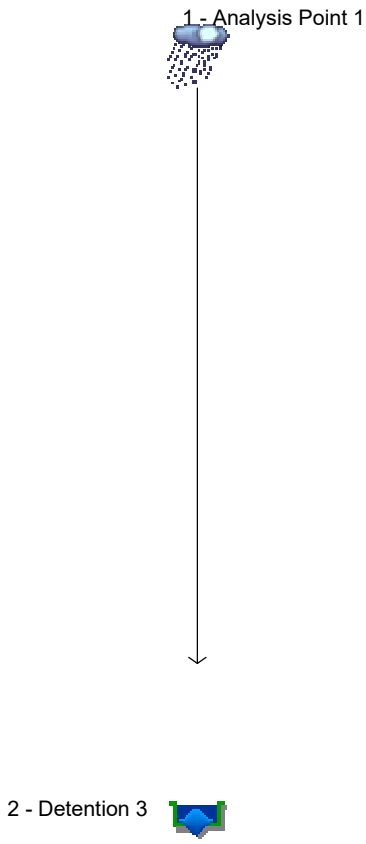
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #3 ANALYSIS

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 17 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 2.84 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 3.9 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 17	DISCHARGE (CFS) = 0.2
TIME (MIN) = 34	DISCHARGE (CFS) = 0.2
TIME (MIN) = 51	DISCHARGE (CFS) = 0.2
TIME (MIN) = 68	DISCHARGE (CFS) = 0.2
TIME (MIN) = 85	DISCHARGE (CFS) = 0.2
TIME (MIN) = 102	DISCHARGE (CFS) = 0.2
TIME (MIN) = 119	DISCHARGE (CFS) = 0.2
TIME (MIN) = 136	DISCHARGE (CFS) = 0.3
TIME (MIN) = 153	DISCHARGE (CFS) = 0.3
TIME (MIN) = 170	DISCHARGE (CFS) = 0.3
TIME (MIN) = 187	DISCHARGE (CFS) = 0.4
TIME (MIN) = 204	DISCHARGE (CFS) = 0.5
TIME (MIN) = 221	DISCHARGE (CFS) = 0.7
TIME (MIN) = 238	DISCHARGE (CFS) = 0.4
TIME (MIN) = 255	DISCHARGE (CFS) = 3.9
TIME (MIN) = 272	DISCHARGE (CFS) = 0.5
TIME (MIN) = 289	DISCHARGE (CFS) = 0.4
TIME (MIN) = 306	DISCHARGE (CFS) = 0.3
TIME (MIN) = 323	DISCHARGE (CFS) = 0.2
TIME (MIN) = 340	DISCHARGE (CFS) = 0.2
TIME (MIN) = 357	DISCHARGE (CFS) = 0.2
TIME (MIN) = 374	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

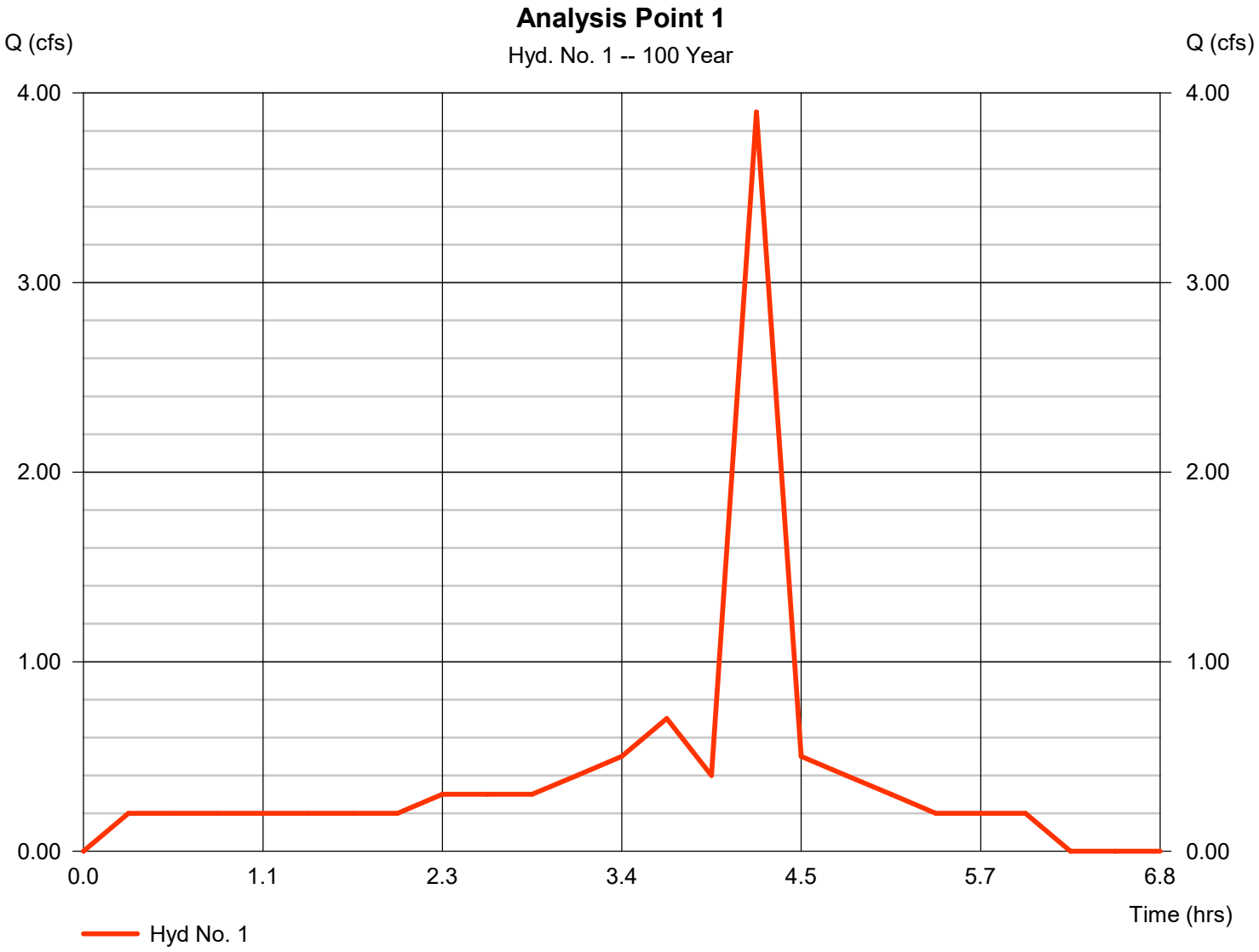
Hyd.	Origin	Description
1	Manual	Analysis Point 1
2	Reservoir	Detention 3

Hydrograph Report

Hyd. No. 1

Analysis Point 1

Hydrograph type	= Manual	Peak discharge	= 3.900 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.25 hrs
Time interval	= 17 min	Hyd. volume	= 10,200 cuft



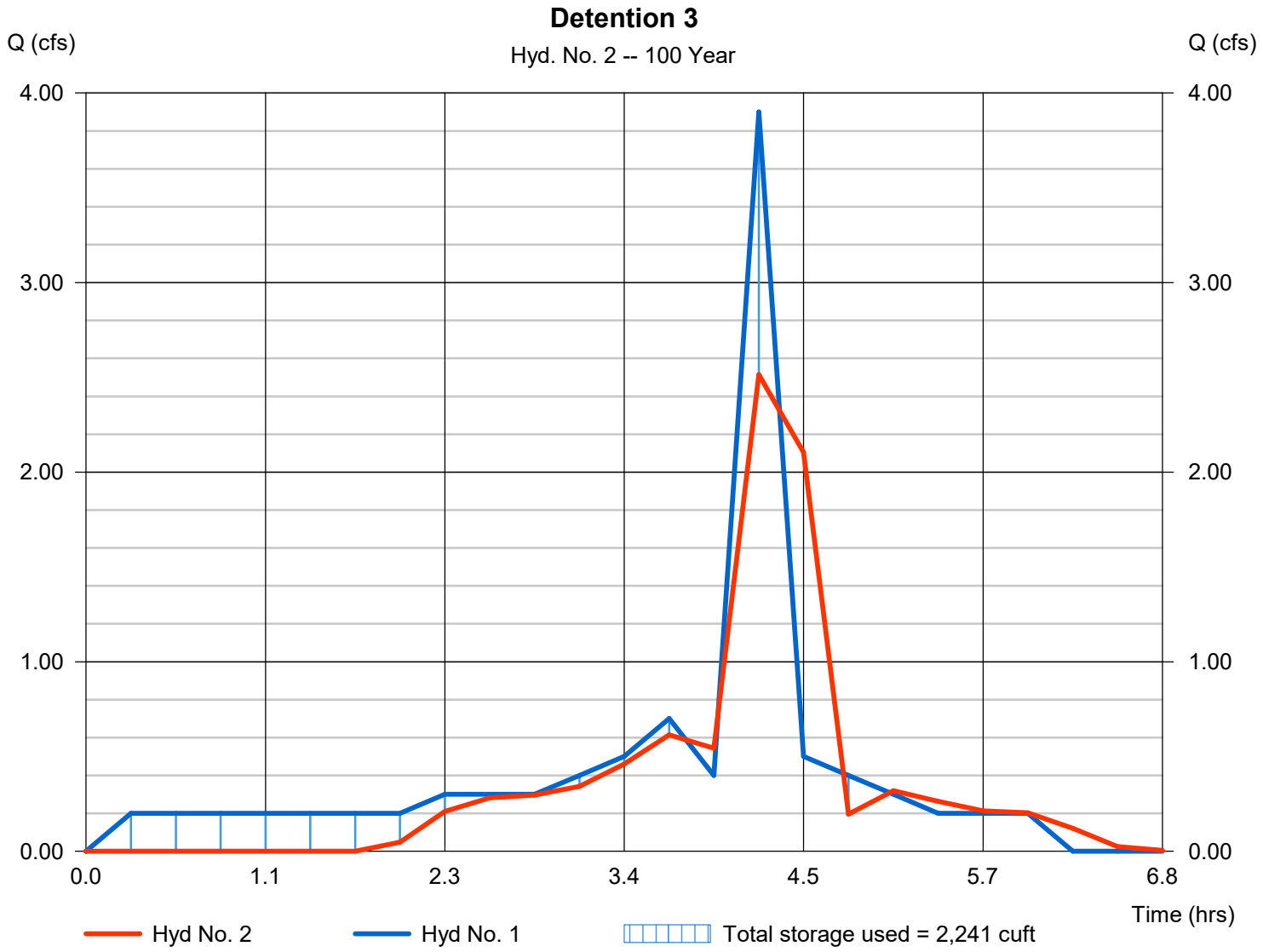
Hydrograph Report

Hyd. No. 2

Detention 3

Hydrograph type	=	Reservoir	Peak discharge	=	2.514 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.25 hrs
Time interval	=	17 min	Hyd. volume	=	8,934 cuft
Inflow hyd. No.	=	1 - Analysis Point 1	Max. Elevation	=	205.00 ft
Reservoir name	=	bmp #1	Max. Storage	=	2,241 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	2,000	0	0
1.00	205.00	3,060	2,530	2,530

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	Inactive
Span (in)	= 18.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.14	Inactive	Inactive	Inactive
Crest El. (ft)	= 204.50	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	2,530	205.00	9.15 oc	0.00	0.00	0.00	2.35 ic	0.00	---	---	---	---	2.345

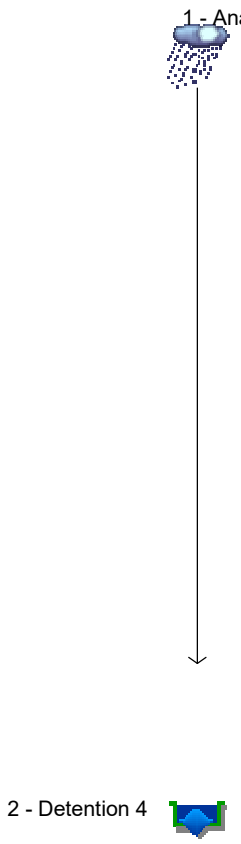
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #4 ANALYSIS

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 0.4 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 0.79 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0
TIME (MIN) = 14	DISCHARGE (CFS) = 0
TIME (MIN) = 21	DISCHARGE (CFS) = 0
TIME (MIN) = 28	DISCHARGE (CFS) = 0
TIME (MIN) = 35	DISCHARGE (CFS) = 0
TIME (MIN) = 42	DISCHARGE (CFS) = 0
TIME (MIN) = 49	DISCHARGE (CFS) = 0
TIME (MIN) = 56	DISCHARGE (CFS) = 0
TIME (MIN) = 63	DISCHARGE (CFS) = 0
TIME (MIN) = 70	DISCHARGE (CFS) = 0
TIME (MIN) = 77	DISCHARGE (CFS) = 0
TIME (MIN) = 84	DISCHARGE (CFS) = 0
TIME (MIN) = 91	DISCHARGE (CFS) = 0
TIME (MIN) = 98	DISCHARGE (CFS) = 0
TIME (MIN) = 105	DISCHARGE (CFS) = 0
TIME (MIN) = 112	DISCHARGE (CFS) = 0
TIME (MIN) = 119	DISCHARGE (CFS) = 0
TIME (MIN) = 126	DISCHARGE (CFS) = 0
TIME (MIN) = 133	DISCHARGE (CFS) = 0
TIME (MIN) = 140	DISCHARGE (CFS) = 0
TIME (MIN) = 147	DISCHARGE (CFS) = 0
TIME (MIN) = 154	DISCHARGE (CFS) = 0
TIME (MIN) = 161	DISCHARGE (CFS) = 0
TIME (MIN) = 168	DISCHARGE (CFS) = 0
TIME (MIN) = 175	DISCHARGE (CFS) = 0.1
TIME (MIN) = 182	DISCHARGE (CFS) = 0.1
TIME (MIN) = 189	DISCHARGE (CFS) = 0.1
TIME (MIN) = 196	DISCHARGE (CFS) = 0.1
TIME (MIN) = 203	DISCHARGE (CFS) = 0.1
TIME (MIN) = 210	DISCHARGE (CFS) = 0.1
TIME (MIN) = 217	DISCHARGE (CFS) = 0.1
TIME (MIN) = 224	DISCHARGE (CFS) = 0.1
TIME (MIN) = 231	DISCHARGE (CFS) = 0.2
TIME (MIN) = 238	DISCHARGE (CFS) = 0.3
TIME (MIN) = 245	DISCHARGE (CFS) = 0.79
TIME (MIN) = 252	DISCHARGE (CFS) = 0.1
TIME (MIN) = 259	DISCHARGE (CFS) = 0.1
TIME (MIN) = 266	DISCHARGE (CFS) = 0.1
TIME (MIN) = 273	DISCHARGE (CFS) = 0.1
TIME (MIN) = 280	DISCHARGE (CFS) = 0.1
TIME (MIN) = 287	DISCHARGE (CFS) = 0
TIME (MIN) = 294	DISCHARGE (CFS) = 0
TIME (MIN) = 301	DISCHARGE (CFS) = 0
TIME (MIN) = 308	DISCHARGE (CFS) = 0
TIME (MIN) = 315	DISCHARGE (CFS) = 0
TIME (MIN) = 322	DISCHARGE (CFS) = 0
TIME (MIN) = 329	DISCHARGE (CFS) = 0
TIME (MIN) = 336	DISCHARGE (CFS) = 0
TIME (MIN) = 343	DISCHARGE (CFS) = 0
TIME (MIN) = 350	DISCHARGE (CFS) = 0
TIME (MIN) = 357	DISCHARGE (CFS) = 0
TIME (MIN) = 364	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Manual	Analysis Point 2
2	Reservoir	Detention 4

Hydrograph Report

Hyd. No. 1

Analysis Point 2

Hydrograph type	= Manual	Peak discharge	= 0.790 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 7 min	Hyd. volume	= 1,088 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (hrs)	Outflow (cfs)	
2.92	0.100	
3.03	0.100	
3.15	0.100	
3.27	0.100	
3.38	0.100	
3.50	0.100	
3.62	0.100	
3.73	0.100	
3.85	0.200	
3.97	0.300	
4.08	0.790	<<
4.20	0.100	
4.32	0.100	
4.43	0.100	
4.55	0.100	
4.67	0.100	

...End

Hydrograph Report

Hyd. No. 2

Detention 4

Hydrograph type	= Reservoir	Peak discharge	= 0.036 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.78 hrs
Time interval	= 7 min	Hyd. volume	= 39 cuft
Inflow hyd. No.	= 1 - Analysis Point 2	Reservoir name	= bmp #4
Max. Elevation	= 204.51 ft	Max. Storage	= 1,071 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
4.67	0.100	204.51	4.420	-----	-----	-----	0.021	-----	-----	-----	-----	0.021
4.78	0.000	204.51 <<	4.420	-----	-----	-----	0.036	-----	-----	-----	-----	0.036
4.90	0.000	204.51	4.420	-----	-----	-----	0.018	-----	-----	-----	-----	0.018
5.02	0.000	204.50	4.420	-----	-----	-----	0.009	-----	-----	-----	-----	0.009
5.13	0.000	204.50	4.420	-----	-----	-----	0.004	-----	-----	-----	-----	0.005
5.25	0.000	204.50	4.420	-----	-----	-----	0.002	-----	-----	-----	-----	0.002
5.37	0.000	204.50	4.420	-----	-----	-----	0.001	-----	-----	-----	-----	0.001

<

...End

Pond Report

Pond No. 1 - bmp #4

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	1,670	0	0
1.00	205.00	2,525	2,098	2,098

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	Inactive	Inactive	Inactive
Span (in)	= 12.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.14	Inactive	Inactive	Inactive
Crest El. (ft)	= 204.50	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	2,098	205.00	4.42 oc	0.00	0.00	0.00	2.34 ic	0.00	---	---	---	---	2.343

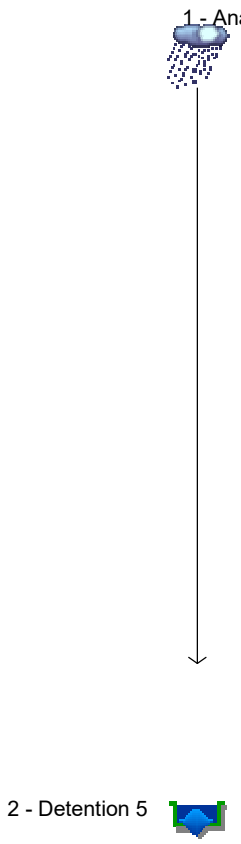
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #5 ANALYSIS

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 6 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 1.32 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 2.75 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 6	DISCHARGE (CFS) = 0.1
TIME (MIN) = 12	DISCHARGE (CFS) = 0.1
TIME (MIN) = 18	DISCHARGE (CFS) = 0.1
TIME (MIN) = 24	DISCHARGE (CFS) = 0.1
TIME (MIN) = 30	DISCHARGE (CFS) = 0.1
TIME (MIN) = 36	DISCHARGE (CFS) = 0.1
TIME (MIN) = 42	DISCHARGE (CFS) = 0.1
TIME (MIN) = 48	DISCHARGE (CFS) = 0.1
TIME (MIN) = 54	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 66	DISCHARGE (CFS) = 0.1
TIME (MIN) = 72	DISCHARGE (CFS) = 0.1
TIME (MIN) = 78	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 90	DISCHARGE (CFS) = 0.1
TIME (MIN) = 96	DISCHARGE (CFS) = 0.1
TIME (MIN) = 102	DISCHARGE (CFS) = 0.1
TIME (MIN) = 108	DISCHARGE (CFS) = 0.1
TIME (MIN) = 114	DISCHARGE (CFS) = 0.1
TIME (MIN) = 120	DISCHARGE (CFS) = 0.1
TIME (MIN) = 126	DISCHARGE (CFS) = 0.1
TIME (MIN) = 132	DISCHARGE (CFS) = 0.1
TIME (MIN) = 138	DISCHARGE (CFS) = 0.1
TIME (MIN) = 144	DISCHARGE (CFS) = 0.1
TIME (MIN) = 150	DISCHARGE (CFS) = 0.1
TIME (MIN) = 156	DISCHARGE (CFS) = 0.1
TIME (MIN) = 162	DISCHARGE (CFS) = 0.2
TIME (MIN) = 168	DISCHARGE (CFS) = 0.2
TIME (MIN) = 174	DISCHARGE (CFS) = 0.2
TIME (MIN) = 180	DISCHARGE (CFS) = 0.2
TIME (MIN) = 186	DISCHARGE (CFS) = 0.2
TIME (MIN) = 192	DISCHARGE (CFS) = 0.2
TIME (MIN) = 198	DISCHARGE (CFS) = 0.2
TIME (MIN) = 204	DISCHARGE (CFS) = 0.2
TIME (MIN) = 210	DISCHARGE (CFS) = 0.3
TIME (MIN) = 216	DISCHARGE (CFS) = 0.3
TIME (MIN) = 222	DISCHARGE (CFS) = 0.4
TIME (MIN) = 228	DISCHARGE (CFS) = 0.4
TIME (MIN) = 234	DISCHARGE (CFS) = 0.6
TIME (MIN) = 240	DISCHARGE (CFS) = 1.2
TIME (MIN) = 246	DISCHARGE (CFS) = 2.75
TIME (MIN) = 252	DISCHARGE (CFS) = 0.5
TIME (MIN) = 258	DISCHARGE (CFS) = 0.3
TIME (MIN) = 264	DISCHARGE (CFS) = 0.3
TIME (MIN) = 270	DISCHARGE (CFS) = 0.2
TIME (MIN) = 276	DISCHARGE (CFS) = 0.2
TIME (MIN) = 282	DISCHARGE (CFS) = 0.2
TIME (MIN) = 288	DISCHARGE (CFS) = 0.2
TIME (MIN) = 294	DISCHARGE (CFS) = 0.1
TIME (MIN) = 300	DISCHARGE (CFS) = 0.1
TIME (MIN) = 306	DISCHARGE (CFS) = 0.1
TIME (MIN) = 312	DISCHARGE (CFS) = 0.1
TIME (MIN) = 318	DISCHARGE (CFS) = 0.1
TIME (MIN) = 324	DISCHARGE (CFS) = 0.1
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 342	DISCHARGE (CFS) = 0.1
TIME (MIN) = 348	DISCHARGE (CFS) = 0.1
TIME (MIN) = 354	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 366	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

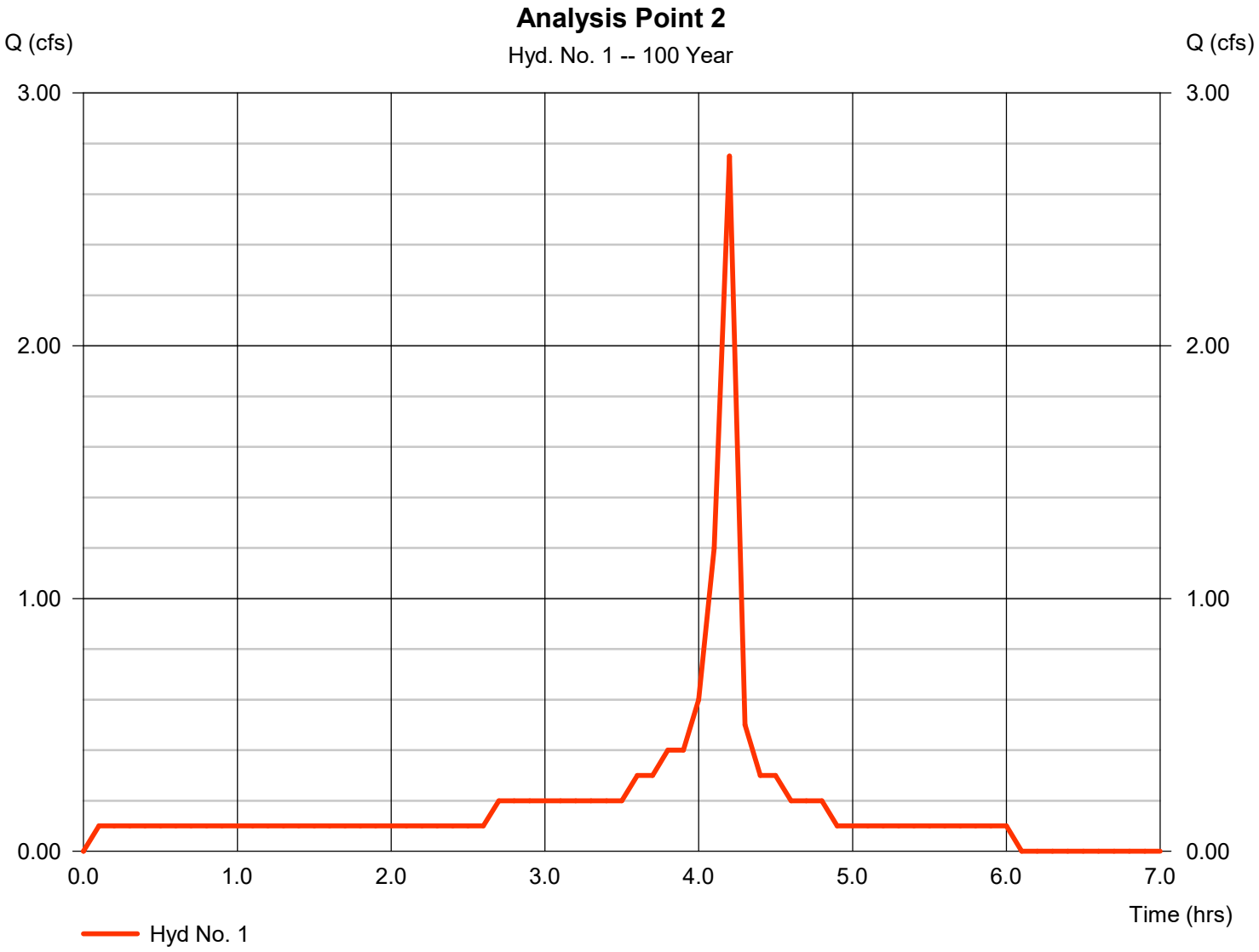
Hyd.	Origin	Description
1	Manual	Analysis Point 2
2	Reservoir	Detention 5

Hydrograph Report

Hyd. No. 1

Analysis Point 2

Hydrograph type	= Manual	Peak discharge	= 2.750 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.20 hrs
Time interval	= 6 min	Hyd. volume	= 4,770 cuft



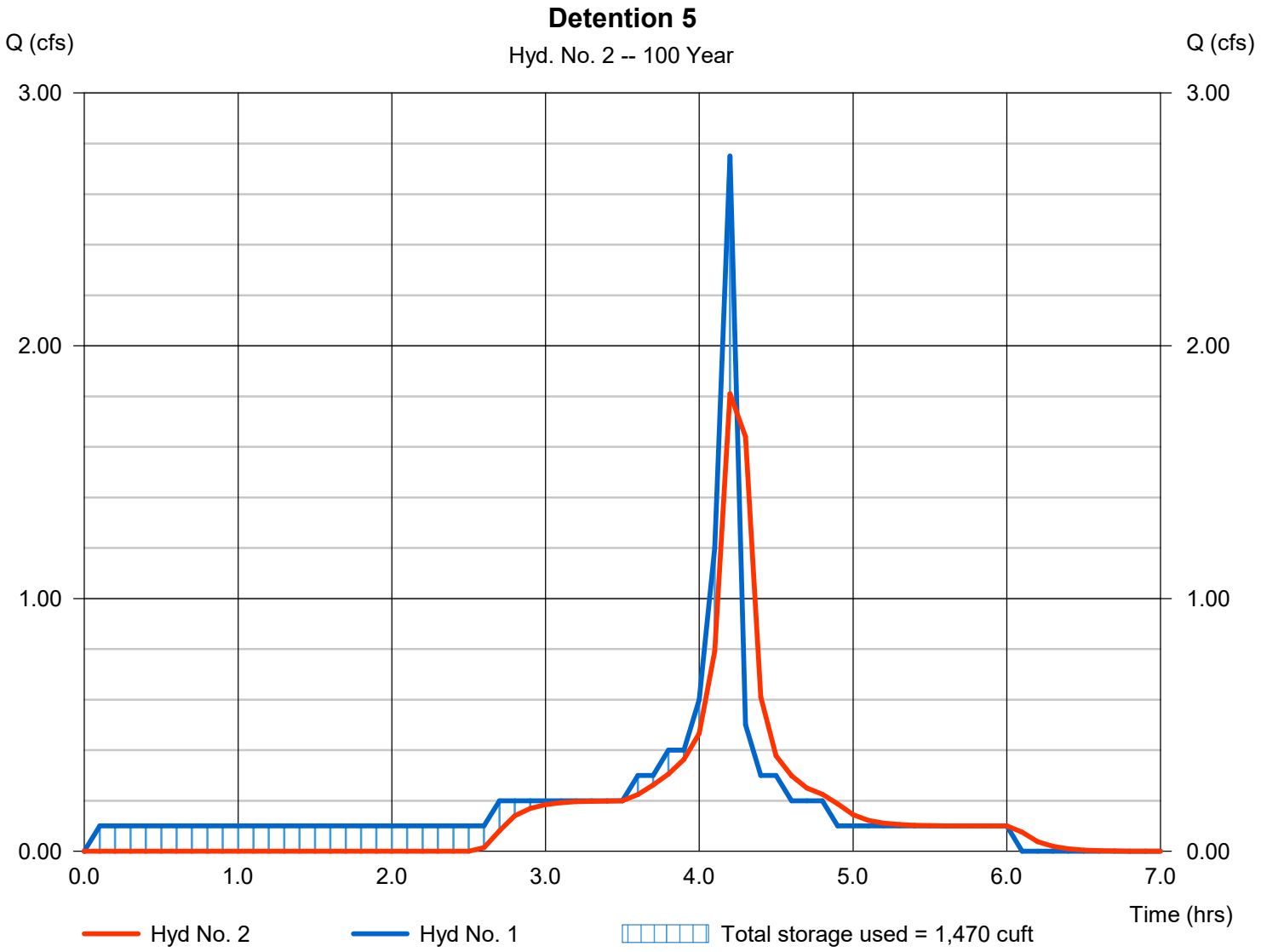
Hydrograph Report

Hyd. No. 2

Detention 5

Hydrograph type	=	Reservoir	Peak discharge	=	1.810 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.20 hrs
Time interval	=	6 min	Hyd. volume	=	3,862 cuft
Inflow hyd. No.	=	1 - Analysis Point 2	Max. Elevation	=	204.90 ft
Reservoir name	=	bmp #5	Max. Storage	=	1,470 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #5

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	1,550	0	0
1.00	205.00	2,080	1,815	1,815

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	Inactive	Inactive	Inactive
Span (in)	= 12.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.14	Inactive	Inactive	Inactive
Crest El. (ft)	= 204.50	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	1,815	205.00	4.42 oc	0.00	0.00	0.00	2.34 ic	0.00	---	---	---	---	2.343

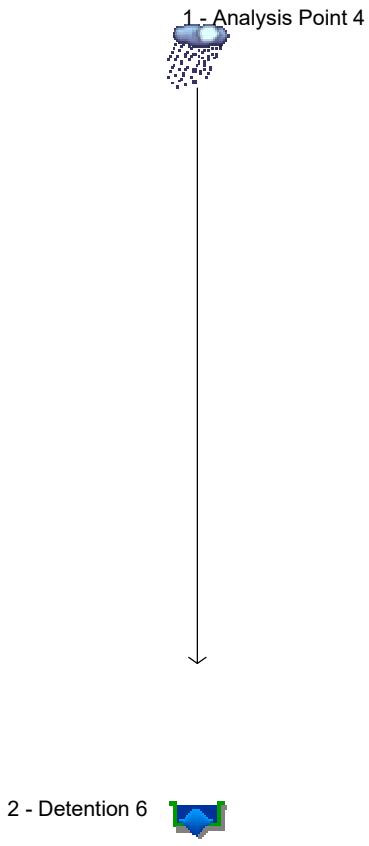
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #6 ANALYSIS

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 1.61 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 3.1 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0.1
TIME (MIN) = 14	DISCHARGE (CFS) = 0.1
TIME (MIN) = 21	DISCHARGE (CFS) = 0.1
TIME (MIN) = 28	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 42	DISCHARGE (CFS) = 0.1
TIME (MIN) = 49	DISCHARGE (CFS) = 0.1
TIME (MIN) = 56	DISCHARGE (CFS) = 0.1
TIME (MIN) = 63	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 91	DISCHARGE (CFS) = 0.1
TIME (MIN) = 98	DISCHARGE (CFS) = 0.1
TIME (MIN) = 105	DISCHARGE (CFS) = 0.1
TIME (MIN) = 112	DISCHARGE (CFS) = 0.1
TIME (MIN) = 119	DISCHARGE (CFS) = 0.1
TIME (MIN) = 126	DISCHARGE (CFS) = 0.2
TIME (MIN) = 133	DISCHARGE (CFS) = 0.2
TIME (MIN) = 140	DISCHARGE (CFS) = 0.2
TIME (MIN) = 147	DISCHARGE (CFS) = 0.2
TIME (MIN) = 154	DISCHARGE (CFS) = 0.2
TIME (MIN) = 161	DISCHARGE (CFS) = 0.2
TIME (MIN) = 168	DISCHARGE (CFS) = 0.2
TIME (MIN) = 175	DISCHARGE (CFS) = 0.2
TIME (MIN) = 182	DISCHARGE (CFS) = 0.2
TIME (MIN) = 189	DISCHARGE (CFS) = 0.3
TIME (MIN) = 196	DISCHARGE (CFS) = 0.3
TIME (MIN) = 203	DISCHARGE (CFS) = 0.3
TIME (MIN) = 210	DISCHARGE (CFS) = 0.3
TIME (MIN) = 217	DISCHARGE (CFS) = 0.4
TIME (MIN) = 224	DISCHARGE (CFS) = 0.5
TIME (MIN) = 231	DISCHARGE (CFS) = 0.7
TIME (MIN) = 238	DISCHARGE (CFS) = 1.3
TIME (MIN) = 245	DISCHARGE (CFS) = 3.1
TIME (MIN) = 252	DISCHARGE (CFS) = 0.5
TIME (MIN) = 259	DISCHARGE (CFS) = 0.4
TIME (MIN) = 266	DISCHARGE (CFS) = 0.3
TIME (MIN) = 273	DISCHARGE (CFS) = 0.2
TIME (MIN) = 280	DISCHARGE (CFS) = 0.2
TIME (MIN) = 287	DISCHARGE (CFS) = 0.2
TIME (MIN) = 294	DISCHARGE (CFS) = 0.2
TIME (MIN) = 301	DISCHARGE (CFS) = 0.2
TIME (MIN) = 308	DISCHARGE (CFS) = 0.1
TIME (MIN) = 315	DISCHARGE (CFS) = 0.1
TIME (MIN) = 322	DISCHARGE (CFS) = 0.1
TIME (MIN) = 329	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 343	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 357	DISCHARGE (CFS) = 0.1
TIME (MIN) = 364	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

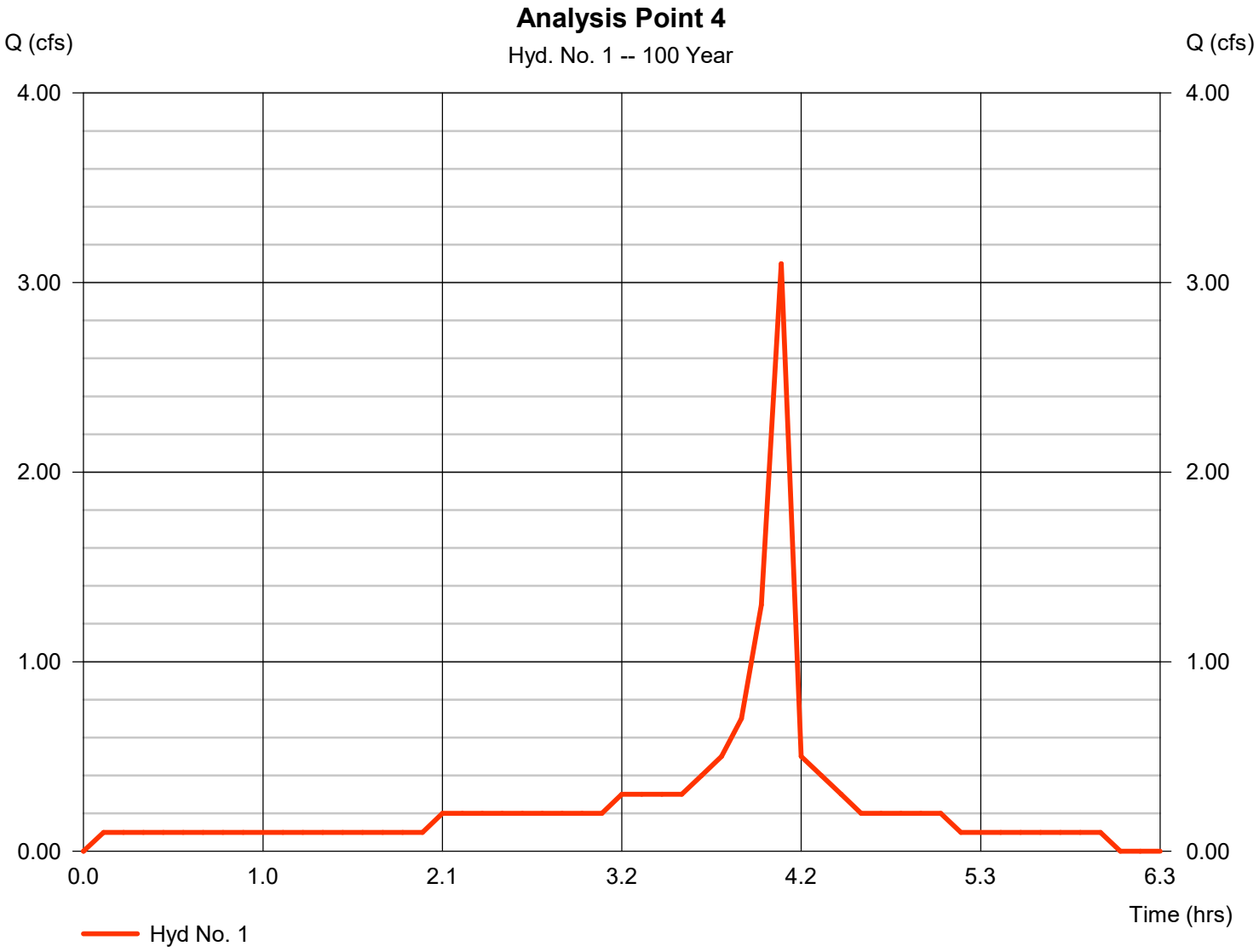
Hyd.	Origin	Description
1	Manual	Analysis Point 4
2	Reservoir	Detention 6

Hydrograph Report

Hyd. No. 1

Analysis Point 4

Hydrograph type	= Manual	Peak discharge	= 3.100 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 7 min	Hyd. volume	= 5,754 cuft



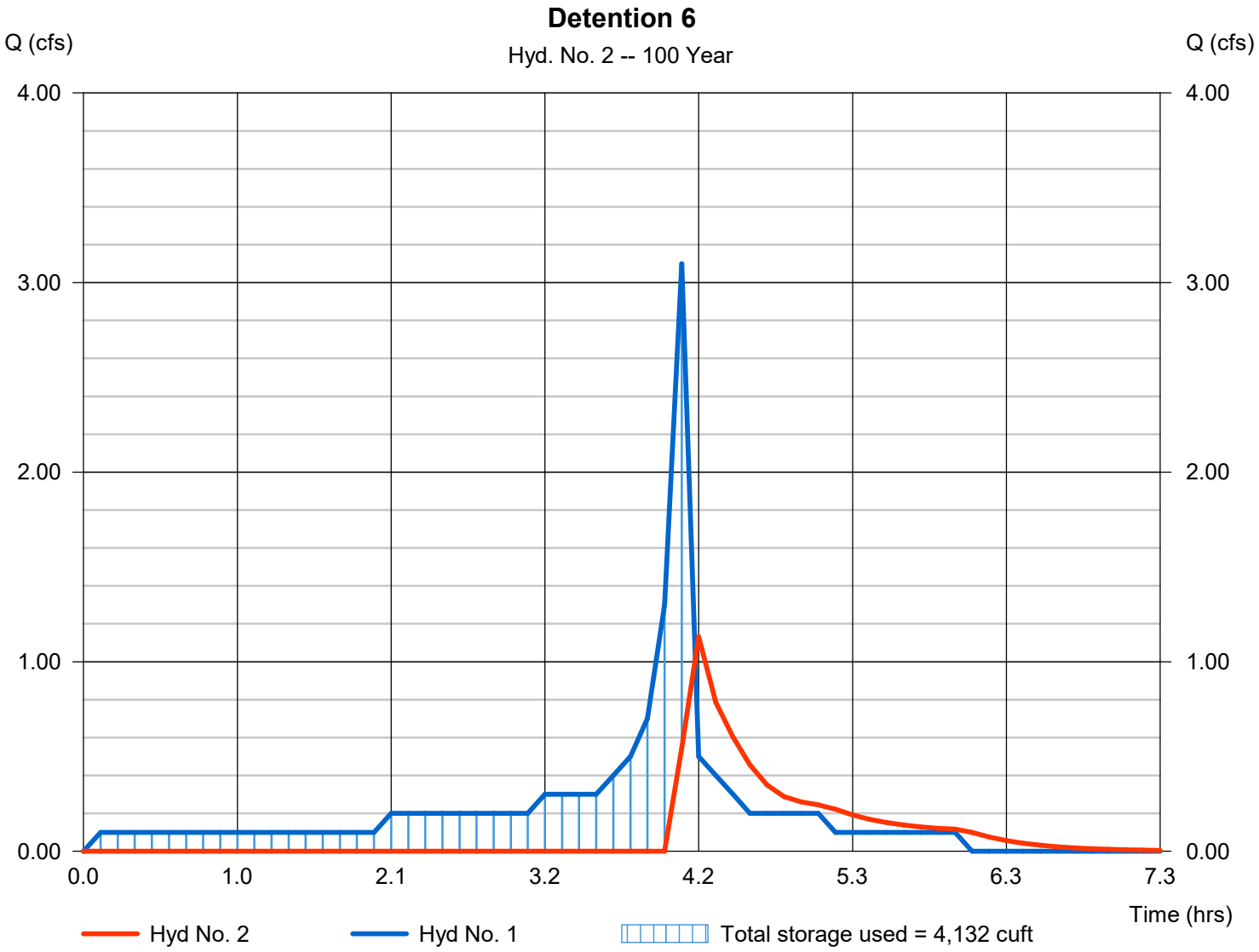
Hydrograph Report

Hyd. No. 2

Detention 6

Hydrograph type	=	Reservoir	Peak discharge	=	1.131 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.20 hrs
Time interval	=	7 min	Hyd. volume	=	2,642 cuft
Inflow hyd. No.	=	1 - Analysis Point 4	Max. Elevation	=	205.29 ft
Reservoir name	=	bmp #6	Max. Storage	=	4,132 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #6

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	2,740	0	0
1.00	205.00	3,480	3,110	3,110
2.00	206.00	4,540	4,010	7,120

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	Inactive	Inactive	Inactive
Span (in)	= 10.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.60	Inactive	Inactive	Inactive
Crest El. (ft)	= 205.00	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	3,110	205.00	3.03 oc	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
2.00	7,120	206.00	3.03 oc	0.00	0.00	0.00	2.27 ic	0.00	---	---	---	---	2.272

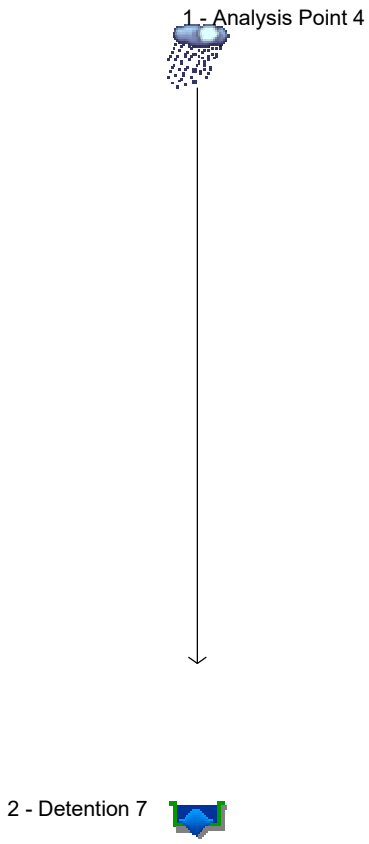
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #7 ANALYSIS

RUN DATE 8/20/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 8 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 1.08 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 2.02 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 8	DISCHARGE (CFS) = 0.1
TIME (MIN) = 16	DISCHARGE (CFS) = 0.1
TIME (MIN) = 24	DISCHARGE (CFS) = 0.1
TIME (MIN) = 32	DISCHARGE (CFS) = 0.1
TIME (MIN) = 40	DISCHARGE (CFS) = 0.1
TIME (MIN) = 48	DISCHARGE (CFS) = 0.1
TIME (MIN) = 56	DISCHARGE (CFS) = 0.1
TIME (MIN) = 64	DISCHARGE (CFS) = 0.1
TIME (MIN) = 72	DISCHARGE (CFS) = 0.1
TIME (MIN) = 80	DISCHARGE (CFS) = 0.1
TIME (MIN) = 88	DISCHARGE (CFS) = 0.1
TIME (MIN) = 96	DISCHARGE (CFS) = 0.1
TIME (MIN) = 104	DISCHARGE (CFS) = 0.1
TIME (MIN) = 112	DISCHARGE (CFS) = 0.1
TIME (MIN) = 120	DISCHARGE (CFS) = 0.1
TIME (MIN) = 128	DISCHARGE (CFS) = 0.1
TIME (MIN) = 136	DISCHARGE (CFS) = 0.1
TIME (MIN) = 144	DISCHARGE (CFS) = 0.1
TIME (MIN) = 152	DISCHARGE (CFS) = 0.1
TIME (MIN) = 160	DISCHARGE (CFS) = 0.1
TIME (MIN) = 168	DISCHARGE (CFS) = 0.1
TIME (MIN) = 176	DISCHARGE (CFS) = 0.1
TIME (MIN) = 184	DISCHARGE (CFS) = 0.2
TIME (MIN) = 192	DISCHARGE (CFS) = 0.2
TIME (MIN) = 200	DISCHARGE (CFS) = 0.2
TIME (MIN) = 208	DISCHARGE (CFS) = 0.2
TIME (MIN) = 216	DISCHARGE (CFS) = 0.2
TIME (MIN) = 224	DISCHARGE (CFS) = 0.3
TIME (MIN) = 232	DISCHARGE (CFS) = 0.4
TIME (MIN) = 240	DISCHARGE (CFS) = 0.7
TIME (MIN) = 248	DISCHARGE (CFS) = 2.02
TIME (MIN) = 256	DISCHARGE (CFS) = 0.3
TIME (MIN) = 264	DISCHARGE (CFS) = 0.2
TIME (MIN) = 272	DISCHARGE (CFS) = 0.2
TIME (MIN) = 280	DISCHARGE (CFS) = 0.1
TIME (MIN) = 288	DISCHARGE (CFS) = 0.1
TIME (MIN) = 296	DISCHARGE (CFS) = 0.1
TIME (MIN) = 304	DISCHARGE (CFS) = 0.1
TIME (MIN) = 312	DISCHARGE (CFS) = 0.1
TIME (MIN) = 320	DISCHARGE (CFS) = 0.1
TIME (MIN) = 328	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 344	DISCHARGE (CFS) = 0.1
TIME (MIN) = 352	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 368	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

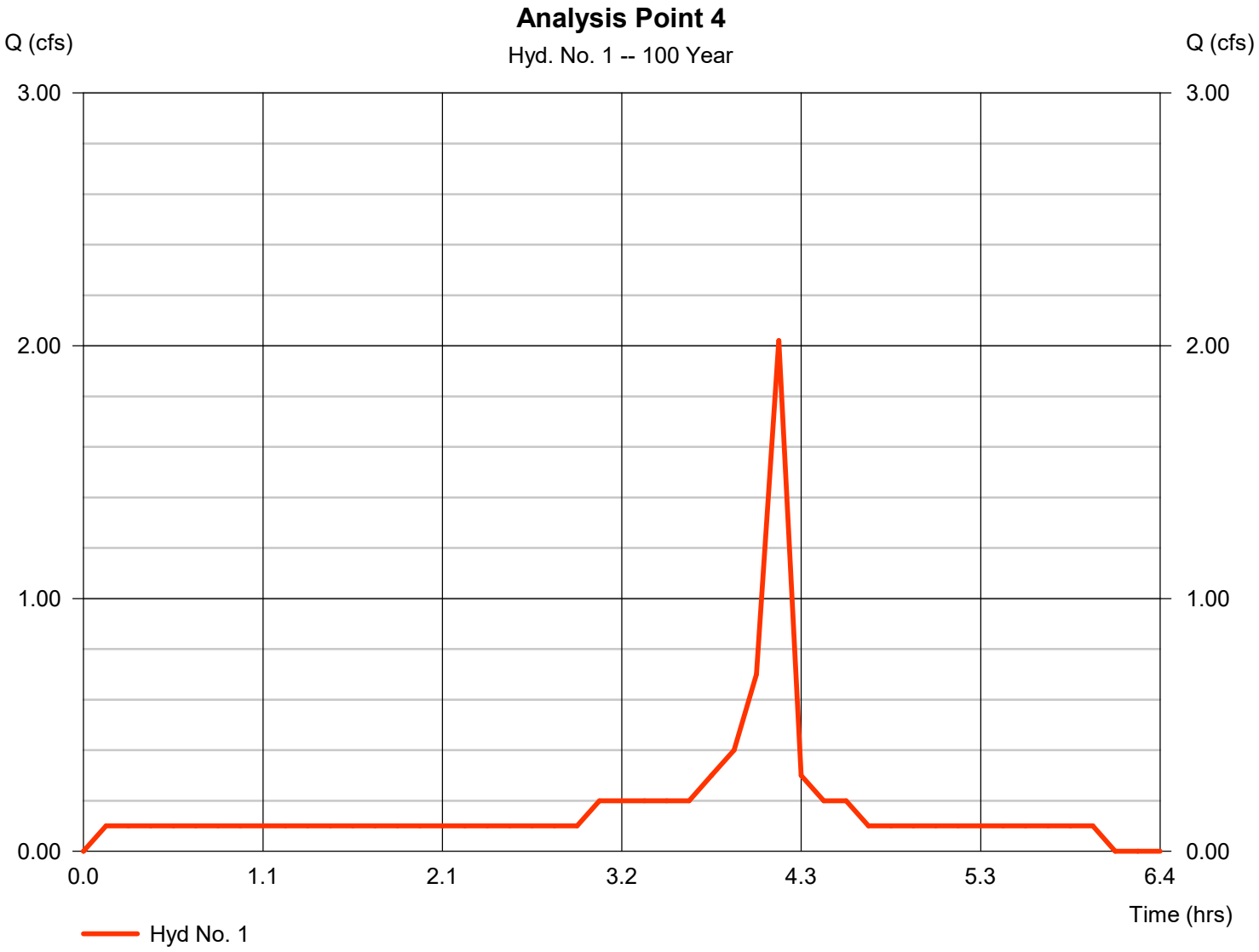
Hyd.	Origin	Description
1	Manual	Analysis Point 4
2	Reservoir	Detention 7

Hydrograph Report

Hyd. No. 1

Analysis Point 4

Hydrograph type	= Manual	Peak discharge	= 2.020 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.13 hrs
Time interval	= 8 min	Hyd. volume	= 4,042 cuft



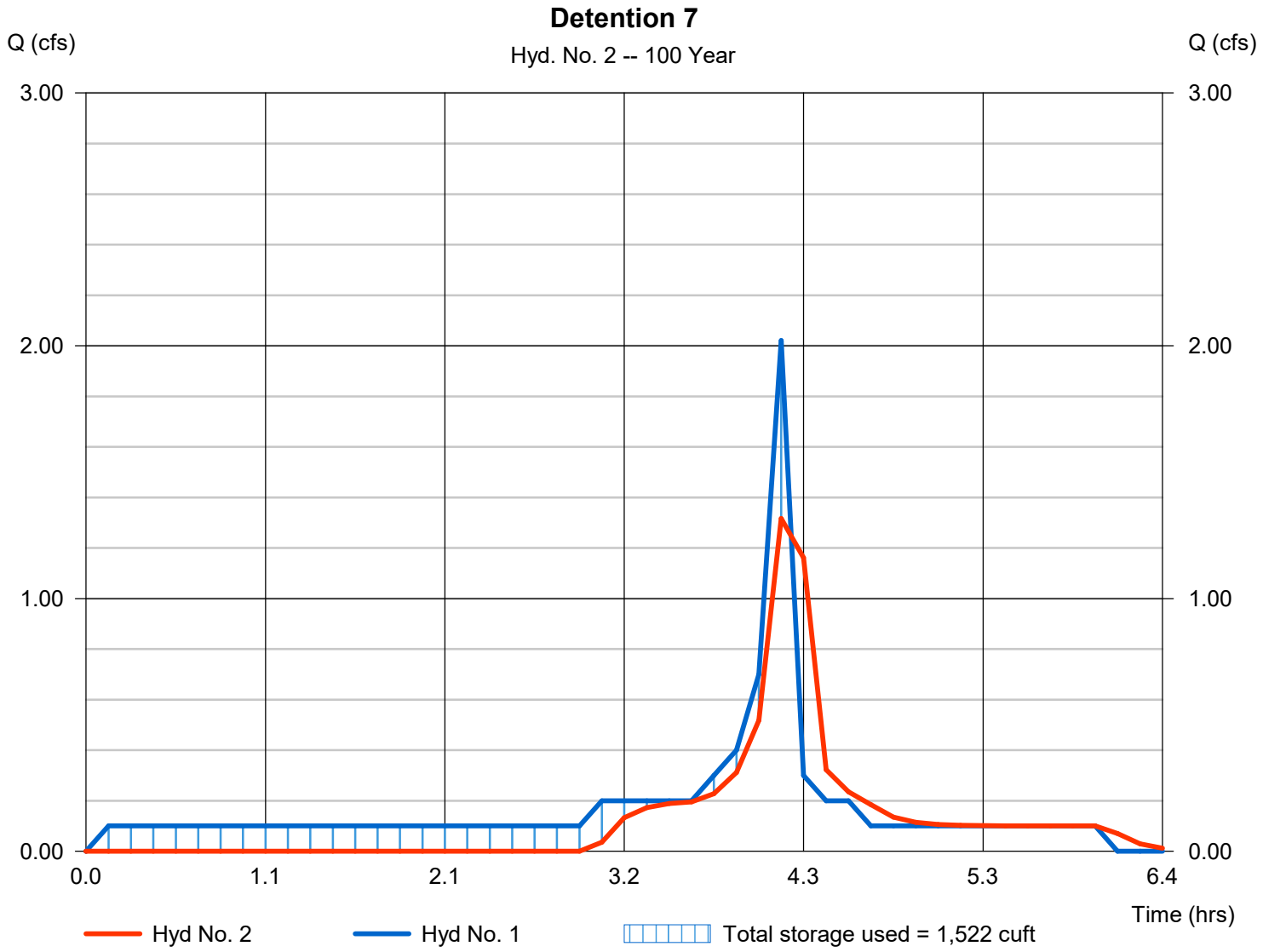
Hydrograph Report

Hyd. No. 2

Detention 7

Hydrograph type	=	Reservoir	Peak discharge	=	1.317 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.13 hrs
Time interval	=	8 min	Hyd. volume	=	2,966 cuft
Inflow hyd. No.	=	1 - Analysis Point 4	Max. Elevation	=	205.39 ft
Reservoir name	=	bmp #7	Max. Storage	=	1,522 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #7

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 204.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	840	0	0
1.00	205.00	1,310	1,075	1,075
2.00	206.00	1,840	1,575	2,650

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	Inactive	Inactive	Inactive
Span (in)	= 10.00	0.90	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 202.00	277.67	305.45	48.25
Length (ft)	= 50.00	0.00	0.00	2.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.60	Inactive	Inactive	Inactive
Crest El. (ft)	= 205.00	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	1,075	205.00	3.03 oc	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
2.00	2,650	206.00	3.03 oc	0.00	0.00	0.00	2.27 ic	0.00	---	---	---	---	2.272

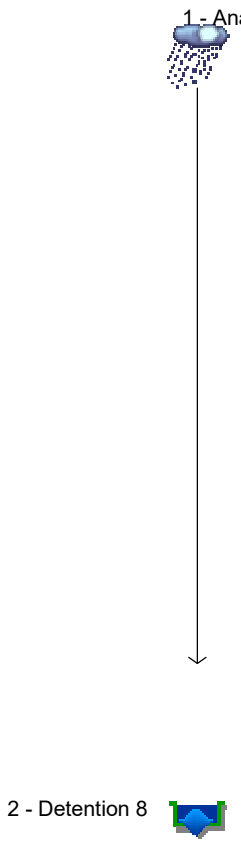
RATIONAL METHOD HYDROGRAPH PROGRAM

DETENTION #8 ANALYSIS

RUN DATE 8/21/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 2 INCHES
BASIN AREA 1.07 ACRES
RUNOFF COEFFICIENT 0.5
PEAK DISCHARGE 2.12 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0.1
TIME (MIN) = 14	DISCHARGE (CFS) = 0.1
TIME (MIN) = 21	DISCHARGE (CFS) = 0.1
TIME (MIN) = 28	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 42	DISCHARGE (CFS) = 0.1
TIME (MIN) = 49	DISCHARGE (CFS) = 0.1
TIME (MIN) = 56	DISCHARGE (CFS) = 0.1
TIME (MIN) = 63	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 91	DISCHARGE (CFS) = 0.1
TIME (MIN) = 98	DISCHARGE (CFS) = 0.1
TIME (MIN) = 105	DISCHARGE (CFS) = 0.1
TIME (MIN) = 112	DISCHARGE (CFS) = 0.1
TIME (MIN) = 119	DISCHARGE (CFS) = 0.1
TIME (MIN) = 126	DISCHARGE (CFS) = 0.1
TIME (MIN) = 133	DISCHARGE (CFS) = 0.1
TIME (MIN) = 140	DISCHARGE (CFS) = 0.1
TIME (MIN) = 147	DISCHARGE (CFS) = 0.1
TIME (MIN) = 154	DISCHARGE (CFS) = 0.1
TIME (MIN) = 161	DISCHARGE (CFS) = 0.1
TIME (MIN) = 168	DISCHARGE (CFS) = 0.1
TIME (MIN) = 175	DISCHARGE (CFS) = 0.1
TIME (MIN) = 182	DISCHARGE (CFS) = 0.2
TIME (MIN) = 189	DISCHARGE (CFS) = 0.2
TIME (MIN) = 196	DISCHARGE (CFS) = 0.2
TIME (MIN) = 203	DISCHARGE (CFS) = 0.2
TIME (MIN) = 210	DISCHARGE (CFS) = 0.2
TIME (MIN) = 217	DISCHARGE (CFS) = 0.3
TIME (MIN) = 224	DISCHARGE (CFS) = 0.3
TIME (MIN) = 231	DISCHARGE (CFS) = 0.4
TIME (MIN) = 238	DISCHARGE (CFS) = 0.8
TIME (MIN) = 245	DISCHARGE (CFS) = 2.12
TIME (MIN) = 252	DISCHARGE (CFS) = 0.4
TIME (MIN) = 259	DISCHARGE (CFS) = 0.2
TIME (MIN) = 266	DISCHARGE (CFS) = 0.2
TIME (MIN) = 273	DISCHARGE (CFS) = 0.2
TIME (MIN) = 280	DISCHARGE (CFS) = 0.1
TIME (MIN) = 287	DISCHARGE (CFS) = 0.1
TIME (MIN) = 294	DISCHARGE (CFS) = 0.1
TIME (MIN) = 301	DISCHARGE (CFS) = 0.1
TIME (MIN) = 308	DISCHARGE (CFS) = 0.1
TIME (MIN) = 315	DISCHARGE (CFS) = 0.1
TIME (MIN) = 322	DISCHARGE (CFS) = 0.1
TIME (MIN) = 329	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 343	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 357	DISCHARGE (CFS) = 0.1
TIME (MIN) = 364	DISCHARGE (CFS) = 0

Watershed Model Schematic



Legend

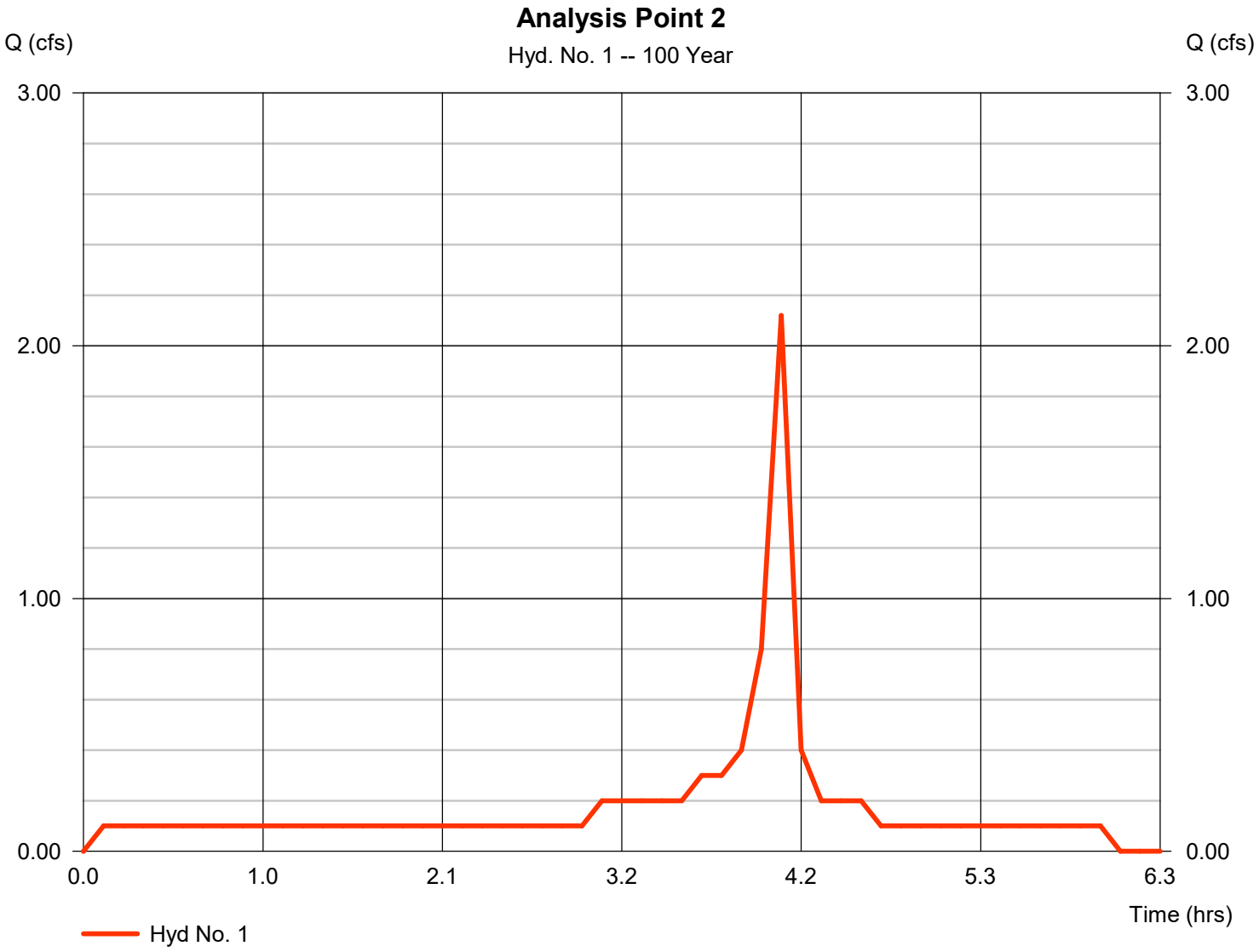
Hyd.	Origin	Description
1	Manual	Analysis Point 2
2	Reservoir	Detention 8

Hydrograph Report

Hyd. No. 1

Analysis Point 2

Hydrograph type	= Manual	Peak discharge	= 2.120 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 7 min	Hyd. volume	= 4,040 cuft



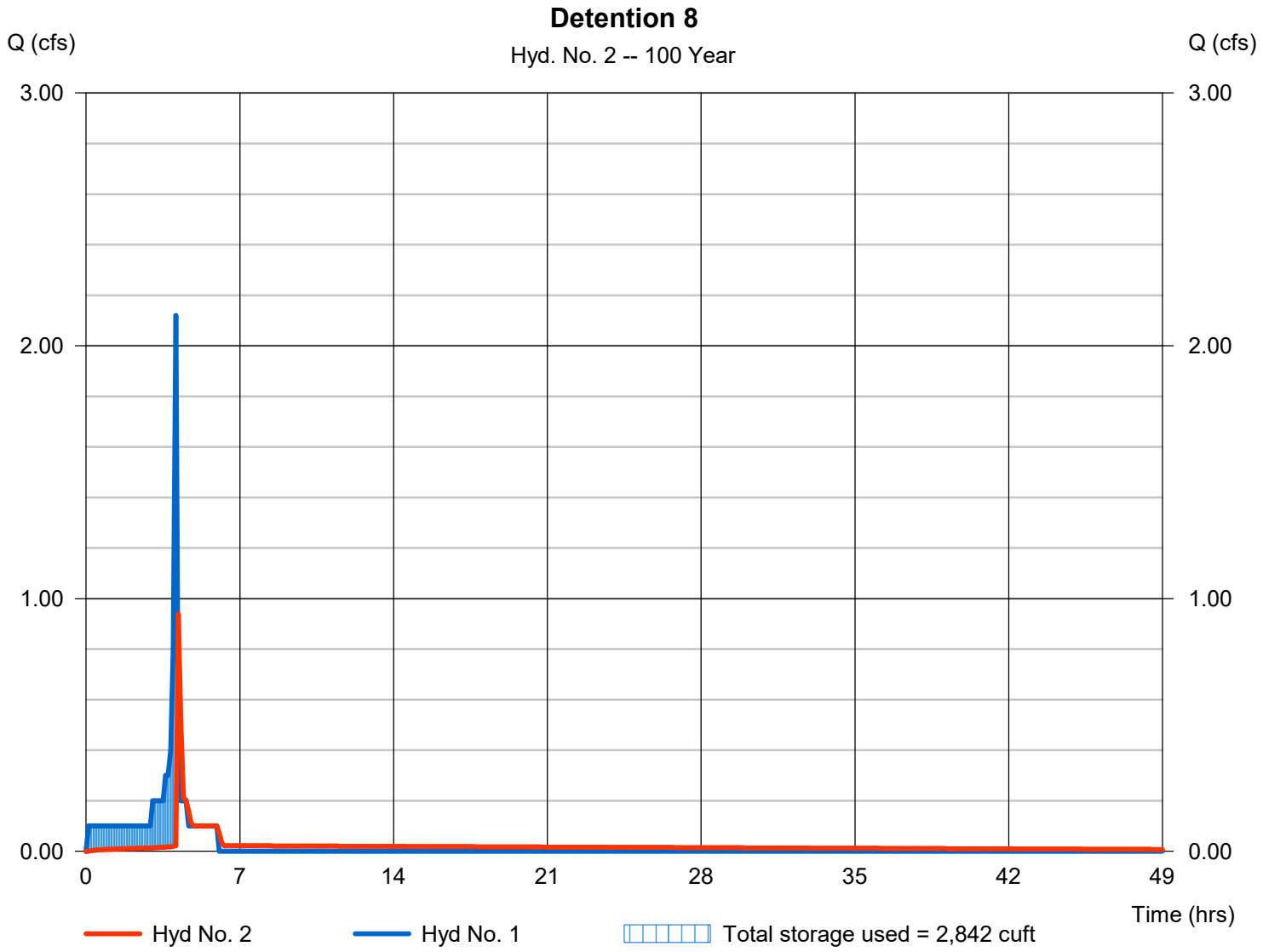
Hydrograph Report

Hyd. No. 2

Detention 8

Hydrograph type	=	Reservoir	Peak discharge	=	0.938 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.20 hrs
Time interval	=	7 min	Hyd. volume	=	4,016 cuft
Inflow hyd. No.	=	1 - Analysis Point 2	Max. Elevation	=	207.50 ft
Reservoir name	=	bmp #9	Max. Storage	=	2,842 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - bmp #9

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	204.00	n/a	0	0
1.00	205.00	n/a	840	840
2.00	206.00	n/a	840	1,680
3.00	207.00	n/a	840	2,520
3.50	207.50	n/a	420	2,940

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	0.70	Inactive	Inactive
Span (in)	= 8.00	0.70	5.80	24.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 204.00	204.00	305.45	48.25
Length (ft)	= 20.00	0.00	0.00	2.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.10	Inactive	Inactive	Inactive
Crest El. (ft)	= 207.00	304.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	204.00	0.00	0.00	0.00	0.00	0.00	0.00	---	---	---	---	0.000
1.00	840	205.00	0.01 ic	0.01 ic	0.00	0.00	0.00	0.00	---	---	---	---	0.012
2.00	1,680	206.00	0.02 ic	0.02 ic	0.00	0.00	0.00	0.00	---	---	---	---	0.018
3.00	2,520	207.00	0.02 ic	0.02 ic	0.00	0.00	0.00	0.00	---	---	---	---	0.022
3.50	2,940	207.50	1.07 ic	0.02 ic	0.00	0.00	1.05 ic	0.00	---	---	---	---	1.069

APPENDIX E:

Excerpts from Drainage Design Manual

Chapter 2

Hydrology

The design discharge depends upon many variables. Some of the more important variables are duration and intensity of rainfall; storm frequency; ground cover; and the size, imperviousness, slope, and shape of the drainage area.

2.1. Discharge Flow Methods

The designer should check with Drainage and Flood Plain Management Section, Public Works Department, to determine if there are established storm discharge flows.

If the project involves a watershed of major size or importance, flood flows may already be established through one or more of the following activities:

1. Master Plan Developments in the City and/or County
2. Studies for Development and Road Projects near the proposed project
3. Flood Insurance Studies prepared by FEMA based on existing land use at the time the study was completed. Urbanization may have caused increased flows. FEMA maps can be viewed at the SanGIS web site (www.sangis.org).
4. Recorded flows may be available from the United States Geological Survey (USGS) or the County of San Diego

If no established storm discharge flows are available, the applicable methods are:

1. Rational Method for watersheds less than 0.5 square miles – See Appendix A
2. Modified Rational Method for watersheds between 0.5 and 1.0 square miles – See Appendix A; or,
3. Natural Resources Conservation Service (NRCS) Method (formally called Soil Conservation Service (SCS) Method) for watersheds greater than 1.0 square miles – See Appendix B; or
4. Hydrologic Engineering Center (HEC) computer method.

2.2. Design Storm Frequency

Design storm frequency shall be based upon the following criteria:

1. Within floodplain and floodplain fringe areas as defined by FEMA, the runoff criteria shall be based upon a 100-year frequency storm.

2. For all drainage channels and storm water conveyance systems, which will convey drainage from a tributary area equal to or greater than one (1) square mile, the runoff criteria, shall be based upon a 100-year frequency storm.
3. For tributary areas under one (1) square mile:
    a. The storm water conveyance system shall be designed so that the combination of storm drain system capacity and overflow (streets and gutter) will be able to carry the 100-year frequency storm without damage to or flooding of adjacent existing buildings or potential building sites.
    b. The runoff criteria for the underground storm drain system shall be based upon a 50-year frequency storm.

2.3. Soil Type

For storm drain, culverts, channels, and all associated structures, Type D soil shall be used for all areas.

2.4. Other Requirements

1. Design runoff for drainage and flood control facilities within the City shall be based upon full development of the watershed area in accordance with the land uses shown on the City of San Diego, Progress Guide and General Plan.
2. When determining criteria for floodplain management and flood proofing, design runoff within the City shall be based upon existing conditions in accordance with the City Floodplain Management Requirements and FEMA Regulations.
3. Under City requirements, the minimum elevation of the finished, first floor elevation of any building is 2 feet above the 100-year frequency flood elevation.

2.5. Water Quality Considerations

Requirements for hydrologic studies specific to the design of pollution prevention controls and hydromodification management controls are detailed in the Storm Water Standards. Where the Storm Water Standards specify modifications to the guidelines stated herein on discharge flow methods, design storm frequency, or soil type, the modifications shall supersede these but only for the purposes stated in the Storm Water Standards. Where the Storm Water Standards does not specify a modification, the guidance found here in Chapter 2 shall apply.

Appendix A

Rational Method and Modified Rational Method

A.1. Rational Method (RM)

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has 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 drainage structures. The RM is recommended for analyzing the runoff response from drainage areas for watersheds less than 0.5 square miles. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 0.5 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section A.2); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Appendix B).

A.1.1. Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (T_c), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed in Equation A-1.

Equation A-1. RM Formula Expression

$$Q = C\ I\ A$$

where:

Q	=	peak discharge, in cubic feet per second (cfs)
C	=	runoff coefficient expressed as that percentage of rainfall which becomes surface runoff (no units); Refer to Appendix A.1.2
I	=	average rainfall intensity for a storm duration equal to the time of concetrnatation (T_c) of the contributing draiange area, in inches per hour; Refer to Appendix A.1.3 and Appendix A.1.4
A	=	drainage area contributing to the design location, in acres

Combining the units for the expression CIA yields:

$$\left(\frac{1\,\text{acre}\times\text{inch}}{\text{hour}}\right)\left(\frac{43{,}560\,\text{ft}^2}{\text{acre}}\right)\left(\frac{1\,\text{foot}}{12\,\text{inches}}\right)\left(\frac{1\,\text{hour}}{3{,}600\,\text{seconds}}\right)\Rightarrow 1.008\,\text{cfs}$$

For practical purposes, the unit conversion coefficient difference of 0.8% can be ignored.

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Unlike the MRM (discussed in Appendix A.2) or the NRCS hydrologic method (discussed in Appendix B), the RM does not create hydrographs and therefore does not add separate subarea hydrographs at collection points. Instead, the RM develops peak discharges in the main line by increasing the T_c as flow travels downstream.

Characteristics of, or assumptions inherent to, the RM are listed below:

1. The discharge resulting from any I is maximum when the I lasts as long as or longer than the T_c.
2. The storm frequency of peak discharges is the same as that of I for the given T_c.
3. The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in the NRCS method).
4. The peak rate of runoff is the only information produced by using the RM.

A.1.2. Runoff Coefficient

The runoff coefficients are based on land use (see Table A–1). Soil type "D" is used throughout the City of San Diego for storm drain conveyance design. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table A–1, as adjustments to these values may be appropriate based on site-specific characteristics.

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C)
	Soil Type [1]
Residential:	
Single Family	0.55
Multi-Units	0.70
Mobile Homes	0.65
Rural (lots greater than ½ acre)	0.45
Commercial [2]	
80% Impervious	0.85
Industrial [2]	
90% Impervious	0.95

Note:
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%
Tabulated imperviousness = 80%
Revised C = (50/80) x 0.85 = 0.53

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

A.1.3. Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the T_C for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_C calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

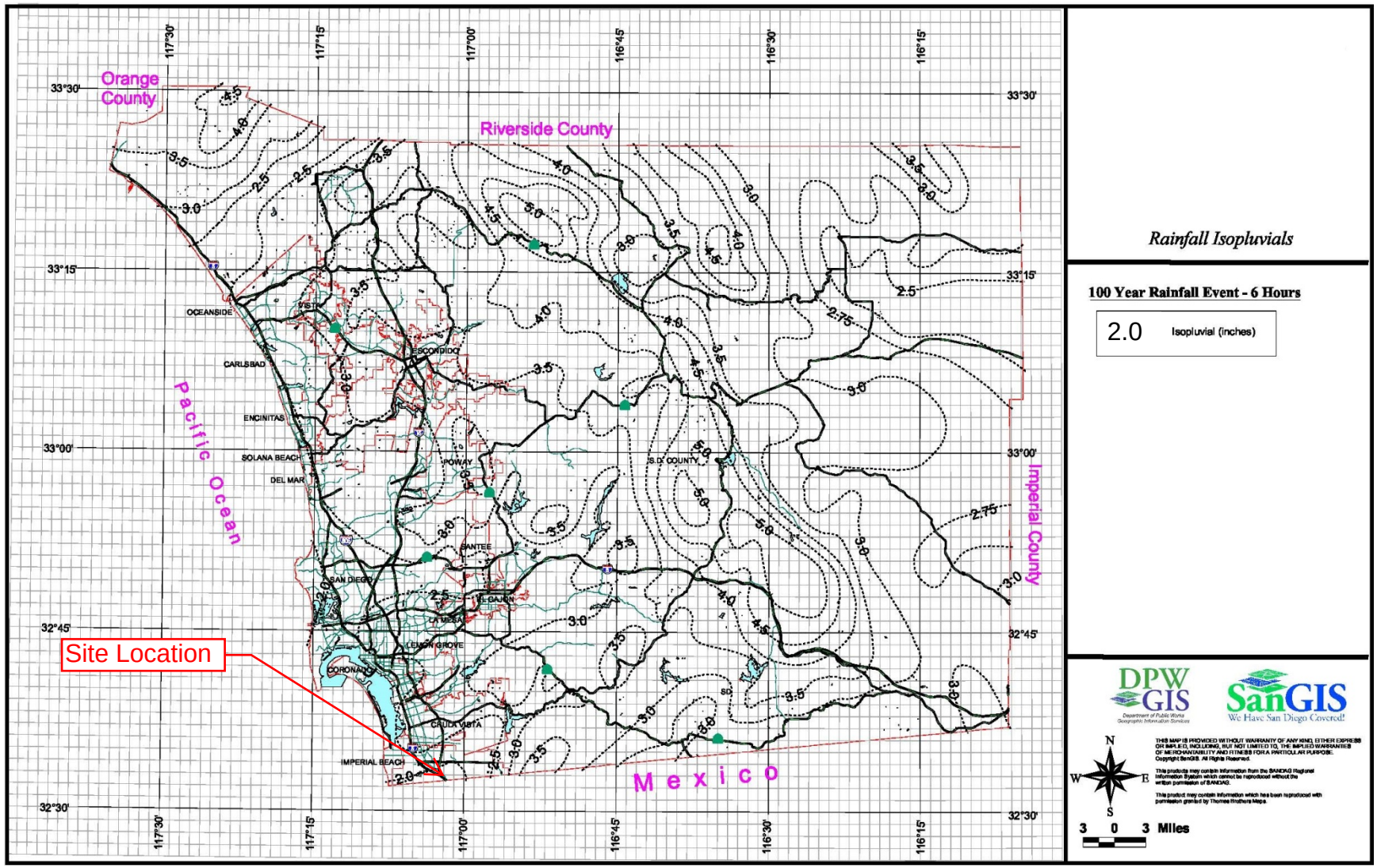


Figure B-2. 100-Year 6-Hour Isopluvials.

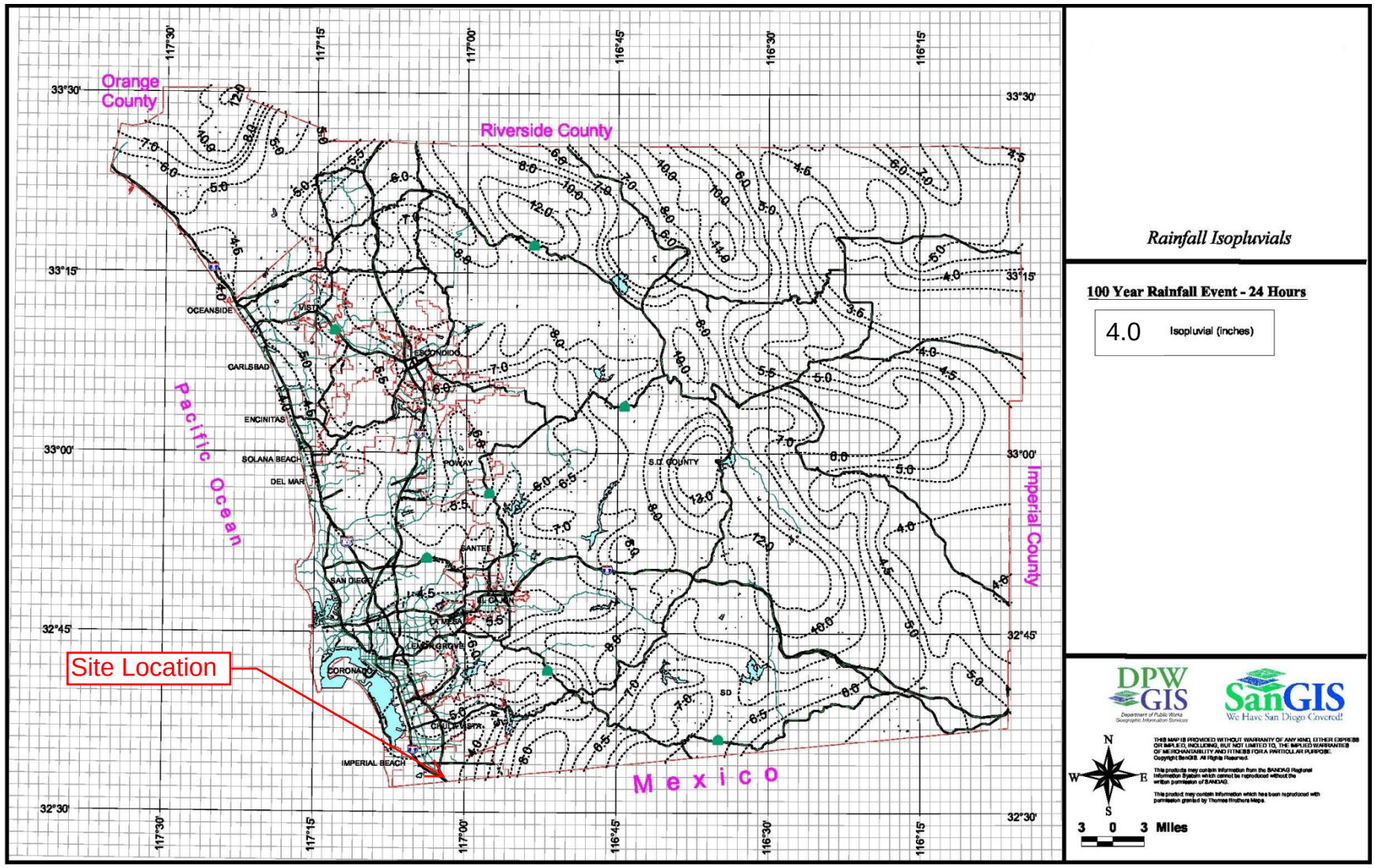


Figure B-3. 100-Year 24-Hour Isopluvials

APPENDIX F:

FEMA Flood Plain Map

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/20/2018 at 6:45:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.