Appendix F

Preliminary Hydrology Study

PRELIMINARY HYDROLOGY STUDY

FOR

DISCRETIONARY APPROVAL – DEVELOPMENT PLAN,
CONDITIONAL USE PERMIT
250 EDDIE JONES WAY, OCEANSIDE CA

PLANNING CASE NO: D22-00001 / CUP22-00001

CITY OF OCEANSIDE, CA

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PRELIMINARY

TYLER G. LAWSON, RCE 80356 DATE

TABLE OF CONTENTS

	SECTION
Executive Summary	**1.0**
Introduction	1.1
Existing Conditions	1.2
Proposed Project	1.3
Conclusions	1.4
References	1.5
Methodology	**2.0**
Introduction	2.1
County of San Diego Criteria	2.2
City of Oceanside Standards	2.3
Runoff Coefficient Determination	2.4
AES Rational Method Computer Model	2.5
Hydrology & Hydraulic Model Output	**3.0**
Pre-Developed Hydrologic Model Output (100-Year Event)	3.1
Post-Developed Hydrologic Model Output (100-Year Event)	3.2
Detention Analysis (100-Year Event)	3.3
Hydromodification Analysis	3.4
Storm Water Pollutant Control	3.5
Pipe Flow Capacity	3.6
Appendix	**4.0**
Appendix A: Hydrology Support Material	
Appendix B: Storm Water Pollutant Control and Detention Calculations	

1.0 EXECUTIVE SUMMARY

1.1 Introduction

This Preliminary Hydrology Study for the proposed development at 250 Eddie Jones Way has been prepared to analyze the hydrologic and hydraulic characteristics of the existing and proposed project site. This report intends to present both the methodology and the calculations used for determining the runoff from the project site in both the pre-developed (existing) conditions and the post-developed (proposed) conditions produced by the 100-year, 6-hour storm. For hydromodification management and compliance including analysis up to the 10-year, 6-hour storm event, refer to the project Storm Water Quality Management Plan (SWQMP) prepared by Pasco, Laret, Suiter & Associates under separate cover.

1.2 Existing Conditions

The subject property is located just northeast of the intersection of Eddie Jones Way and Benet Road in the City of Oceanside. The site is bordered directly to the north by the San Luis Rey River and river trail, as well as directly to the south by the Bob Maxwell Memorial Field Oceanside Municipal Airport. To the east of the subject property is a vacant, undeveloped parcel that has been previously graded. The project site has a General Plan Land Use designation of Limited Industrial (LI) and is in the Limited Industrial (IL) Zoning District. The existing site consists of an existing industrial building that is currently vacant but was formerly used for electronics manufacturing. The site contains various surface and drainage improvements typical of this type of development including onsite parking, drive aisles, and landscaping to support the previous use. The site is located within the Mission Hydrologic Sub-Area of the Lower San Luis Hydrologic Area within the San Luis Rey Watershed (903.11), as well as within flood plain Zone A99 per the FEMA Flood Insurance Rate Map (FIRM) panel 06073C0751H.

The existing site is comprised of approximately 31.7 gross acres. The site is relatively flat with minimal elevation change across the depth of the property considering the site area. Runoff through the site primarily flows to three different discharge locations from the property, one in the southwest corner to Benet Road, one in the northwest corner to the San Luis Rey River, and one in the northeast corner to the adjacent parcel. Runoff primarily flows through the site via sheet flow methods, though previous development on the site including a molding assembly plant and associated surface improvements to support this use resulted in the installation of private storm drain infrastructure to convey drainage through the site as well. A study of the existing conditions and site topography shows that an earthen flood levee wrapping the property was previously constructed to protect the site from flooding in the San Luis Rey River.

As such, the southwestern-most portion of the site between the toe of slope at the bottom of Benet Road and the flood levee is conveyed generally southwest to either existing public storm drain piping or on the surface to an existing storm drain inlet located adjacent the airport runway. This runoff all ultimately collects in storm drain within Benet Road before

discharging to the San Luis Rey River not far downstream. From there, the river conveys drainage west to the outlet at the Pacific Ocean near Oceanside Harbor Beach. A majority of the site contained within the flood levee appears to drain on the surface towards a series of storm drain inlets located north of the existing buildings. As-builts for the site show small pump stations within each inlet convey water to the northwest corner of the site and an existing headwall structure / sump inlet that feeds a 36" RCP storm drain. This storm drain travels under the San Luis Rey River Trail to discharge to the adjacent San Luis Rey River. Once in the river, runoff continues west downstream to confluence with runoff leaving the property from the southwest corner.

A review of the site topography offsite revealed that the existing improvements to the north, including the San Luis Rey River Trail, prevent additional runoff from entering the site from the river in a non-flood condition. Additionally, the Oceanside Municipal Airport to the south is downstream of the subject property and appears to drain west and south to Benet Road. For the purpose of the analysis, the analyzed point of compliance for each discharge location is just outside of the limits of the property. Additional runoff from the airport and Benet Road enter the public storm drain system, but the limits were contained to the subject property only in order to size onsite flood control measures accordingly and perform all the mitigation for the increased impervious footprint onsite. A further analysis of the larger drainage basin was not performed.

Per the Web Soil Survey application available through the United States Department of Agriculture, the area is generally categorized to have majority group A soils. A portion of the site is also mapped as Type D, but an overview of the larger surrounding properties also indicates majority Type A soils in the area containing Tujunga sand (TuB). In an effort to perform a more conservative analysis, Type A soils is used throughout to mitigate the proposed development to a lower peak flow rate in the pre-project condition. Based upon soil type and the amount of existing impervious area onsite, a runoff coefficient of 0.50 was calculated for the existing site using the methodology described in section 3.1.2 of the San Diego County Hydrology Manual and the formula provided therein. This runoff coefficient was applied to each drainage basin for use in determining peak runoff leaving the site from the property discharge location. Using the Rational Method Procedure outlined in the San Diego County Hydrology Manual, a peak flow rate and time of concentration was calculated for the analyzed basin for the 100-year, 6-hour storm event. Table 1 below summarizes the results of the Rational Method calculations.

EXISTING DRAINAGE FLOWS			
DRAINAGE AREA	DRAINAGE AREA (ACRES)	Q_{100} (CFS)	I_{100} (IN/HR)
EX-1	25.94 Ac	37.2	2.87
EX-2	3.52 Ac	6.2	3.54
EX-3	1.90 Ac	2.4	2.51

Table 1. Existing Condition Peak Drainage Flow Rates

Table 1 above lists the peak flow rates for the project site in the existing condition for the respective rainfall events. The peak flow rate for the 100-year, 6-hour storm for Basin EX-1 was determined to be 37.2 cfs with a time of concentration of 21.6 minutes, discharging from the northwest corner of the site, 6.2 cfs with a time of concentration of 15.6 minutes for Basin EX-2 discharging from the southwest corner of the site, and 2.4 cfs with a time of concentration of 26.7 minutes discharging from the northeast corner of the site. Refer to pre-development hydrology calculations included in Section 3.1 of this report for a detailed analysis of the existing drainage basin, as well as a pre-development hydrology node map included in the appendix of this report for pre-development drainage basin delineation and discharge locations leaving the subject property.

1.3 Proposed Project

The proposed project includes the demolition of all onsite structures and improvements and the construction of a new ~547,320 square foot industrial building, along with a fire access lane / circulation driveway, loading docks, flat-bed trailer parking, and various surface, grading, and utility improvements typical of this type of construction. The proposed building finished floor elevation is 28.0 and building height will be in compliance with restrictions of the Oceanside Municipal Airport Land Use Compatibility Plan. Additional information can be seen on the project Preliminary Grading Plan submitted as part of the Conditional Use Permit and Development Plan application under separate cover.

The proposed development consists of an industrial building located in the center of the site, along with fire access driveways / circulation elements around the building. The proposed surface improvements and proposed development will primarily drain away from the building and dock high doors via surface flow to a series of inlets located within the drive aisle. These inlets will route runoff to a proposed private buried storm drain system that convey drainage to a storm water treatment and flood control mitigation system prior to leaving the site. This system, located at each discharge point from the property, consists of an underground detention vault to reduce peak flows generated by the 100-year, 6-hour storm event to pre-development conditions, a duplex sump pump system, proprietary biofiltration BMP's, and an outlet pipe to then gravity flow offsite after detention, treatment, and mechanical pumping methods.

As in the existing condition, the project site will not accept any offsite runon from the adjacent San Luis Rey River to the north of the San Luis Rey River Trail, or from Benet Road to the west, the airport to the south, and vacant lot to the east. Similar to the existing condition, the analyzed watershed can be broken down into three major drainage basins with three separate discharge locations from the site, one from the northwest corner of the site, one from the southwest corner of the site, and one from the northeast corner of the site. These discharge locations both outlet to the San Luis Rey River and continue downstream to the west, ultimately confluencing and discharging at the river outlet to the Pacific Ocean near Oceanside Harbor Beach. Basin PR-1 consists of roughly half of the property and is approximately 13.43 acres in size. This drainage area consists of the northern and western portions of the site, including a large portion of the building roof, and is ultimately collected and routed to the northwest discharge location. Basin PR-2 consists

of roughly the remaining half of the property and is approximately 17.43 acres in size. This drainage area consists of the eastern and southern portions of the site, including the remaining portion of the building roof, and is routed to the southwest discharge location. Basin PR-3 comprises the remaining area of the site included in this analysis that will be swale-graded to continue flowing east to the Basin EX-3 discharge location in the existing condition. A culvert is proposed under the private driveways entering the site from Alex Road so as to not impede the flow of drainage to the ultimate point of discharge.

Based on the proposed land use and soil type of the subject property, runoff coefficients for this site were determined using Table 3-1 Runoff Coefficients for Urban Areas of the San Diego County Hydrology Manual. Refer to section 3.2 of this report, as well as the post-development hydrology map included in Appendix A, for additional analysis and a summary of runoff coefficients used. Using the Rational Method Procedure outlined in the San Diego County Hydrology Manual, a peak flow rate and time of concentration were calculated for the 100-year, 6-hour storm event for each of the drainage basins in the proposed condition. Table 2 below summarizes the results of the Rational Method calculations.

PROPOSED DRAINAGE FLOWS			
DRAINAGE AREA	DRAINAGE AREA (ACRES)	Q_{100} (CFS)	I_{100} (IN/HR)
PR-1	13.49 Ac	60.7	6.81
PR-2	17.43 Ac	52.3	5.08
PR-3	0.43 Ac	1.4	4.23

Table 2. Proposed Condition Peak Drainage Flow Rates

The results above show the undetained peak flows leaving the subject property at the three (3) main points of discharge in the proposed condition, in order to compare to pre-developed conditions. Refer to Section 3.3 of this report for a full discussion of the routing analysis performed for the project in order to size the onsite detention facilities to mitigate peak flows to pre-project conditions. Refer to post-development hydrology calculations included in Section 3.2 of this report for detailed analyses of the proposed drainage basins as well as a post-development hydrology node map included in Appendix A of this report for post-development drainage delineation and discharge locations.

COMPARISON DRAINAGE FLOWS			
DRAINAGE AREA	DRAINAGE AREA (ACRES)	Q_{100} (CFS)	I_{100} (IN/HR)
EX-1	25.94 Ac	37.2	2.87
PR-1	10.8 Ac	60.7	6.81
EX-2	3.52 Ac	6.2	3.54
PR-2	17.43 Ac	52.3	5.08
EX-3	1.90 Ac	2.4	2.51
PR-3	0.43 Ac	1.4	4.23

Table 3. Comparison Peak Drainage Flow Rates

As this section of the report only serves to analyze the total, unmitigated peak runoff generated from the proposed project, refer to Section 3.3 of this report for a discussion of the detention components of the site. This analysis takes into account the proposed flood control mitigation facilities proposed onsite, which include underground concrete storage vaults. The results of the detention analysis provide a resultant, mitigated peak runoff leaving the site in addition to the detained time to peak (see Appendix B for results of the dynamic detention analysis performed using HydroCAD-10 software).

In an effort to comply with the City of Oceanside's Stormwater standards, all runoff generated onsite will be conveyed to an onsite biofiltration facility for treatment and pollutant removal. For a discussion regarding hydromodification management requirements and compliance, refer to the project Storm Water Quality Management Plan (SWQMP) under separate cover. The property was deemed infeasible to infiltrate by the project geotechnical engineer in accordance with "Report of Limited Geotechnical Investigation for Proposed Storm Water Infiltration BMPs" dated March 10, 2021 prepared by NOVA Services, and as such, proprietary biofiltration treatment is proposed to satisfy pollutant removal requirements of the Regional MS4 Permit.

In an effort to comply with the City of Oceanside's storm water standards for all development projects, the project site will implement source control and site design BMP's in addition to the proposed biofiltration treatment control BMP where feasible and applicable in accordance with the City of Oceanside's BMP Design Manual, February 2016 edition. Proposed impervious area and soil compaction are minimized to the greatest extent feasible, and dispersion is promoted as well. Partial infiltration and evapotranspiration in landscaped areas will assist in slowing peak discharges and in reducing total volume generated during storm events, while in addition serving to comply with volume retention requirements of the project. The onsite landscaped areas will assist to remove sediment and particulate-bound pollutants from storm water prior to leaving the project site.

1.4 Conclusions

Based upon the hydrology calculations performed for the project site, there is an increase in peak runoff in the post-developed condition compared to the existing condition as a direct result of the increase in impervious area. For a discussion on the detention analysis performed for the project site, refer to Section 3.3 below as well as the Appendix of this report. Based on the analysis included in this report, the proposed onsite detention facilities accommodate the increase in peak runoff generated in the proposed condition, mitigating peak flows to below pre-developed conditions. The site has been designed and graded in a way to minimize earthwork to the greatest extent feasible and maintain historic drainage patterns. Water leaving the subject property will continue to do so from the same points of discharge as in the existing condition. Thus, water will not be diverted away from existing drainage patterns, and the proposed development and resulting peak runoff will not have an adverse effect on the downstream watershed and existing infrastructure.

1.5 References

"San Diego County Hydrology Manual", revised June 2003, County of San Diego, Department of Public Works, Flood Control Section.

"San Diego County Hydraulic Design Manual", revised September 2014, County of San Diego, Department of Public Works, Flood Control Section

"Master Plan of Drainage, Update 2013", revised October 2013, City of Oceanside, prepared by Tory R. Walker Engineering, Inc.

"*City of Oceanside BMP Design Manual for Permanent Site Design, Storm Water Treatment and Hydromodification Management*", revised February 2016, City of Oceanside, prepared by GHD

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov.

2.0 METHODOLOGY

2.1 Introduction

The hydrologic model used to perform the hydrologic analysis presented in this report utilizes the Rational Method (RM) equation, Q = CIA. The RM formula estimates the peak rate of runoff based on the variables of area, runoff coefficient, and rainfall intensity. The rainfall intensity (I) is equal to:

$$I = 7.44 \times P_6 \times D^{-0.645}$$

Where:

I = Intensity (in/hr)
P_6 = 6-hour precipitation (inches)
D = duration (minutes – use Tc)

Using the Time of Concentration (Tc), which is the time required for a given element of water that originates at the most remote point of the basin being analyzed to reach the point at which the runoff from the basin is being analyzed. The RM equation determines the storm water runoff rate (Q) for a given basin in terms of flow (typically in cubic feet per second (cfs) but sometimes as gallons per minute (gpm)). The RM equation is as follows:

$$Q = CIA$$

Where:

Q = flow (in cfs)
C = runoff coefficient, ratio of rainfall that produces storm water runoff (runoff vs. infiltration/evaporation/absorption/etc)
I = average rainfall intensity for a duration equal to the Tc for the area, in inches per hour.
A = drainage area contributing to the basin in acres.

The RM equation assumes that the storm event being analyzed delivers precipitation to the entire basin uniformly, and therefore the peak discharge rate will occur when a raindrop that falls at the most remote portion of the basin arrives at the point of analysis. The RM also assumes that the fraction of rainfall that becomes runoff or the runoff coefficient C is not affected by the storm intensity, I, or the precipitation zone number.

2.2 County of San Diego Criteria

As defined by the County Hydrology Manual dated June 2003, the rational method is the preferred equation for determining the hydrologic characteristics of basins up to approximately one square mile in size. The County of San Diego has developed its own tables, nomographs, and methodologies for analyzing storm water runoff for areas within the county. The County has also developed precipitation isopluvial contour maps that show even lines of rainfall anticipated from a given storm event (i.e. 100-year, 6-hour storm).

One of the variables of the RM equation is the runoff coefficient, C. The runoff coefficient is dependent only upon land use and soil type and the County of San Diego has developed a table of Runoff Coefficients for Urban Areas to be applied to basin located within the County of San Diego. The table categorizes the land use, the associated development density (dwelling units per acre) and the percentage of impervious area. Each of the categories listed has an associated runoff coefficient, C, for each soil type class.

The County has also illustrated in detail the methodology for determining the time of concentration, in particular the initial time of concentration. The County has adopted the Federal Aviation Agency's (FAA) overland time of flow equation. This equation essentially limits the flow path length for the initial time of concentration to lengths under 100 feet, and is dependent on land use and slope.

2.3 City of Oceanside Standards

The City of Oceanside has additional information, overview, analysis, and findings for watersheds located within the City which are outlined in the Master Plan of Drainage, 2013 Update. Please refer to this manual for reference and further details.

2.4 Runoff Coefficient Determination

As stated in section 2.2, the runoff coefficient is dependent only upon land use and soil type and the County of San Diego has developed a table of Runoff Coefficients for Urban Areas to be applied to basin located within the County of San Diego. The table, included at the end of this section, categorizes the land use, the associated development density (dwelling units per acre) and the percentage of impervious area.

2.5 AES Rational Method Computer Model

The Rational Method computer program developed by Advanced Engineering Software (AES) satisfies the County of San Diego design criteria, therefore it is the computer model used for this study. The AES hydrologic model is capable of creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points to determine peak flow rates. The program utilizes base information input by the user to perform calculations for up to 15 hydrologic processes. The required base information includes drainage basin area, storm water facility locations and sizes, land

uses, flow patterns, and topographic elevations. The hydrologic conditions were analyzed in accordance with the 2003 County of San Diego Hydrology Manual criteria as follows:

Design Storm	100-year, 6-hour
100-year, 6-hour Precipitation	2.8 inches
Rainfall Intensity	Based on the 2003 County of San Diego Hydrology Manual criteria
Runoff Coefficient	Weighted Runoff Coefficients per Section 3.1, 3.2 of this report and Table 3-2 of SDHDM

2.5.1 AES Computer Model Code Information

0: Enter Comment
2: Initial Subarea Analysis
3: Pipe/Box/Culvert Travel Time
5: Open Channel Travel Time
7: User-Specified hydrology data at Node
8: Addition of sub-area runoff to Main Stream
10: Copy Main Stream data onto a Memory Bank
11: Confluence Memory Bank data with Main Stream
13: Clear the Main Stream

3.0 HYDROLOGY MODEL OUTPUT

3.1 Pre-Developed Hydrologic Model Output (100 Year Event)

Pre-Development:

$Q = CIA$ *Rational Method Equation
$P_{100} = 2.8$ *100-Year, 6-Hour Rainfall Precipitation

Entire Disturbed Area (Onsite Drainage Basin)

Total Area = 1,365,367 sf ➔ 31.34 Acres
Impervious Area = 591,152 sf ➔ 13.57 Ac
Pervious Area = 774,215 sf ➔ 17.77 Ac

Cn, Weighted Runoff Coefficient,
- 0.20, Cn value for natural ground, Type A Soils
  *Per San Diego Hydrology Design Manual (SDHDM) Section 3.1.2
- 0.90, Cn value for developed/impervious surface
  *Per SDHDM Section 3.1.2

$$Cn = \frac{0.90 \times 591{,}152 \text{ sf} + 0.20 \times 774{,}215 \text{ sf}}{1{,}365{,}367 \text{ sf}} = 0.50$$

Cn = 0.50 *Weighted Runoff Coefficient for Site

Basin EX-1 (Discharging to the Northwest of the site to San Luis Rey River)

Total Area = 1,130,006 sf ➔ 25.94 Acres
Cn = 0.50 *Weighted Runoff Coefficient for Site

$Q = Cn \times I_{100} \times A$ *Q based on flow to outlet location

Entering the existing headwall and 36" RCP storm drain pipe
T_C = 21.6 min (See attached AES calculations)
Q_{100} = 37.2 cfs (See attached AES calculations)

Basin EX-2 (Discharging to the Southwest of the site)

Total Area = 153,147 sf ➔ 3.52 Acres
Cn = 0.50 *Weighted Runoff Coefficient for Site

Q = Cn x I_{100} x A *Q based on flow to outlet location

Discharging from the site to the southwest corner entering the existing inlet
T_C = 15.6 min (See attached AES calculations)
Q_{100} = 6.2 cfs (See attached AES calculations)

Basin EX-3 (Discharging to the Northeast of the site to adjacent property)

Total Area = 82,422 sf ➔ 1.90 Acres
Cn = 0.50 *Weighted Runoff Coefficient for Site

Q = Cn x I_{100} x A *Q based on flow to outlet location

Discharging from the site to the northeast corner
T_C = 26.7 min (See attached AES calculations)
Q_{100} = 2.4 cfs (See attached AES calculations)

Pre-Development – Total Site Runoff

Pre-Development (Basin EX-1)
Q_{100} = 37.2 cfs

Pre-Development (Basin EX-2)
Q_{100} = 6.2 cfs

Pre-Development (Basin EX-3)
Q_{100} = 2.4 cfs

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2016 Advanced Engineering Software (aes)
             Ver. 23.0 Release Date: 07/01/2016  License ID 1452

                           Analysis prepared by:





 ************************* DESCRIPTION OF STUDY *************************
* 250 EDDIE JONES WAY, OCEANSIDE CA                                      *
* PLSA 3751 - PRE-DEVELOPMENT HYDROLOGICAL STUDY                         *
*                                                                        *
 ************************************************************************

  FILE NAME: 3751PRE.DAT
  TIME/DATE OF STUDY: 16:53 07/25/2022
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.800
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     32.00
  DOWNSTREAM ELEVATION(FEET) =     26.90
  ELEVATION DIFFERENCE(FEET) =      5.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.959
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    90.20
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.588
  SUBAREA RUNOFF(CFS) =      0.79
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.79

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     26.90  DOWNSTREAM(FEET) =     23.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =   876.00   CHANNEL SLOPE =  0.0043
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.872
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.81
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.93
  AVERAGE FLOW DEPTH(FEET) =   0.18   TRAVEL TIME(MIN.) =  15.63
  Tc(MIN.) =   21.59
  SUBAREA AREA(ACRES) =    11.33       SUBAREA RUNOFF(CFS) =   16.27
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       11.6         PEAK FLOW RATE(CFS) =      16.61

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.24   FLOW VELOCITY(FEET/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     976.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.872
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5000
  SUBAREA AREA(ACRES) =   13.70   SUBAREA RUNOFF(CFS) =   19.67
  TOTAL AREA(ACRES) =       25.3   TOTAL RUNOFF(CFS) =      36.28
  TC(MIN.) =   21.59

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.872
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5000
  SUBAREA AREA(ACRES) =    0.67   SUBAREA RUNOFF(CFS) =    0.96
  TOTAL AREA(ACRES) =       25.9   TOTAL RUNOFF(CFS) =      37.24
  TC(MIN.) =   21.59

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     30.10
  DOWNSTREAM ELEVATION(FEET) =     29.70
  ELEVATION DIFFERENCE(FEET) =      0.40
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.621
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.837
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     29.70  DOWNSTREAM(FEET) =     26.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   288.00   CHANNEL SLOPE =  0.0115
  CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.546
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.94
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.81
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   5.94
  Tc(MIN.) =   15.57
  SUBAREA AREA(ACRES) =     1.88       SUBAREA RUNOFF(CFS) =    3.33
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =        2.0         PEAK FLOW RATE(CFS) =       3.49

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.10   FLOW VELOCITY(FEET/SEC.) =   1.04
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     388.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.546
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5000
  SUBAREA AREA(ACRES) =    1.55   SUBAREA RUNOFF(CFS) =    2.75
  TOTAL AREA(ACRES) =        3.5   TOTAL RUNOFF(CFS) =       6.24
  TC(MIN.) =   15.57

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     31.30
  DOWNSTREAM ELEVATION(FEET) =     31.10
  ELEVATION DIFFERENCE(FEET) =      0.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.621
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
```

```
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.837
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     31.10  DOWNSTREAM(FEET) =     29.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =   417.00   CHANNEL SLOPE =  0.0048
  CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) = 417.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.691
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.03
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.49
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =  14.26
  Tc(MIN.) =   23.88
  SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    1.48
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       1.61

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   0.58
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     517.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    29.10  DOWNSTREAM(FEET) =    28.30
  FLOW LENGTH(FEET) =    57.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.86
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.61
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   24.08
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =     574.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     28.30  DOWNSTREAM(FEET) =     27.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   116.00   CHANNEL SLOPE =  0.0078
  CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.505
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.05
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.74
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   2.60
  Tc(MIN.) =   26.68
  SUBAREA AREA(ACRES) =     0.70       SUBAREA RUNOFF(CFS) =    0.88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =        1.9         PEAK FLOW RATE(CFS) =       2.38

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   0.80
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =     690.00 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.9  TC(MIN.) =     26.68
  PEAK FLOW RATE(CFS)   =       2.38
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

🡅

3.2 Post-Developed Hydrologic Model Output (100-Year Event)

Post-Development:

Q = CIA *Rational Method Equation
P_{100} = 2.8 *100-Year, 6-Hour Rainfall Precipitation

Entire Disturbed Area (Onsite Drainage Basin)

Total Area = 1,384,577 sf ➔ 31.79 Acres
Total Drainage Area = 1,365,575 sf ➔ 31.35 Acres
Total Disturbed Area = 1,157,378 sf ➔ 26.57 Acres
Impervious Area = 1,098,687 sf ➔ 25.22 Ac
Pervious Area = 285,890 sf ➔ 6.56 Ac

Cn, Weighted Runoff Coefficient,
- 0.20, Cn value for natural ground, Type A Soils
  *Per San Diego Hydrology Design Manual (SDHDM) Section 3.1.2
- 0.90, Cn value for developed/impervious surface
  *Per SDHDM Section 3.1.2

$$Cn = \frac{0.90 \times 1{,}098{,}687 \text{ sf} + 0.20 \times 285{,}890 \text{ sf}}{1{,}384{,}577 \text{ sf}} = 0.75$$

Cn = 0.75 *Weighted Runoff Coefficient for Site

Basin PR-1 (Discharging to the Northwest of the site to San Luis Rey River)

Total Area = 587,757 sf ➔ 13.49 Acres
Cn = 0.75 *Weighted Runoff Coefficient for Site

Q = Cn x I_{100} x A *Q based on flow to proposed BMP

Entering the proposed catch basin and existing 36" RCP storm drain pipe
T_C = 5.7 min (See attached AES calculations)
Q_{100} = 60.7 cfs (See attached AES calculations)

Basin PR-2 (Discharging to the Southwest corner of the site)

Total Area = 759,423 sf ➔ 17.43 Acres
Cn = 0.75 *Weighted Runoff Coefficient for Site

Q = Cn x I_{100} x A *Q based on flow to proposed BMP

Discharging from the site to the southwest corner entering the existing inlet
T_C = 8.8 min (See attached AES calculations)
Q_{100} = 52.3 cfs (See attached AES calculations)

Basin PR-3 (Discharging to the Northeast corner of the site)

Total Area = 18,395 sf ➔ 0.43 Acres
Cn = 0.75 *Weighted Runoff Coefficient for Site

Q = Cn x I_{100} x A *Q based on flow to proposed BMP

Initial Slope ~1%
Land Use = Limited Industrial zoning
Ti = 3.7 mins *Table 3-2 per SDCHM

Tt = {[11.9*(550 ft / 5,280 ft/mile)^3]/2.4 ft}^0.385 = .135 hours
= .135 hours * 60 = 8.2 mins

Tc = 3.7 + 8.2 = 11.9 min
Tc = **11.9 min**

P_6 = 2.6
I = 7.44 x P_6 x $D^{-0.645}$
I = 7.44 x 2.8 x $11.9^{-0.645}$ ≈ 4.23 in/hr
I_{100} ≈ 4.23 in/hr

Q_{100} = C*I*A
Q_{100} = 0.75 x 4.23 in/hr x 0.43 Ac = 1.36 cfs

Discharging from the site to the northeast corner
T_C = 11.9 min
Q_{100} = 1.4 cfs

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2016 Advanced Engineering Software (aes)
             Ver. 23.0 Release Date: 07/01/2016  License ID 1452

                           Analysis prepared by:

                      PASCO LARET SUITER & ASSOCIATES
                        535 NORTH HIGHWAY 101, STE A
                           SOLANA BEACH, CA 92075
                                858-259-8212

 ************************** DESCRIPTION OF STUDY **************************
* 250 EDDY JONES WAY, OCEANSIDE, CA                                        *
* PLSA 3751 - POST DEVELOPMENT UNDETAINED HYDROLOGICAL STUDY               *
*                                                                          *
 ****************************************************************************

  FILE NAME: 3751POST.DAT
  TIME/DATE OF STUDY: 12:40 07/26/2022
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.800
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     38.00
  DOWNSTREAM ELEVATION(FEET) =     25.20
  ELEVATION DIFFERENCE(FEET) =     12.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.924
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.77
  TOTAL AREA(ACRES) =      0.32   TOTAL RUNOFF(CFS) =      1.77

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     25.20  DOWNSTREAM(FEET) =     22.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   105.00   CHANNEL SLOPE =  0.0267
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.93
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   0.91
  Tc(MIN.) =    3.83
  SUBAREA AREA(ACRES) =     1.14       SUBAREA RUNOFF(CFS) =    6.31
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       8.08

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.38
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     205.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    20.00  DOWNSTREAM(FEET) =    18.10
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.08
  PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =    4.33
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.81   SUBAREA RUNOFF(CFS) =   10.01
  TOTAL AREA(ACRES) =        3.3   TOTAL RUNOFF(CFS) =      18.09
  TC(MIN.) =    4.33

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    18.10  DOWNSTREAM(FEET) =    16.20
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.81
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.09
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =    4.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     587.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
```

```
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.82   SUBAREA RUNOFF(CFS) =   10.07
  TOTAL AREA(ACRES) =        5.1   TOTAL RUNOFF(CFS) =      28.16
  TC(MIN.) =    4.73

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.20  DOWNSTREAM(FEET) =    14.30
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.60
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      28.16
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =    5.10
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     778.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.279
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.82   SUBAREA RUNOFF(CFS) =    9.94
  TOTAL AREA(ACRES) =        6.9   TOTAL RUNOFF(CFS) =      37.73
  TC(MIN.) =    5.10

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    14.30  DOWNSTREAM(FEET) =    12.45
  FLOW LENGTH(FEET) =   188.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.20
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      37.73
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =    5.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =     966.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.982
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    2.83   SUBAREA RUNOFF(CFS) =   14.82
  TOTAL AREA(ACRES) =        9.7   TOTAL RUNOFF(CFS) =      51.00
  TC(MIN.) =    5.45

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    12.45  DOWNSTREAM(FEET) =    11.50
  FLOW LENGTH(FEET) =    52.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.02
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      51.00
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    5.67
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    1059.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.67
  RAINFALL INTENSITY(INCH/HR) =   6.81
  TOTAL STREAM AREA(ACRES) =     9.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     51.00

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     28.00
  DOWNSTREAM ELEVATION(FEET) =     27.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.880
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.44
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.44

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     27.00  DOWNSTREAM(FEET) =     24.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   236.00   CHANNEL SLOPE =  0.0102
  CHANNEL BASE(FEET) =   35.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.874
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.00
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.76
  AVERAGE FLOW DEPTH(FEET) =   0.09   TRAVEL TIME(MIN.) =   2.24
  Tc(MIN.) =    7.12
  SUBAREA AREA(ACRES) =     2.04       SUBAREA RUNOFF(CFS) =    8.99
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =      10.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   2.11
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.30  DOWNSTREAM(FEET) =    12.20
  FLOW LENGTH(FEET) =   214.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.13
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =    7.53
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.666
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    0.87   SUBAREA RUNOFF(CFS) =    3.70
  TOTAL AREA(ACRES) =        3.2   TOTAL RUNOFF(CFS) =      13.47
  TC(MIN.) =    7.53

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    12.20  DOWNSTREAM(FEET) =    11.50
  FLOW LENGTH(FEET) =    72.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.44
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.47
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =    7.88
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     622.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.88
  RAINFALL INTENSITY(INCH/HR) =   5.50
  TOTAL STREAM AREA(ACRES) =     3.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.47

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       51.00     5.67        6.805          9.74
      2       13.47     7.88        5.502          3.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       60.69     5.67       6.805
      2       54.71     7.88       5.502

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      60.69   Tc(MIN.) =    5.67
  TOTAL AREA(ACRES) =       12.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    124.00 =    1059.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    125.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.805
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7264
  SUBAREA AREA(ACRES) =    0.58   SUBAREA RUNOFF(CFS) =    0.79
  TOTAL AREA(ACRES) =       13.5   TOTAL RUNOFF(CFS) =      66.68
  TC(MIN.) =    5.67

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     37.70
  DOWNSTREAM ELEVATION(FEET) =     27.00
  ELEVATION DIFFERENCE(FEET) =     10.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.924
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.33
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.33

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     27.00  DOWNSTREAM(FEET) =     24.15
  CHANNEL LENGTH THRU SUBAREA(FEET) =   285.00   CHANNEL SLOPE =  0.0100
  CHANNEL BASE(FEET) =   35.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.565
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.55
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   3.07
  Tc(MIN.) =    5.99
  SUBAREA AREA(ACRES) =     1.18       SUBAREA RUNOFF(CFS) =    5.81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       6.99

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.86
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    21.15  DOWNSTREAM(FEET) =    19.35
  FLOW LENGTH(FEET) =   178.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.99
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    6.46
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     563.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.251
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    0.87   SUBAREA RUNOFF(CFS) =    4.08
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =      10.74
  TC(MIN.) =    6.46

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    19.35  DOWNSTREAM(FEET) =    16.62
  FLOW LENGTH(FEET) =   271.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.74
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =    7.11
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     834.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.877
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.79   SUBAREA RUNOFF(CFS) =    7.89
  TOTAL AREA(ACRES) =        4.1   TOTAL RUNOFF(CFS) =      17.98
  TC(MIN.) =    7.11

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.62  DOWNSTREAM(FEET) =    14.64
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.98
  PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =    7.54
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =    1034.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.659
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.88   SUBAREA RUNOFF(CFS) =    7.98
  TOTAL AREA(ACRES) =        6.0   TOTAL RUNOFF(CFS) =      25.30
  TC(MIN.) =    7.54
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    14.64  DOWNSTREAM(FEET) =    12.66
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.47
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.30
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    7.94
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =    1234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    206.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.477
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.88   SUBAREA RUNOFF(CFS) =    7.72
  TOTAL AREA(ACRES) =        7.8   TOTAL RUNOFF(CFS) =      32.20
  TC(MIN.) =    7.94

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    12.66  DOWNSTREAM(FEET) =    10.68
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.02
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.20
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =    8.30
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    207.00 =    1434.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    207.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.318
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.88   SUBAREA RUNOFF(CFS) =    7.50
  TOTAL AREA(ACRES) =        9.7   TOTAL RUNOFF(CFS) =      38.77
  TC(MIN.) =    8.30

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    10.68  DOWNSTREAM(FEET) =     8.70
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.28
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.77
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =    8.66
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    208.00 =    1632.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.176
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    3.75   SUBAREA RUNOFF(CFS) =   14.56
  TOTAL AREA(ACRES) =       13.5   TOTAL RUNOFF(CFS) =      52.29
  TC(MIN.) =    8.66

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     8.70  DOWNSTREAM(FEET) =     7.20
  FLOW LENGTH(FEET) =   107.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.55
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.29
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    8.81
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    209.00 =    1739.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.118
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6434
  SUBAREA AREA(ACRES) =    3.24   SUBAREA RUNOFF(CFS) =    3.32
  TOTAL AREA(ACRES) =       16.7   TOTAL RUNOFF(CFS) =      55.02
  TC(MIN.) =    8.81

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.118
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .2000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6250
  SUBAREA AREA(ACRES) =    0.72   SUBAREA RUNOFF(CFS) =    0.74
  TOTAL AREA(ACRES) =       17.4   TOTAL RUNOFF(CFS) =      55.75
  TC(MIN.) =    8.81
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       17.4  TC(MIN.) =      8.81
  PEAK FLOW RATE(CFS)   =      55.75
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Total Q_{100} for Proposed Development **= PR-1 + PR-2 + PR-3**
= 60.7 + 52.3 + 1.4 cfs
= 114.1 cfs

Pre-Development vs. Post-Development (Undetained – Total Site Runoff)

Pre-Development (Basin EX-1)	Post-Development (PR-1)	Delta
Q_{100} = 37.8 cfs	**Q_{100} = 60.7 cfs**	**22.9 cfs**
Pre-Development (Basin EX-2)	Post-Development (PR-2)	Delta
Q_{100} = 6.2 cfs	**Q_{100} = 52.3 cfs**	**46.1 cfs**
Pre-Development (Basin EX-3)	Post-Development (PR-3)	Delta
Q_{100} = 2.4 cfs	**Q_{100} = 1.4 cfs**	**-1.0 cfs**

3.3 Detention Analysis (100-Year Event)

The onsite detention facilities consist of underground storage vaults located beneath the drive aisle to provide mitigation of the 100-year, 6-hour storm event peak flow rate. HydroCAD-10 has the ability to route the 100-year, 6-hour storm event inflow hydrograph (generated and modeled using RatHydro, which is a Rational Method Design Storm Hydrograph software that creates a hydrograph using the results of the Rational Method calculations) through the underground detention vault. Based on the vault cross-section geometry, stage-storage and outlet structure data, HydroCAD-10 has the ability to perform a dynamic / routing analysis and calculate the detained peak flow rate as well as detained time to peak. The inflow runoff hydrograph to the biofiltration basin was modeled using RatHydro which is a Rational Method Design Storm Hydrograph software that creates a hydrograph using the results of the Rational Method calculations.

All site runoff will be collected by a series of private storm drain inlets and piping, and will be conveyed to the underground storage vaults prior to discharging from the property. The project also proposes the use of Modular Wetlands system proprietary biofiltration treatment devices to comply with the water quality component of the MS4 Permit. Additionally, an outlet module installed as part of the detention vault, consisting of a system of weirs and connected to an outlet pipe, will further serve to mitigate peak flows before discharging directly offsite. The weir system detail can be seen on the project plans. This drainage path with both outlets from the storage vault has been modeled in the HydroCAD-10 analysis as seen on the Routing Diagram included in Appendix B of this report.

PROPOSED DRAINAGE FLOWS (MIT)			
DRAINAGE AREA	DRAINAGE AREA (ACRES)	Q_{100} (CFS)	I_{100} (IN/HR)
PR-1	13.49 Ac	10.8	4.20
PR-2	17.43 Ac	5.8	2.01

Table 3. Proposed Condition Peak Drainage Flow Rates (Mitigated)

Table 3 above lists the peak flow rates for the project site in the proposed, mitigated condition after being routed through the biofiltration basin. Based on the results of the HydroCAD-10 analysis, the underground detention vaults and outlet structures provide mitigation for the 100-year, 6-hour storm event peak flow rate. The resulting total peak discharge leaving the site for Basin PR-1 is 10.8 cfs and for Basin PR-2 is 5.8 cfs, which is below the pre-development Q_{100} of 37.2 cfs for Basin EX-1 and 6.2 cfs for Basin EX-2 at the same points of discharge.

Runoff leaving the site from basin PR-1 continues west to outlet to the curb face in Kurtz Street, prior to traveling south and confluences with the offsite drainage basin PR-2. Refer to Appendix A of this Hydrology Report and also to Appendix B for the HydroCAD-10 detailed output, which shows the effect of the detention characteristics of the underground storage vaults on the resulting peak discharge and time of concentration leaving the subject property.

3.3.1 Proposed Detained Condition Output Summary (100-Year Event)

Summary of Pre-Development Flows

Peak Runoff Generated (At Northwest Corner)
Total Area = 1,130,006 sf (EX-1) → 25.94 Acres
Q_{100} = 37.2 cfs

Peak Runoff Generated (At Southwest Corner)
Total Area = 152,939 sf (EX-2) → 3.51 Acres
Q_{100} = 6.2 cfs

Peak Runoff Generated (At Northeast Corner)
Total Area = 82,422 sf (EX-3) → 1.90 Acres
Q_{100} = 2.4 cfs

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2016 Advanced Engineering Software (aes)
             Ver. 23.0 Release Date: 07/01/2016  License ID 1452

                           Analysis prepared by:

                      PASCO LARET SUITER & ASSOCIATES
                        535 NORTH HIGHWAY 101, STE A
                           SOLANA BEACH, CA 92075
                                858-259-8212

 ************************** DESCRIPTION OF STUDY **************************
* 250 EDDY JONES WAY, OCEANSIDE, CA                                        *
* POST DEVELOPMENT DETAINED                                                *
*                                                                          *
 ****************************************************************************

  FILE NAME: 3751PD.DAT
  TIME/DATE OF STUDY: 11:59 07/27/2022
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.800
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     38.00
  DOWNSTREAM ELEVATION(FEET) =     25.20
  ELEVATION DIFFERENCE(FEET) =     12.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.924
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.77
  TOTAL AREA(ACRES) =      0.32   TOTAL RUNOFF(CFS) =      1.77

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     25.20  DOWNSTREAM(FEET) =     22.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   105.00   CHANNEL SLOPE =  0.0267
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.93
  AVERAGE FLOW DEPTH(FEET) =   0.05   TRAVEL TIME(MIN.) =   0.91
  Tc(MIN.) =    3.83
  SUBAREA AREA(ACRES) =     1.14       SUBAREA RUNOFF(CFS) =    6.31
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       8.08

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   2.38
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     205.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    20.00  DOWNSTREAM(FEET) =    18.10
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.08
  PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =    4.33
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.81   SUBAREA RUNOFF(CFS) =   10.01
  TOTAL AREA(ACRES) =        3.3   TOTAL RUNOFF(CFS) =      18.09
  TC(MIN.) =    4.33

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    18.10  DOWNSTREAM(FEET) =    16.20
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.81
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.09
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =    4.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     587.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
```

```
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.82   SUBAREA RUNOFF(CFS) =   10.07
  TOTAL AREA(ACRES) =        5.1   TOTAL RUNOFF(CFS) =      28.16
  TC(MIN.) =    4.73

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.20  DOWNSTREAM(FEET) =    14.30
  FLOW LENGTH(FEET) =   191.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.60
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      28.16
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =    5.10
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     778.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.279
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.82   SUBAREA RUNOFF(CFS) =    9.94
  TOTAL AREA(ACRES) =        6.9   TOTAL RUNOFF(CFS) =      37.73
  TC(MIN.) =    5.10

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    14.30  DOWNSTREAM(FEET) =    12.45
  FLOW LENGTH(FEET) =   188.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.20
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      37.73
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =    5.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =     966.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.982
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    2.83   SUBAREA RUNOFF(CFS) =   14.82
  TOTAL AREA(ACRES) =        9.7   TOTAL RUNOFF(CFS) =      51.00
  TC(MIN.) =    5.45

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    12.45  DOWNSTREAM(FEET) =    11.50
  FLOW LENGTH(FEET) =    52.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.02
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      51.00
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    5.67
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    1059.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.67
  RAINFALL INTENSITY(INCH/HR) =   6.81
  TOTAL STREAM AREA(ACRES) =     9.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     51.00

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     28.00
  DOWNSTREAM ELEVATION(FEET) =     27.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.880
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.44
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.44

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     27.00  DOWNSTREAM(FEET) =     24.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   236.00   CHANNEL SLOPE =  0.0102
  CHANNEL BASE(FEET) =   35.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.874
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.00
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.76
  AVERAGE FLOW DEPTH(FEET) =   0.09   TRAVEL TIME(MIN.) =   2.24
  Tc(MIN.) =    7.12
  SUBAREA AREA(ACRES) =     2.04       SUBAREA RUNOFF(CFS) =    8.99
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =      10.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   2.11
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.30  DOWNSTREAM(FEET) =    12.20
  FLOW LENGTH(FEET) =   214.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.13
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =    7.53
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.666
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    0.87   SUBAREA RUNOFF(CFS) =    3.70
  TOTAL AREA(ACRES) =        3.2   TOTAL RUNOFF(CFS) =      13.47
  TC(MIN.) =    7.53

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    12.20  DOWNSTREAM(FEET) =    11.50
  FLOW LENGTH(FEET) =    72.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.44
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.47
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =    7.88
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     622.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.88
  RAINFALL INTENSITY(INCH/HR) =   5.50
  TOTAL STREAM AREA(ACRES) =     3.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.47

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       51.00     5.67        6.805          9.74
      2       13.47     7.88        5.502          3.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       60.69     5.67       6.805
      2       54.71     7.88       5.502

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      60.69   Tc(MIN.) =    5.67
  TOTAL AREA(ACRES) =       12.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    124.00 =    1059.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  11.97   RAIN INTENSITY(INCH/HOUR) =  4.20
  TOTAL AREA(ACRES) =    12.90   TOTAL RUNOFF(CFS) =     10.28

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.97
  RAINFALL INTENSITY(INCH/HR) =   4.20
  TOTAL STREAM AREA(ACRES) =    12.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.28

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    125.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   5.67   RAIN INTENSITY(INCH/HOUR) =  6.80
  TOTAL AREA(ACRES) =     0.58   TOTAL RUNOFF(CFS) =      0.79

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.67
  RAINFALL INTENSITY(INCH/HR) =   6.80
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.79

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.28    11.97        4.201         12.90
      2        0.79     5.67        6.803          0.58

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        5.66     5.67       6.803
      2       10.77    11.97       4.201

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.77   Tc(MIN.) =   11.97
  TOTAL AREA(ACRES) =       13.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    125.00 =    1059.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     37.70
```

REFER TO HYDROCAD CALCULATIONS FOR DETENTION AND MITIGATED PEAK FLOW FROM VAULT 1

MITIGATED PEAK RUNOFF FROM BASIN PR-1

```
  DOWNSTREAM ELEVATION(FEET) =     27.00
  ELEVATION DIFFERENCE(FEET) =     10.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.924
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.377
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.33
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.33

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     27.00  DOWNSTREAM(FEET) =     24.15
  CHANNEL LENGTH THRU SUBAREA(FEET) =   285.00   CHANNEL SLOPE =  0.0100
  CHANNEL BASE(FEET) =   35.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.565
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.55
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   3.07
  Tc(MIN.) =    5.99
  SUBAREA AREA(ACRES) =     1.18       SUBAREA RUNOFF(CFS) =    5.81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       6.99

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.86
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    21.15  DOWNSTREAM(FEET) =    19.35
  FLOW LENGTH(FEET) =   178.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.99
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    6.46
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     563.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.251
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    0.87   SUBAREA RUNOFF(CFS) =    4.08
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =      10.74
  TC(MIN.) =    6.46

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    19.35  DOWNSTREAM(FEET) =    16.62
  FLOW LENGTH(FEET) =   271.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.74
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =    7.11
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     834.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.877
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.79   SUBAREA RUNOFF(CFS) =    7.89
  TOTAL AREA(ACRES) =        4.1   TOTAL RUNOFF(CFS) =      17.98
  TC(MIN.) =    7.11

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.62  DOWNSTREAM(FEET) =    14.64
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.98
  PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =    7.54
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =    1034.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.659
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.88   SUBAREA RUNOFF(CFS) =    7.98
  TOTAL AREA(ACRES) =        6.0   TOTAL RUNOFF(CFS) =      25.30
  TC(MIN.) =    7.54

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    14.64  DOWNSTREAM(FEET) =    12.66
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.47
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.30
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    7.94
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =    1234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    206.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.477
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.88   SUBAREA RUNOFF(CFS) =    7.72
  TOTAL AREA(ACRES) =        7.8   TOTAL RUNOFF(CFS) =      32.20
  TC(MIN.) =    7.94

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    12.66  DOWNSTREAM(FEET) =    10.68
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.02
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.20
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =    8.30
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    207.00 =    1434.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    207.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.318
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    1.88   SUBAREA RUNOFF(CFS) =    7.50
  TOTAL AREA(ACRES) =        9.7   TOTAL RUNOFF(CFS) =      38.77
  TC(MIN.) =    8.30

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    10.68  DOWNSTREAM(FEET) =     8.70
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.28
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.77
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =    8.66
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    208.00 =    1632.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.176
  *USER SPECIFIED(SUBAREA):
  GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    3.75   SUBAREA RUNOFF(CFS) =   14.56
  TOTAL AREA(ACRES) =       13.5   TOTAL RUNOFF(CFS) =      52.29
  TC(MIN.) =    8.66

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     8.70  DOWNSTREAM(FEET) =     7.20
  FLOW LENGTH(FEET) =   107.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.55
```

REFER TO HYDROCAD CALCULATIONS FOR DETENTION AND MITIGATED PEAK FLOW FROM VAULT 2

```
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.29
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    8.81
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    209.00 =    1739.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    209.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  37.51   RAIN INTENSITY(INCH/HOUR) =  2.01
  TOTAL AREA(ACRES) =    13.50   TOTAL RUNOFF(CFS) =      4.17

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    210.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   37.51
  RAINFALL INTENSITY(INCH/HR) =   2.01
  TOTAL STREAM AREA(ACRES) =    13.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.17

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   8.81   RAIN INTENSITY(INCH/HOUR) =  5.12
  TOTAL AREA(ACRES) =     3.24   TOTAL RUNOFF(CFS) =      3.32

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.81
  RAINFALL INTENSITY(INCH/HR) =   5.12
  TOTAL STREAM AREA(ACRES) =     3.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.32

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   8.81   RAIN INTENSITY(INCH/HOUR) =  5.12
  TOTAL AREA(ACRES) =     0.72   TOTAL RUNOFF(CFS) =      0.74

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.81
  RAINFALL INTENSITY(INCH/HR) =   5.12
  TOTAL STREAM AREA(ACRES) =     0.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.74

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.17    37.51        2.011         13.50
```

```
    2        3.32     8.81        5.119          3.24
    3        0.74     8.81        5.119          0.72

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1         5.04     8.81       5.119
    2         5.04     8.81       5.119
    3         5.76    37.51       2.011

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.76   Tc(MIN.) =   37.51
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =    1739.00 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       17.5  TC(MIN.) =     37.51
  PEAK FLOW RATE(CFS)   =       5.76
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

MITIGATED PEAK RUNOFF FROM BASIN PR-2

Summary of Post-Development Flows (Mitigated)

Peak Runoff Generated (At Northwest Corner)
Total Area = 587,757 sf (PR-1) → 13.49 Acres
Q_{100} = 10.8 cfs < 37.2 cfs in the existing condition

Peak Runoff Generated (At Northwest Corner)
Total Area = 759,423 sf (PR-2) → 17.43 Acres
Q_{100} = 5.8 cfs < 6.2 cfs in the existing condition

Peak Runoff Generated (At Northwest Corner)
Total Area = 18,395 sf (PR-3) → 0.43 Acres
Q_{100} = 1.4 cfs < 2.4 cfs in the existing condition

3.4 Hydromodification Analysis

Refer to the project Storm Water Quality Management Plan (SWQMP) prepared by Pasco, Laret, Suiter & Associates under separate cover for discussion of hydromodification management strategy and compliance to satisfy the requirements of the MS4 Permit.

3.5 Storm Water Pollutant Control

To meet the requirements of the MS4 Permit, the storm water treatment facilities are designed to treat onsite storm water pollutants contained in the volume of runoff from a 24-hour, 85th percentile storm event by infiltrating runoff through an engineered soil layer. Refer to the project Storm Water Quality Management Plan (SWQMP) prepared by Pasco, Laret, Suiter & Associates under separate cover for discussion of pollutant control.

3.6 Pipe Flow Capacity

24” @ 1.0% Pipe Capacity at (3/4 full) Q = 20.63 cfs
30” @ 1.0% Pipe Capacity at (3/4 full) Q = 37.41 cfs
36” @ 1.0% Pipe Capacity at (3/4 full) Q = 60.84 cfs

3.6.1 Benet Road Storm Drain Capacity

As mentioned previously in sections 1.2 and 1.3 of the report, Basins EX-2 and PR-2 discharge from the subject property towards the southwest corner of the site. From here, runoff continues south down Benet Road before entering an existing grated inlet on the south side of Eddie Jones Road. Runoff is then collected in a 30” RCP storm drain pipe sloped at 1.0% which then transitions to a 36” RCP storm drain pipe as shown as Line “A-1” on drawing R-9918. This line runs west under Benet Road prior to outletting to the San Luis Rey River not far downstream.

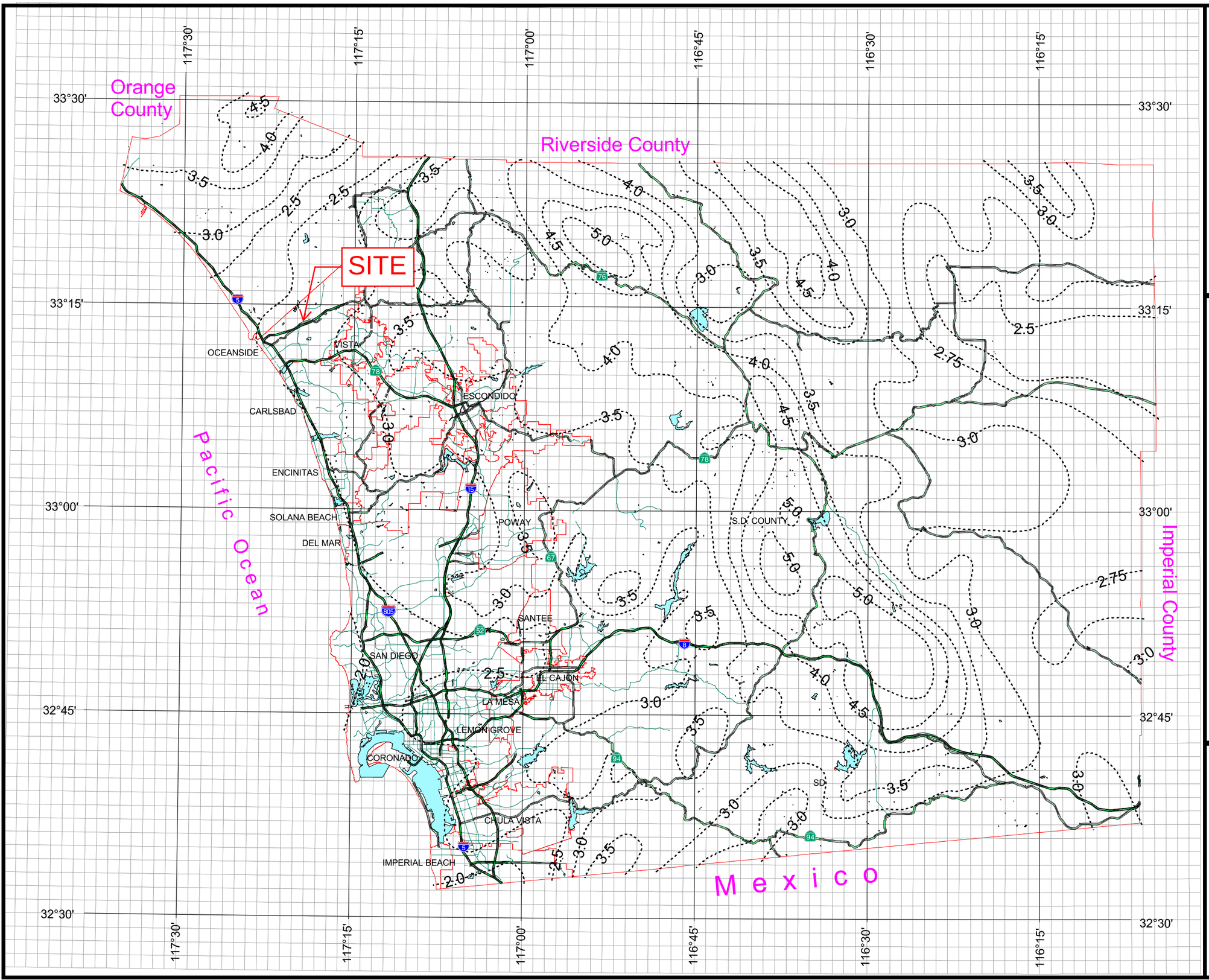
To analyze the impact of the proposed development on this system, the limits of the analysis were contained to the portions of the site within the proposed disturbed area to compare peak flows entering this system in the pre-project and post-developed conditions. A further delineation of the overall drainage basin discharging to this existing storm drain network outside the limits of the project scope was not performed at this time. This assumes the existing system to be adequately sized to handle the total drainage basin reaching this location in the pre-project location, and ensures that any impact of the proposed development and unmitigated increase in peak flows generated to this point of discharge are mitigated onsite to pre-project conditions prior to leaving the subject property.

APPENDIX A

Hydrology Support Material

County of San Diego Hydrology Manual

Rainfall Isopluvials



100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

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3 0 3 Miles

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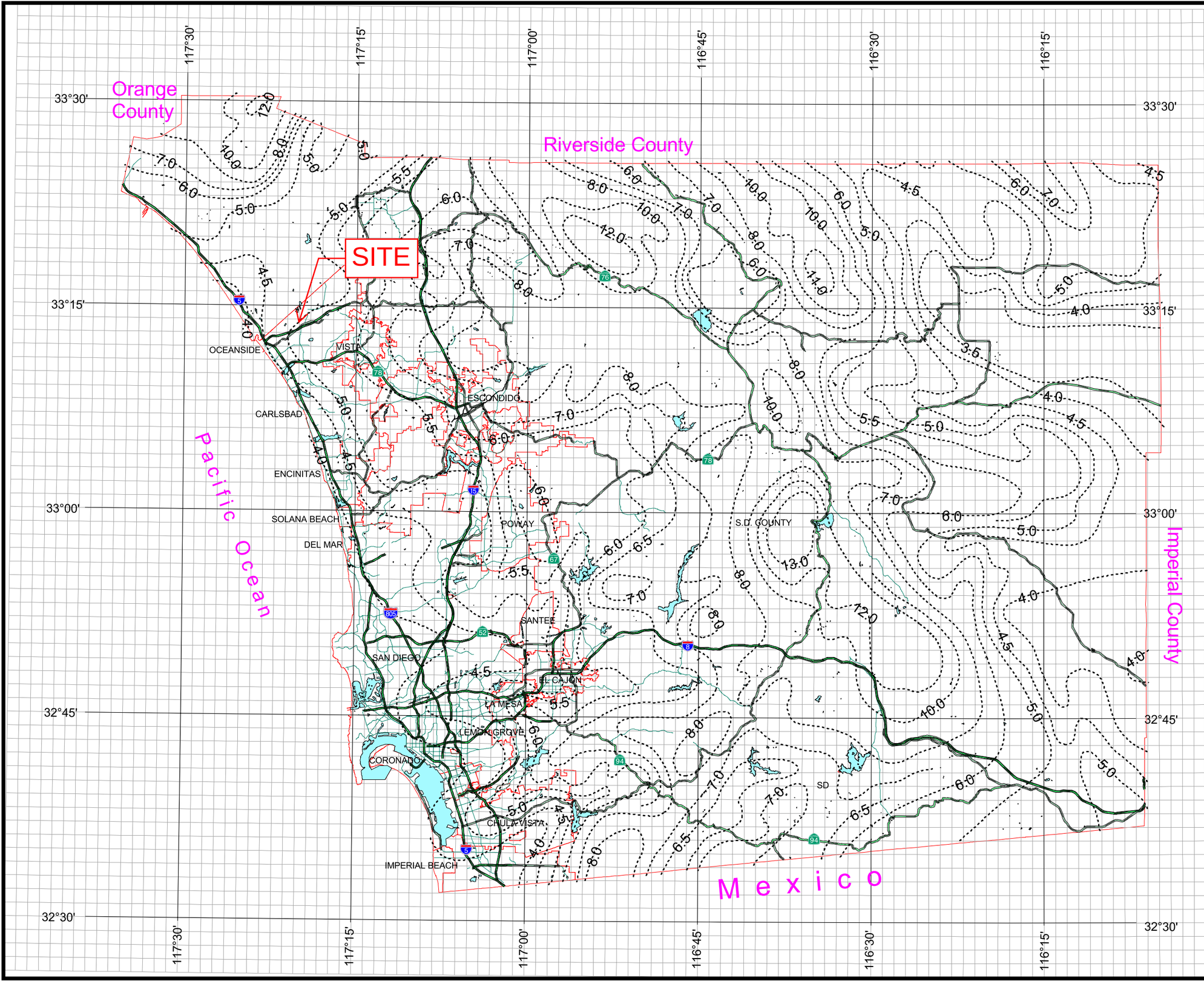
County of San Diego Hydrology Manual

Rainfall Isopluvials



100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

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3 0 3 Miles

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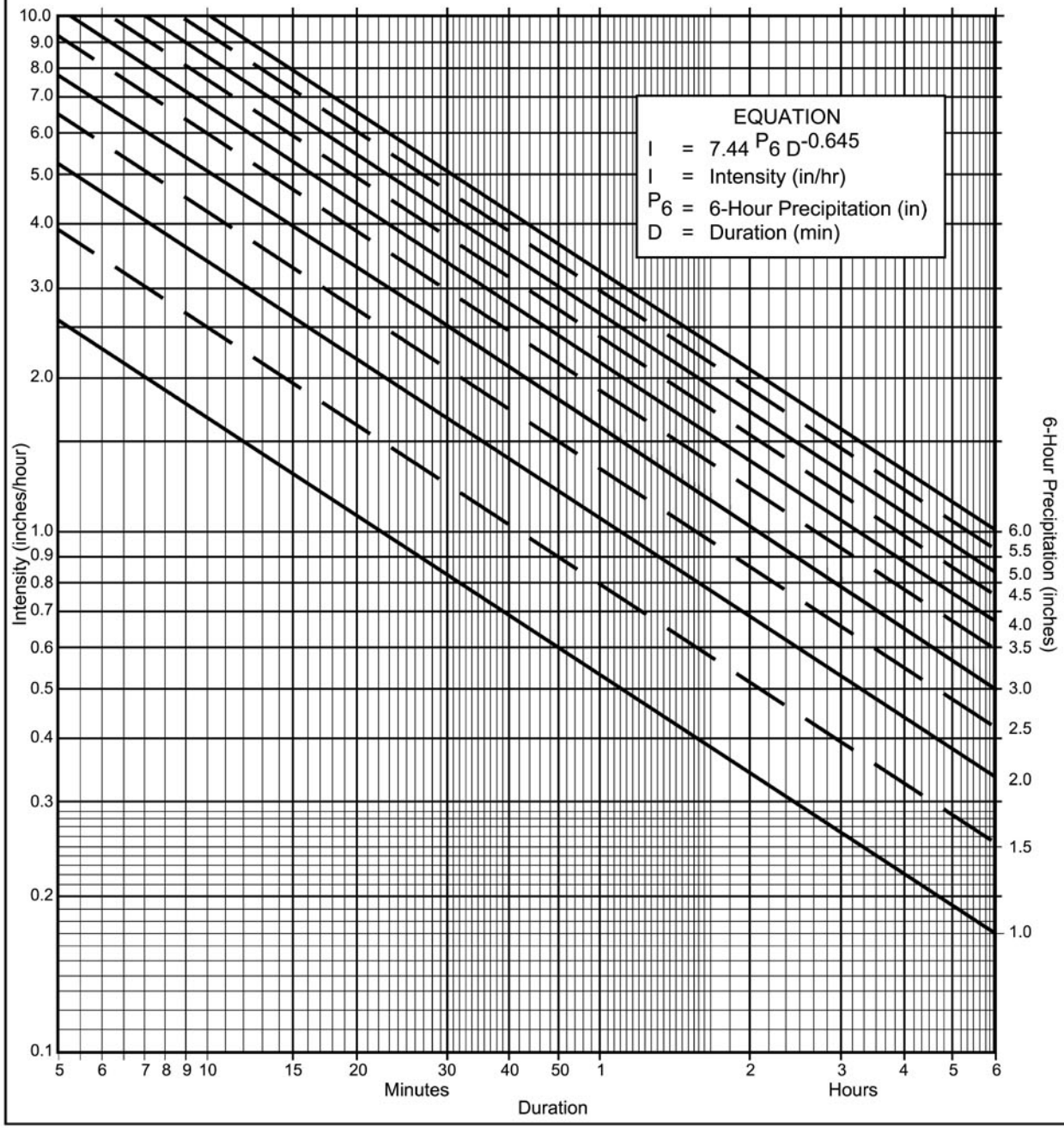


Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency _____ year

(b) P_6 = 2.8 in., P_{24} = 5.0 , $\frac{P_6}{P_{24}}$ = 56 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.8 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

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

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

Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

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

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

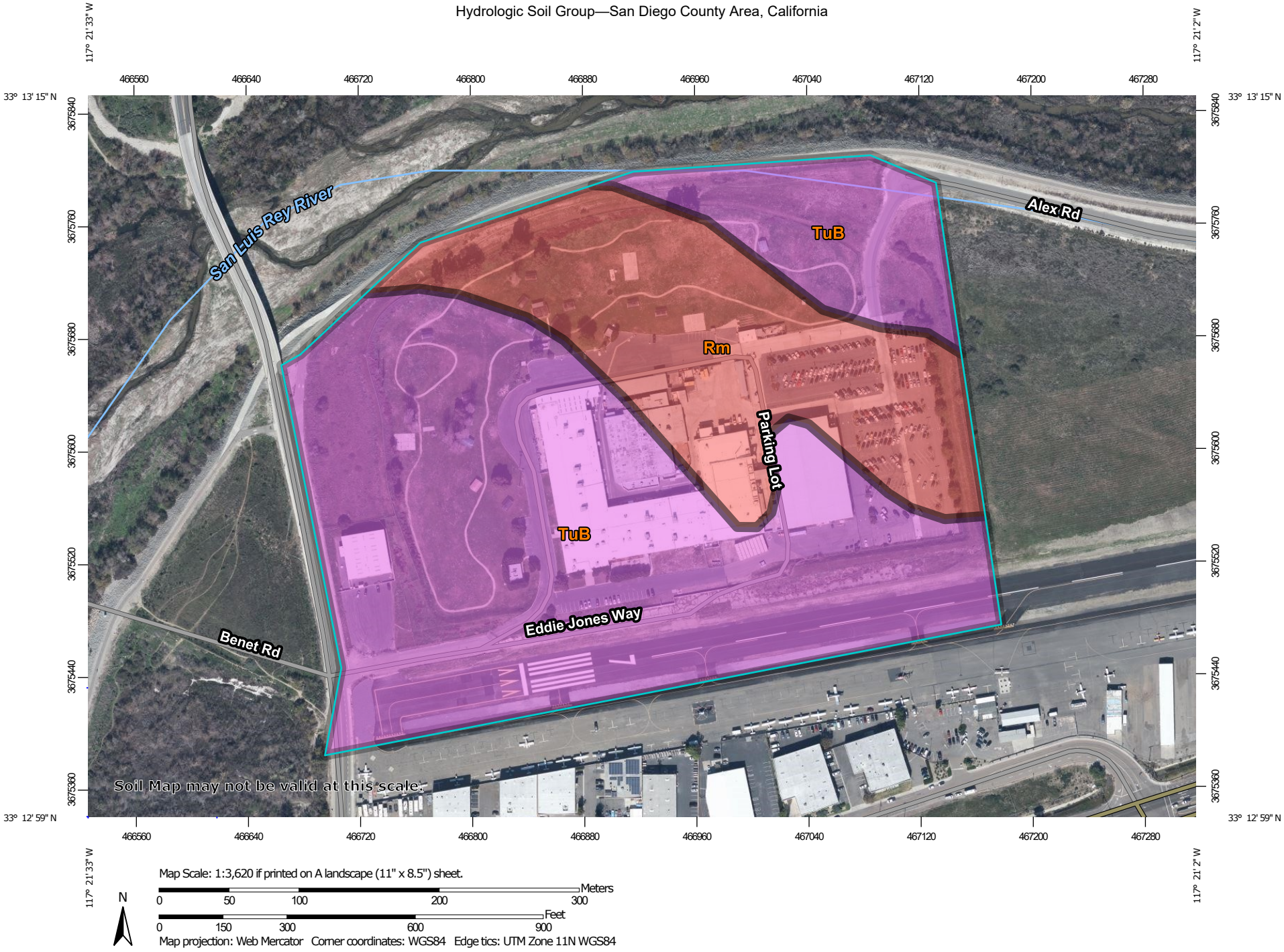
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved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

Table 3-2

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

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

*See Table 3-1 for more detailed description



Map Scale: 1:3,620 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 24, 2020—Feb 12, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Rm	Riverwash	D	11.8	29.0%
TuB	Tujunga sand, 0 to 5 percent slopes	A	28.8	71.0%
Totals for Area of Interest			**40.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

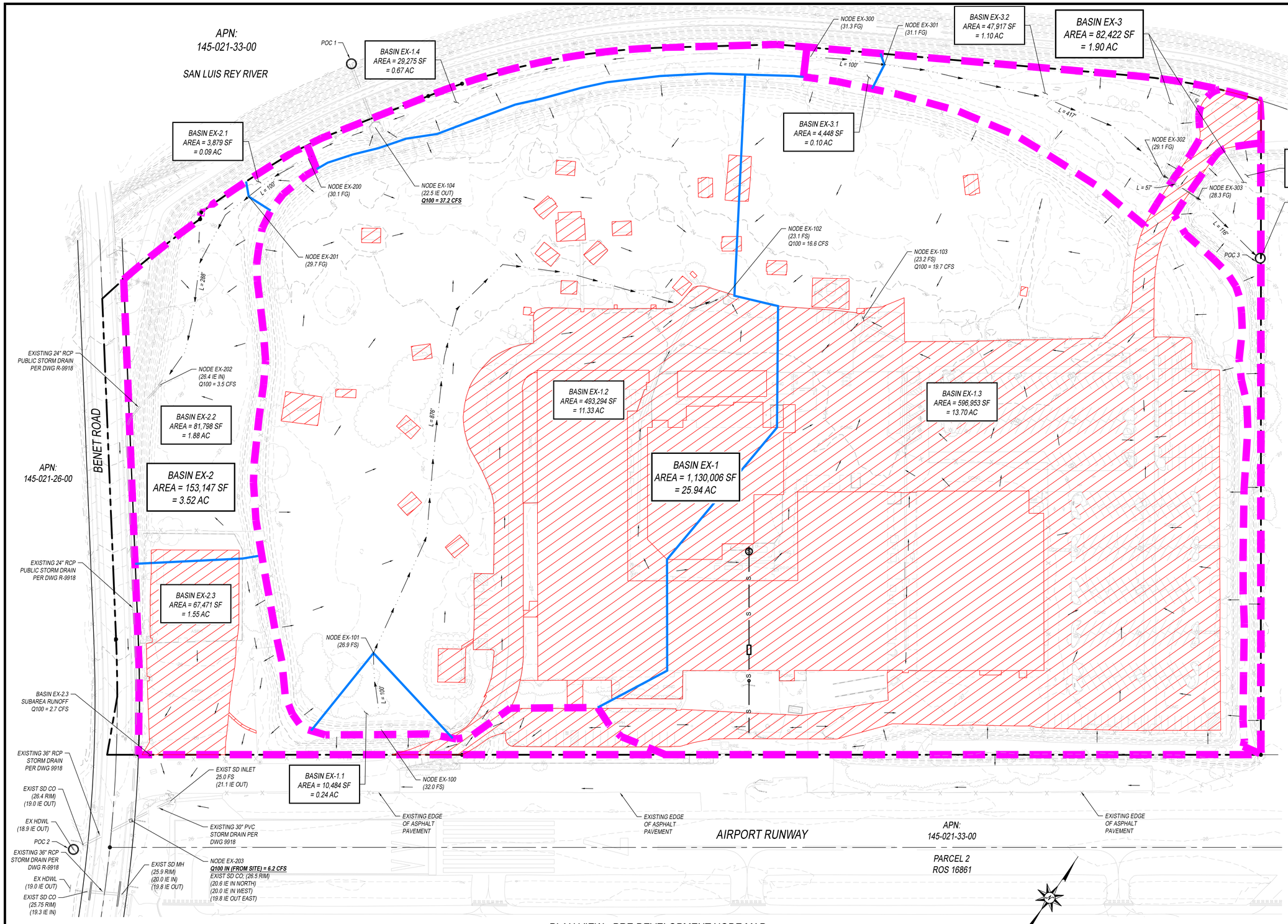
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition



PLAN VIEW - PRE DEVELOPMENT NODE MAP

SCALE: 1" = 60' HORIZONTAL

GRAPHIC SCALE: 1" = 60'

60 0 60 120 180

LEGEND

PROPERTY BOUNDARY	
CENTERLINE OF ROAD	
ADJACENT PROPERTY LINE / RIGHT-OF-WAY	
EXISTING CONTOUR LINE	84
EXISTING PATH OF TRAVEL	
EXISTING DIRECTION OF FLOW	
EXISTING IMPERVIOUS AREA	
MAJOR DRAINAGE BASIN BOUNDARY	
SUB DRAINAGE BASIN BOUNDARY	

DISTURBED AREA - AREA CALCS

TOTAL SITE AREA	1,384,577 SF (31.79 AC)
DRAINAGE AREA TOTAL AREA	1,365,575 SF (31.35 AC)
TOTAL EXISTING IMPERVIOUS AREA	591,152 SF (13.57 AC)
TOTAL EXISTING PERVIOUS AREA	774,215 SF (17.77 AC)
% IMPERVIOUS	43.3%
Cn	0.50

BASIN EX-1 - AREA CALCULATIONS

BASIN EX-1 TOTAL AREA	1,130,006 SF (25.94 AC)
Cn	0.50
Tc	21.6 MIN
Q100	37.2 CFS

BASIN EX-2 - AREA CALCULATIONS

BASIN EX-2 TOTAL AREA	153,147 SF (3.52 AC)
Cn	0.50
Tc	15.6 MIN
Q100	6.2 CFS

BASIN EX-3 - AREA CALCULATIONS

BASIN EX-3 TOTAL AREA	82,422 SF (1.90 AC)
Cn	0.50
Tc	26.7 MIN
Q100	2.4 CFS

EXISTING HYDROLOGY EXHIBIT

250 EDDIE JONES WAY - CITY OF OCEANSIDE
SCALE: 1" = 60' HORIZONTAL

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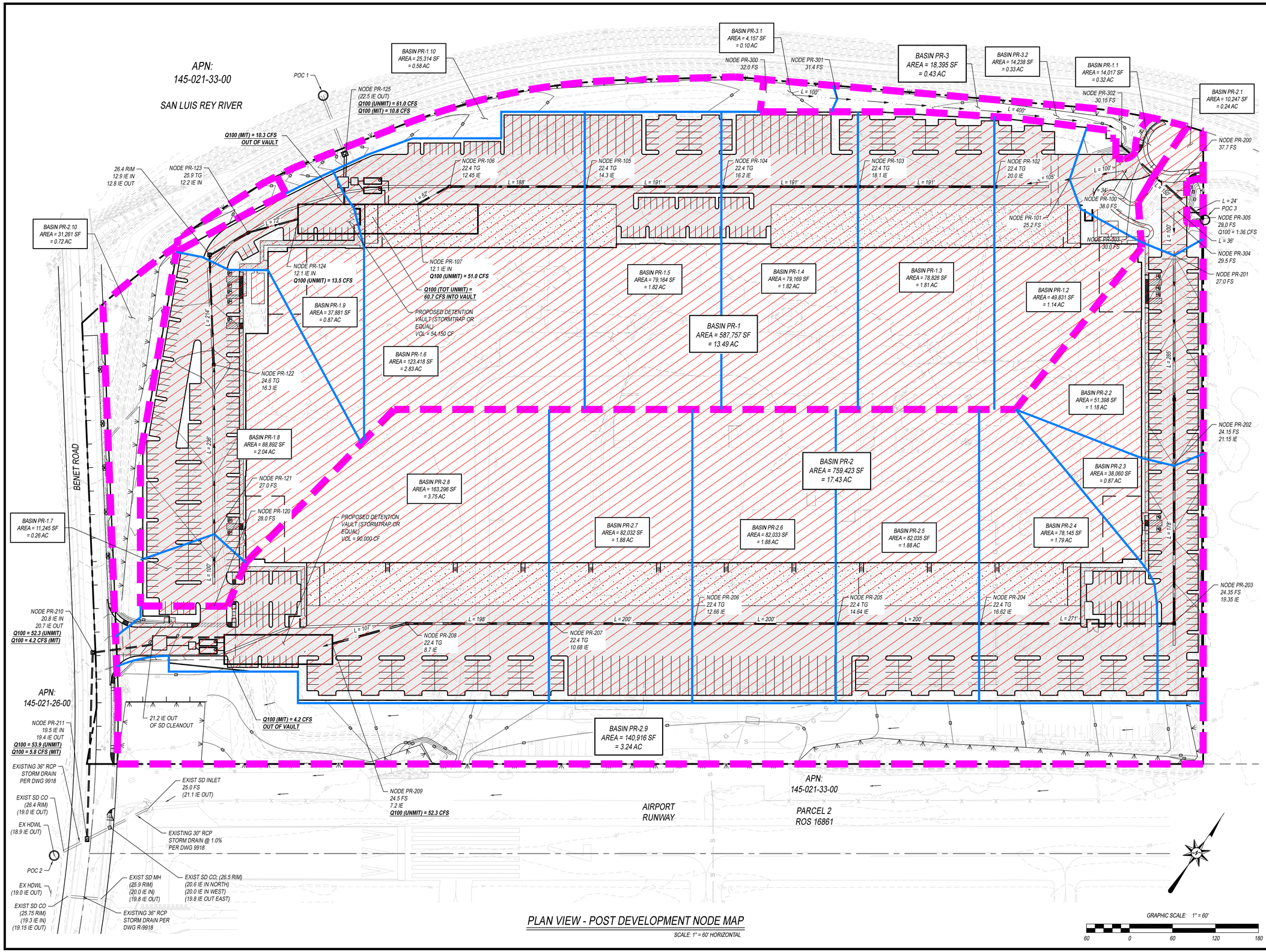
PLSA 3751



PLAN VIEW - POST DEVELOPMENT NODE MAP

SCALE: 1" = 60' HORIZONTAL

GRAPHIC SCALE: 1" = 60'

60 0 60 120 180

LEGEND

- PROPERTY BOUNDARY
- CENTERLINE OF ROAD
- ADJACENT PROPERTY LINE / RIGHT-OF-WAY
- EXISTING CONTOUR LINE
- EXISTING PATH OF TRAVEL
- PROPOSED DIRECTION OF FLOW
- PROPOSED IMPERVIOUS AREA
- MAJOR DRAINAGE BASIN BOUNDARY
- SUB DRAINAGE BASIN BOUNDARY

DISTURBED AREA - AREA CALCS

TOTAL SITE AREA	1,384,577 SF (31.79 AC)
DRAINAGE TOTAL AREA	1,365,575 SF (31.35 AC)
PROPOSED IMPERVIOUS AREA PROPOSED PERVIOUS AREA	1,098,687 SF (25.22 AC) 285,890 SF (6.56 AC)
% IMPERVIOUS	79.4%
Cn	0.75
TIME OF CONCENTRATION	5.0 MINUTES (PER SDCHM)

BASIN PR-1 - AREA CALCULATIONS

BASIN PR-1 TOTAL AREA	587,757 SF (13.49 AC)
Cn	0.75
TIME OF CONCENTRATION Q100	12.0 MINUTES 61.0 CFS (UNMIT) 10.8 CFS (MIT)

BASIN PR-2 - AREA CALCULATIONS

BASIN PR-2 TOTAL AREA	759,423 SF (17.43 AC)
Cn	0.75
TIME OF CONCENTRATION Q100	37.5 MINUTES 53.9 CFS (UNMIT) 5.8 CFS (MIT)

BASIN PR-3 - AREA CALCULATIONS

BASIN PR-3 TOTAL AREA	18,395 SF (0.43 AC)
Cn	0.75
TIME OF CONCENTRATION Q100	11.9 MINUTES 1.4 CFS (UNMIT)

PROPOSED HYDROLOGY EXHIBIT

250 EDDIE JONES WAY - CITY OF OCEANSIDE

SCALE: 1" = 60' HORIZONTAL

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Appendix B

Storm Water Pollutant Control and Detention Calculations

RATIONAL METHOD HYDROGRAPH PROGRAM
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RUN DATE 7/25/2022
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 6 MIN.
6 HOUR RAINFALL 2.8 INCHES
BASIN AREA 12.9 ACRES
RUNOFF COEFFICIENT 0.75
PEAK DISCHARGE 60.69 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 6	DISCHARGE (CFS) = 1.6
TIME (MIN) = 12	DISCHARGE (CFS) = 1.6
TIME (MIN) = 18	DISCHARGE (CFS) = 1.7
TIME (MIN) = 24	DISCHARGE (CFS) = 1.7
TIME (MIN) = 30	DISCHARGE (CFS) = 1.7
TIME (MIN) = 36	DISCHARGE (CFS) = 1.8
TIME (MIN) = 42	DISCHARGE (CFS) = 1.8
TIME (MIN) = 48	DISCHARGE (CFS) = 1.8
TIME (MIN) = 54	DISCHARGE (CFS) = 1.9
TIME (MIN) = 60	DISCHARGE (CFS) = 1.9
TIME (MIN) = 66	DISCHARGE (CFS) = 1.9
TIME (MIN) = 72	DISCHARGE (CFS) = 2
TIME (MIN) = 78	DISCHARGE (CFS) = 2
TIME (MIN) = 84	DISCHARGE (CFS) = 2.1
TIME (MIN) = 90	DISCHARGE (CFS) = 2.1
TIME (MIN) = 96	DISCHARGE (CFS) = 2.2
TIME (MIN) = 102	DISCHARGE (CFS) = 2.3
TIME (MIN) = 108	DISCHARGE (CFS) = 2.3
TIME (MIN) = 114	DISCHARGE (CFS) = 2.4
TIME (MIN) = 120	DISCHARGE (CFS) = 2.4
TIME (MIN) = 126	DISCHARGE (CFS) = 2.5
TIME (MIN) = 132	DISCHARGE (CFS) = 2.6
TIME (MIN) = 138	DISCHARGE (CFS) = 2.7
TIME (MIN) = 144	DISCHARGE (CFS) = 2.8
TIME (MIN) = 150	DISCHARGE (CFS) = 2.9
TIME (MIN) = 156	DISCHARGE (CFS) = 3
TIME (MIN) = 162	DISCHARGE (CFS) = 3.2
TIME (MIN) = 168	DISCHARGE (CFS) = 3.3
TIME (MIN) = 174	DISCHARGE (CFS) = 3.6
TIME (MIN) = 180	DISCHARGE (CFS) = 3.7
TIME (MIN) = 186	DISCHARGE (CFS) = 4
TIME (MIN) = 192	DISCHARGE (CFS) = 4.2
TIME (MIN) = 198	DISCHARGE (CFS) = 4.7
TIME (MIN) = 204	DISCHARGE (CFS) = 4.9
TIME (MIN) = 210	DISCHARGE (CFS) = 5.7
TIME (MIN) = 216	DISCHARGE (CFS) = 6.1
TIME (MIN) = 222	DISCHARGE (CFS) = 7.5
TIME (MIN) = 228	DISCHARGE (CFS) = 8.6
TIME (MIN) = 234	DISCHARGE (CFS) = 12.6
TIME (MIN) = 240	DISCHARGE (CFS) = 20.5
TIME (MIN) = 246	DISCHARGE (CFS) = 60.69
TIME (MIN) = 252	DISCHARGE (CFS) = 10.1
TIME (MIN) = 258	DISCHARGE (CFS) = 6.7
TIME (MIN) = 264	DISCHARGE (CFS) = 5.3
TIME (MIN) = 270	DISCHARGE (CFS) = 4.4
TIME (MIN) = 276	DISCHARGE (CFS) = 3.8
TIME (MIN) = 282	DISCHARGE (CFS) = 3.4
TIME (MIN) = 288	DISCHARGE (CFS) = 3.1
TIME (MIN) = 294	DISCHARGE (CFS) = 2.9
TIME (MIN) = 300	DISCHARGE (CFS) = 2.7
TIME (MIN) = 306	DISCHARGE (CFS) = 2.5
TIME (MIN) = 312	DISCHARGE (CFS) = 2.3
TIME (MIN) = 318	DISCHARGE (CFS) = 2.2
TIME (MIN) = 324	DISCHARGE (CFS) = 2.1
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TIME (MIN) = 336	DISCHARGE (CFS) = 1.9
TIME (MIN) = 342	DISCHARGE (CFS) = 1.8
TIME (MIN) = 348	DISCHARGE (CFS) = 1.8
TIME (MIN) = 354	DISCHARGE (CFS) = 1.7
TIME (MIN) = 360	DISCHARGE (CFS) = 1.7
TIME (MIN) = 366	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM
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RUN DATE 7/25/2022
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 9 MIN.
6 HOUR RAINFALL 2.8 INCHES
BASIN AREA 13.5 ACRES
RUNOFF COEFFICIENT 0.75
PEAK DISCHARGE 52.29 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 9	DISCHARGE (CFS) = 0
TIME (MIN) = 18	DISCHARGE (CFS) = 1.7
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TIME (MIN) = 36	DISCHARGE (CFS) = 1.8
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TIME (MIN) = 54	DISCHARGE (CFS) = 1.9
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TIME (MIN) = 72	DISCHARGE (CFS) = 2
TIME (MIN) = 81	DISCHARGE (CFS) = 2.1
TIME (MIN) = 90	DISCHARGE (CFS) = 2.2
TIME (MIN) = 99	DISCHARGE (CFS) = 2.2
TIME (MIN) = 108	DISCHARGE (CFS) = 2.4
TIME (MIN) = 117	DISCHARGE (CFS) = 2.4
TIME (MIN) = 126	DISCHARGE (CFS) = 2.6
TIME (MIN) = 135	DISCHARGE (CFS) = 2.7
TIME (MIN) = 144	DISCHARGE (CFS) = 2.9
TIME (MIN) = 153	DISCHARGE (CFS) = 3
TIME (MIN) = 162	DISCHARGE (CFS) = 3.2
TIME (MIN) = 171	DISCHARGE (CFS) = 3.4
TIME (MIN) = 180	DISCHARGE (CFS) = 3.8
TIME (MIN) = 189	DISCHARGE (CFS) = 4
TIME (MIN) = 198	DISCHARGE (CFS) = 4.6
TIME (MIN) = 207	DISCHARGE (CFS) = 5
TIME (MIN) = 216	DISCHARGE (CFS) = 6.1
TIME (MIN) = 225	DISCHARGE (CFS) = 6.9
TIME (MIN) = 234	DISCHARGE (CFS) = 10.1
TIME (MIN) = 243	DISCHARGE (CFS) = 13.1
TIME (MIN) = 252	DISCHARGE (CFS) = 52.29
TIME (MIN) = 261	DISCHARGE (CFS) = 8.1
TIME (MIN) = 270	DISCHARGE (CFS) = 5.4
TIME (MIN) = 279	DISCHARGE (CFS) = 4.3
TIME (MIN) = 288	DISCHARGE (CFS) = 3.6
TIME (MIN) = 297	DISCHARGE (CFS) = 3.1
TIME (MIN) = 306	DISCHARGE (CFS) = 2.8
TIME (MIN) = 315	DISCHARGE (CFS) = 2.5
TIME (MIN) = 324	DISCHARGE (CFS) = 2.3
TIME (MIN) = 333	DISCHARGE (CFS) = 2.1
TIME (MIN) = 342	DISCHARGE (CFS) = 2
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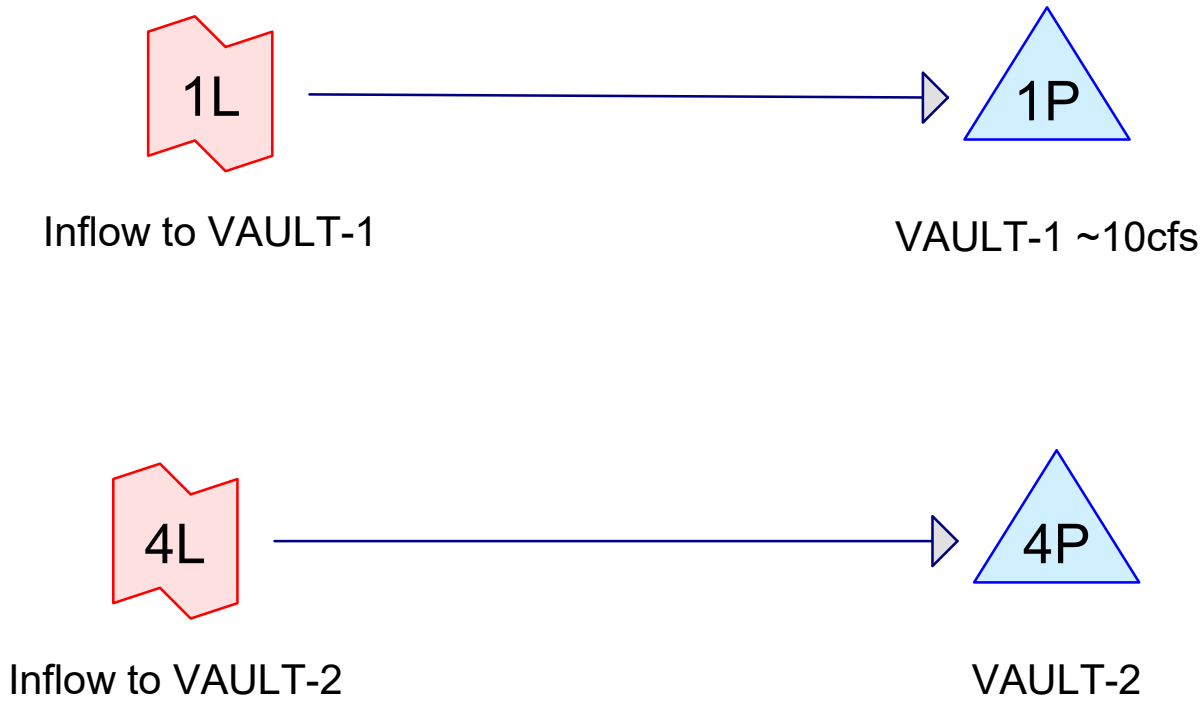
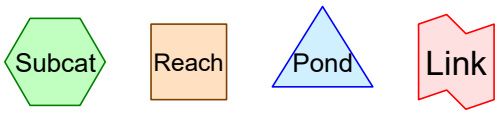




Routing Diagram for 3751
Prepared by Pasco Laret Suiter & Assoc, Printed 7/27/2022
HydroCAD® 10.20-2d s/n 10097 © 2021 HydroCAD Software Solutions LLC

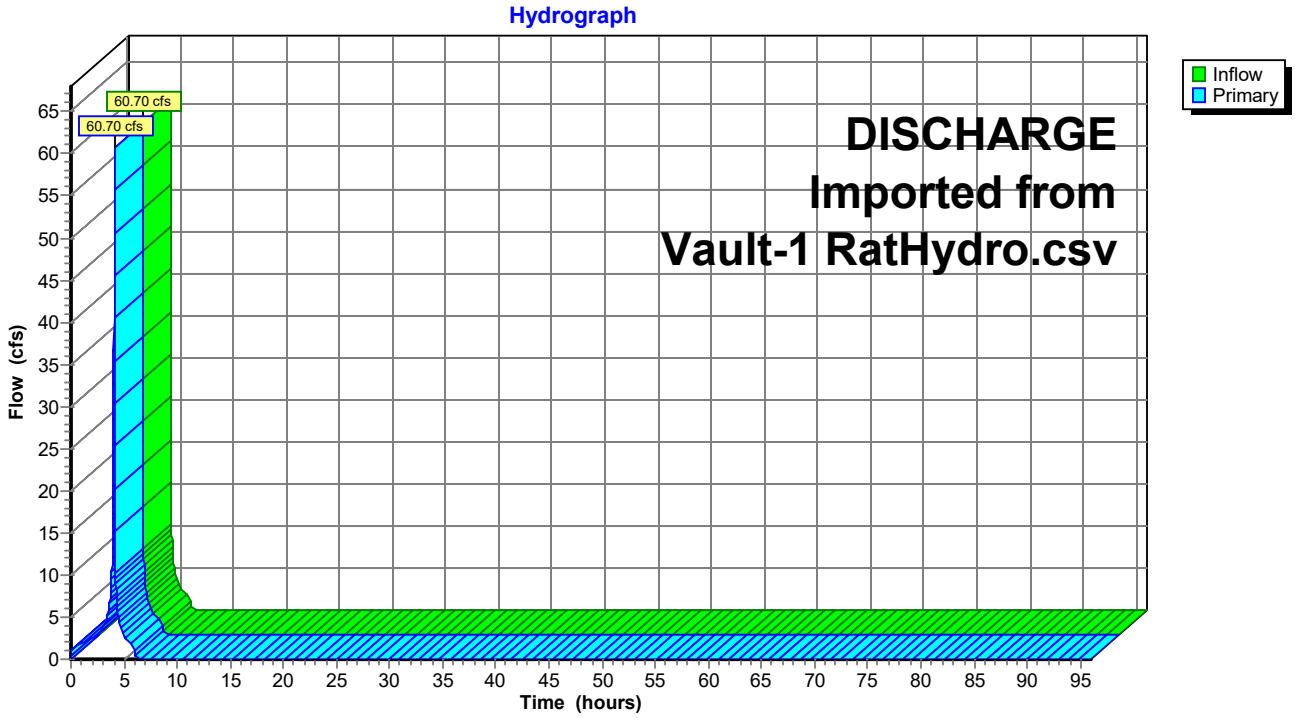
Summary for Link 1L: Inflow to VAULT-1

Inflow = 60.70 cfs @ 4.10 hrs, Volume= 2.243 af
Primary = 60.70 cfs @ 4.10 hrs, Volume= 2.243 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : VAULT-1 ~10cfs

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

DISCHARGE Imported from Vault-1 RatHydro.csv

Link 1L: Inflow to VAULT-1



Summary for Pond 1P: VAULT-1 ~10cfs

Inflow	=	60.70 cfs @	4.10 hrs, Volume=	2.243 af	
Outflow	=	10.28 cfs @	4.20 hrs, Volume=	2.242 af,	Atten= 83%, Lag= 6.3 min
Primary	=	10.28 cfs @	4.20 hrs, Volume=	2.242 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 107.35' @ 4.20 hrs Surf.Area= 10,000 sf Storage= 66,193 cf

Plug-Flow detention time= 407.6 min calculated for 2.242 af (100% of inflow)
Center-of-Mass det. time= 408.1 min (621.1 - 213.0)

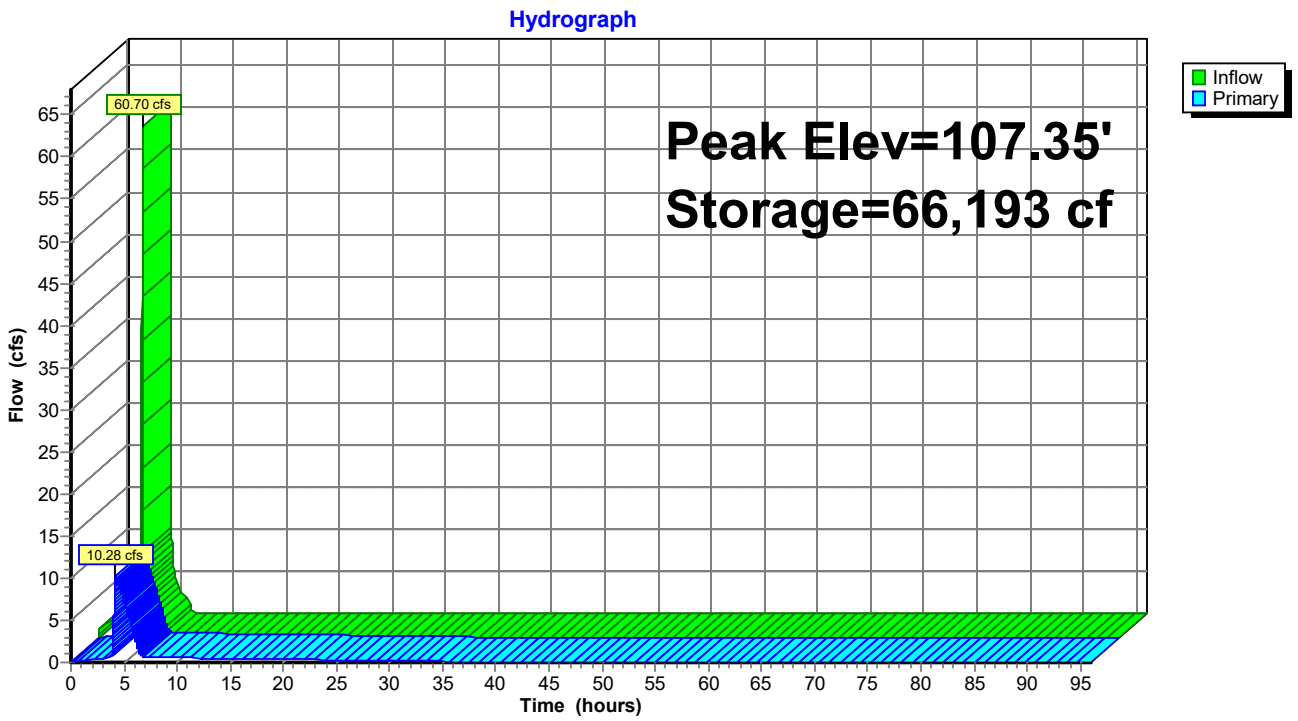
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	74,970 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
100.00	10,000	0.0	0	0	10,000
101.00	10,000	90.0	9,000	9,000	10,354
102.00	10,000	90.0	9,000	18,000	10,709
103.00	10,000	90.0	9,000	27,000	11,063
104.00	10,000	90.0	9,000	36,000	11,418
104.20	10,000	90.0	1,800	37,800	11,489
105.00	10,000	90.0	7,200	45,000	11,772
106.00	10,000	90.0	9,000	54,000	12,127
107.00	10,000	90.0	9,000	63,000	12,481
107.33	10,000	90.0	2,970	65,970	12,598
108.00	10,000	90.0	6,030	72,000	12,836
108.33	10,000	90.0	2,970	74,970	12,953

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.00" Round Culvert** L= 10.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 4.91 sf
#2	Device 1	100.00'	**3.40" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	104.20'	**13.00" W x 6.00" H Vert. Orifice X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	107.33'	**Custom Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 1.00 Width (feet) 25.00 25.00 0.00

Primary OutFlow Max=9.99 cfs @ 4.20 hrs HW=107.35' (Free Discharge)
└─**1=Culvert** (Passes 9.99 cfs of 72.99 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.82 cfs @ 12.93 fps)
  ├─**3=Orifice** (Orifice Controls 8.89 cfs @ 8.20 fps)
  └─**4=Custom Weir** (Weir Controls 0.29 cfs @ 0.50 fps)

Pond 1P: VAULT-1 ~10cfs



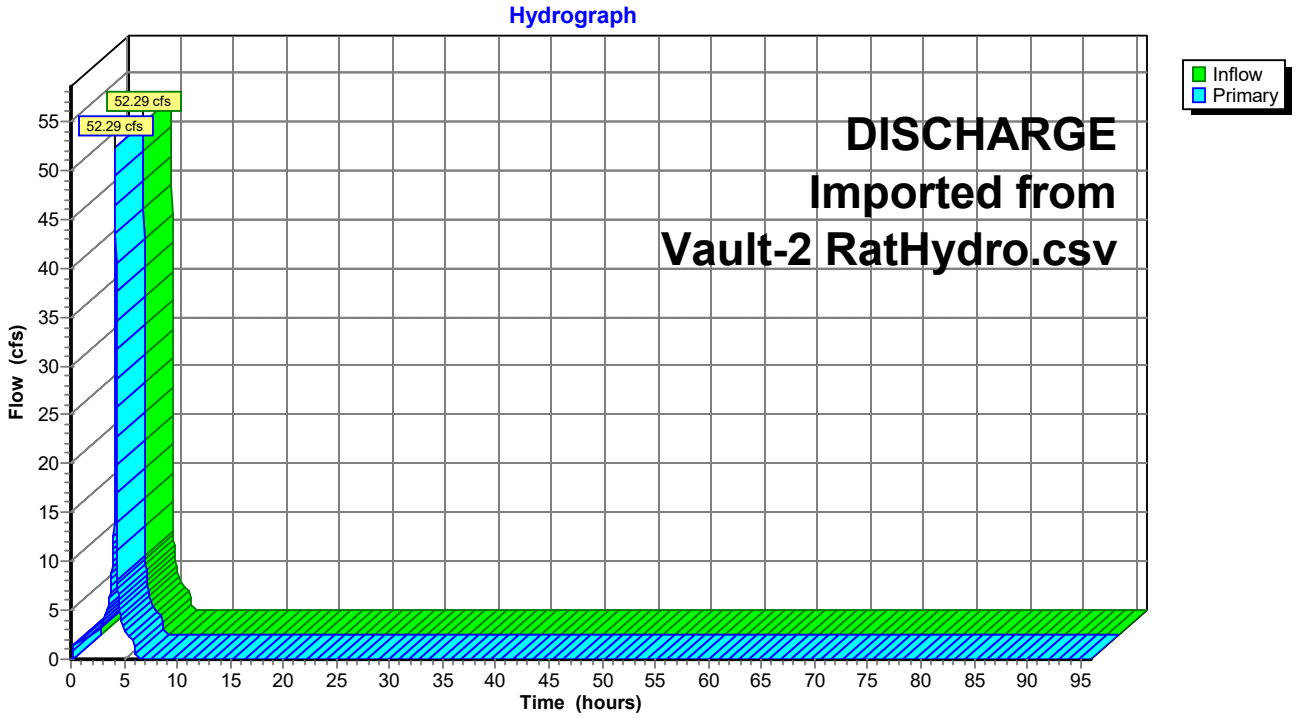
Summary for Link 4L: Inflow to VAULT-2

Inflow = 52.29 cfs @ 4.20 hrs, Volume= 2.329 af
Primary = 52.29 cfs @ 4.20 hrs, Volume= 2.329 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 4P : VAULT-2

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

DISCHARGE Imported from Vault-2 RatHydro.csv

Link 4L: Inflow to VAULT-2



Summary for Pond 4P: VAULT-2

Inflow	=	52.29 cfs @	4.20 hrs, Volume=	2.329 af	
Outflow	=	4.17 cfs @	4.68 hrs, Volume=	2.329 af,	Atten= 92%, Lag= 28.7 min
Primary	=	4.17 cfs @	4.68 hrs, Volume=	2.329 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 113.98' @ 4.68 hrs Surf.Area= 6,000 sf Storage= 75,508 cf

Plug-Flow detention time= 492.0 min calculated for 2.329 af (100% of inflow)
Center-of-Mass det. time= 491.9 min (711.1 - 219.2)

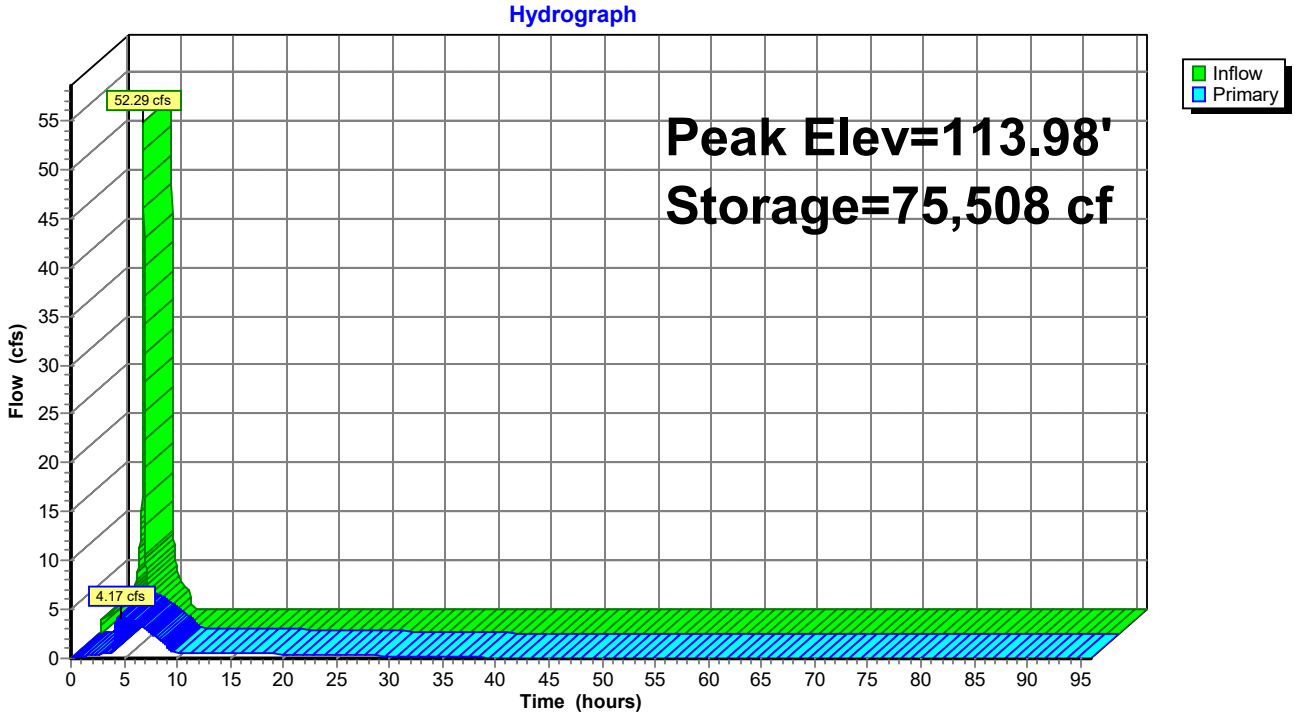
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	81,000 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
100.00	6,000	0.0	0	0	6,000
101.00	6,000	90.0	5,400	5,400	6,275
102.00	6,000	90.0	5,400	10,800	6,549
103.00	6,000	90.0	5,400	16,200	6,824
104.00	6,000	90.0	5,400	21,600	7,098
105.00	6,000	90.0	5,400	27,000	7,373
106.00	6,000	90.0	5,400	32,400	7,648
107.00	6,000	90.0	5,400	37,800	7,922
107.20	6,000	90.0	1,080	38,880	7,977
108.00	6,000	90.0	4,320	43,200	8,197
109.00	6,000	90.0	5,400	48,600	8,471
110.00	6,000	90.0	5,400	54,000	8,746
111.00	6,000	90.0	5,400	59,400	9,020
112.00	6,000	90.0	5,400	64,800	9,295
113.00	6,000	90.0	5,400	70,200	9,570
114.00	6,000	90.0	5,400	75,600	9,844
115.00	6,000	90.0	5,400	81,000	10,119

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**24.00" Round Culvert** L= 10.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	100.00'	**3.00" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	107.20'	**19.00" W x 2.00" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 1	114.00'	**Custom Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 1.00 Width (feet) 20.00 20.00 0.00

Primary OutFlow Max=4.17 cfs @ 4.68 hrs HW=113.98' (Free Discharge)
└─**1=Culvert** (Passes 4.17 cfs of 68.13 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.88 cfs @ 17.92 fps)
  ├─**3=Orifice** (Orifice Controls 3.29 cfs @ 12.46 fps)
  └─**4=Custom Weir** (Controls 0.00 cfs)

Pond 4P: VAULT-2



Vault Drawdown Calculation - Vault-1

Project Name Eddie Jones

Project No 3751 Date: 7/27/2022

Vault Drawdown	**35.7**	**hrs**

Note: Drawdown time is calculated assuming an initial water surface depth equal to the invert of the lowest surface discharge opening in the basin outlet structure.

Underdrain Orifice Diameter:	**3.4**	in
C:	**0.6**	

Surface Depth (ft)	Volume (cf)	$Q_{orifice}$ (cfs)	ΔT (hr)	Total Time (hr)
4.20	37800.00	0.611	0.00	0.00
3.00	27000.00	0.513	5.34	5.34
2.00	18000.00	0.414	5.40	10.73
1.00	9000.00	0.281	7.20	17.93
0.00	0.00	0.000	17.79	35.72

Vault Drawdown Calculation - Vault-2

Project Name Eddie Jones

Project No 3751 Date: 7/27/2022

Vault Drawdown	**35.48**	**hrs**

Note: Drawdown time is calculated assuming an initial water surface depth equal to the invert of the lowest surface discharge opening in the basin outlet structure.

Underdrain Orifice Diameter:	**3**	in
C:	**0.6**	

Surface Depth (ft)	Volume (cf)	$Q_{orifice}$ (cfs)	ΔT (hr)	Total Time (hr)
7.20	38880.00	0.628	0.00	0.00
6.00	32400.00	0.573	3.00	3.00
5.00	27000.00	0.522	2.74	5.74
4.00	21600.00	0.465	3.04	8.78
3.00	16200.00	0.401	3.47	12.25
2.00	10800.00	0.323	4.14	16.39
1.00	5400.00	0.221	5.51	21.90
0.00	0.00	0.000	13.58	35.48