DRAINAGE STUDY
FOR
MAPLE CANYON RESTORATION
PHASE I

(100% DESIGN SUBMITTAL)

Job Number 18022-F

April 4, 2019
Revised: June 21, 2019

RICK™
ENGINEERING COMPANY

DRAINAGE STUDY

FOR

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(100% SUBMITTAL)

Job Number 18022-F

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DRAINAGE STUDY
FOR
MAPLE CANYON RESTORATION PHASE I

REVISION PAGE

June 21, 2019

This drainage study presents a revision (and supersedes entirely) the previous report titled: “Drainage Study for Maple Canyon Restoration Phase I,” dated April 4, 2019. This revision page has been prepared in order to address revisions made to the project following the draft submittal.

- Hydrologic and hydraulic analysis was conducted for the newly proposed Systems 16 and 17.
- Pipeflow analysis was revised for Systems 2, 5, and 13 to reflect minor updates to plans and profiles.
- Normal depth calculations were conducted to size the proposed channel and low-flow crossing downstream of System 13 as part of the stream restoration effort.
- Drainage exhibits were revised to reflect updates.

1.0 INTRODUCTION

1.1 Project Description

This design report summarizes hydrologic and hydraulic analyses for the proposed Maple Canyon Restoration Phase I (herein referred to as the “project”). This design report supersedes the previously prepared drainage study titled “Drainage Report Maple Canyon” dated December 2016 by AECOM. The project is a restoration project which involves replacement and/or relocation of thirteen (13) storm drain outfalls, analyzing hydrology and hydraulics tributary to the outfall and recommending storm drain and inlet improvements to convey the peak flow. The thirteen (13) storm drain outfall locations were identified as a part of Maple Canyon Watershed Master Plan (WMP). The thirteen (13) storm drain outfalls are categorized into seventeen (17) systems for the purpose of analysis. Refer to Table 1 for the locations of the seventeen (17) systems.

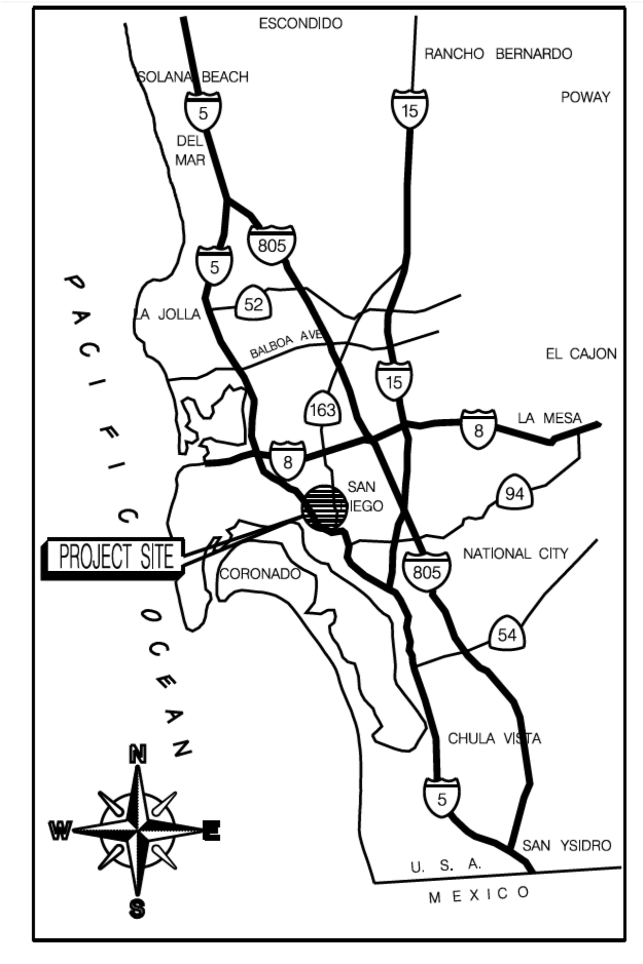
Table 1: Summary of System Locations

System ID	System Location
1	Brant Street and Barnson Place
2	Albatross Street and Olive Street
3	Second Avenue (south of Quince Street)
4	Third Avenue and Quince Street
5	Third Avenue (between Quince Street and Redwood Street)
6	Fourth Avenue and Redwood Street
7	Fourth Avenue and Quince Street
8	Third Avenue and Palm Street
9	Third Avenue (between Olive and Palm Street)
10	Third Avenue and Olive Street
11	Second Avenue and Olive Street
12	First Avenue Pedestrian Bridge
13	First Avenue and Nutmeg Street
14	Front Street (between Nutmeg Street and Maple Street)
15	Albatross Street and Maple Street
16	Curlew Street and Maple Canyon Trail
17	State Street and West Maple Street

1.2 Water Quality

The project is not subject to “Permanent Storm Water Requirements” according to the City of San Diego Storm Water Standards (SWS) Manual, (October 2018). The project does not propose any new impervious surfaces and only includes the removal and replacement of drainage infrastructure (i.e., inlets, storm drains, and outfall energy dissipation). Therefore, the project does not require a Standard Development Project Storm Water Quality Management Plan (SDP SWQMP) or Priority Development Project Storm Water Quality Management Plan (PDP SWQMP).

Figure 1: Vicinity Map



VICINITY MAP
NOT TO SCALE

2.0 HYDROLOGY

Hydrologic conditions for the drainage areas tributary to each storm drain outfall have been analyzed for pre-project and post-project conditions.

2.1 Methodology

The 100-year, 6-hour post-project condition flow rates have been computed using the Modified Rational Method. The hydrologic methodology utilized for the project has been taken from the City of San Diego Drainage Design Manual, dated January 2017. The Rational Method computer program developed by Advanced Engineering Software (AES 2003) was used for this study because it satisfies the City of San Diego's design criteria.

2.2 AES Rational Method Computer Model

The AES hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The AES program has the capability to perform calculations for 15 hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Subarea Hydrologic Processes (Codes)

Code 1: Confluence analysis at node
Code 2: Initial subarea analysis
Code 3: Pipe flow travel time (computer-estimate pipe sizes)
Code 4: Pipe flow travel time (user-specified pipe size)
Code 5: Trapezoidal channel travel time
Code 6: Street flow analysis through a subarea
Code 7: User-specified information at a node
Code 8: Addition of the subarea runoff to mainline
Code 9: V-Gutter flow through subarea

Code 10: Copy mainstream data onto memory bank
Code 11: Confluence a memory bank with the mainstream memory
Code 12: Clear a memory bank
Code 13: Clear the mainstream memory
Code 14: Copy a memory bank onto the mainstream memory
Code 15: Hydrologic data bank storage functions

In order to perform the hydrologic analysis, base information for the study area is required. This information includes the existing drainage facility locations and sizes, existing land uses, flow patterns, drainage basin boundaries, and topographic elevations. Drainage basin boundaries, flow patterns, and topographic elevations are shown on the drainage exhibits located in the map pockets.

2.3 Design Criteria

The hydrologic conditions were analyzed in accordance with the City of San Diego's design criteria as follows:

Design Storm: 100-year, 6-hour
Runoff Coefficients: weighted runoff coefficient
Soil Type: D
Rainfall Intensity: Based on time-intensity criteria per City of San Diego Drainage Design Manual, January 2017

(1) The runoff coefficients selected are presented in, "Table A-1: Runoff Coefficient for Urban Areas" Drainage Design Manual (January 2017). A composite runoff coefficient was calculated for each site.

2.4 Results

The results of the Modified Rational Method analysis for the pre- and post-project Q_{100} flows are provided in Appendices A and B of this report respectively. Please refer Map Pocket 1 and Map Pocket 2 for the drainage area boundaries, nodes, and areas used in the Modified Rational Method analysis under pre-project and post-project conditions, respectively. Since this is a canyon restoration project, the existing impervious area as well as the hydrology of the basins is not anticipated to change. Hence, post-project runoff remains similar to pre-project runoff. A summary of the hydrologic results is provided below in Table 2.

Table 2: Summary of Hydrologic Results

Rational Method Node No.	Q_{100} (cfs)[1]	Proposed Improvements
System 1 – Node 135	8.8	New inlets are being proposed and existing 24-inch CMP is being replaced by 24-inch RCP and extended to a well-defined low point.
System 2 – Node 210	3.0	New inlet is being proposed and existing 18-inch CMP is being replaced by 18-inch RCP and extended to a well-defined low point.
System 3 – Node 315	5.9	New inlet is being proposed and existing 18-inch CMP is being replaced by 18-inch RCP and extended to a well-defined low point.
System 4 – Node 410	2.1	New inlet is being proposed and existing 12-inch CMP is being replaced by 18-inch RCP and extended to a well-defined low point.
System 5 – Node 515	1.4	New inlet is being proposed and existing 14-inch dual concrete culvert is being replaced by 18-inch RCP and extended to a well-defined low point.
System 6 – Node 685	54.7	New inlets are being proposed and existing 18-inch CMP is being replaced by 42-inch RCP and extended to a well-defined low point.
System 7 – Node 745	5.7	New inlets are being proposed and existing 15-inch Metal SD is being replaced by 18-inch RCP and extended to a well-defined low point.
System 8 – Node 850	12.9	Rip-rap of existing SDD-105 is being replaced.
System 9 – Node 910	1.1	New inlet is being proposed and existing 12-inch PVC is being replaced by 18-inch RCP and extended to a well-defined low point.
System 10 – Node 1020	4.6	New inlets are being proposed and existing 10-inch CMP is being replaced by 18-inch RCP and extended to a well-defined low point.

Rational Method Node No.	**Q_{100} (cfs)[1]**	**Proposed Improvements**
System 11 – Node 1110	1.8	Extending the existing 18-inch RCP to a well-defined low point.
System 12 – Node 1210	5.1	New inlet is being proposed and existing 12-inch PVC is being replaced by 18-inch RCP and extended to a well-defined low point.
System 13 – Node 1315 Node 1345	36.8 41.9	Inlets are being replaced and the existing 12- and 18-inch RCP are being replaced with 36-inch RCP.
System 14 –Node 1410	5.6	New inlet and 18-inch RCP storm drain are being proposed.
System 15 – Node 1530	36.9	New inlets are being proposed and existing 18-inch CMP is being replaced by 36-inch RCP and extended to a well-defined low point.
System 16 – Node 1610	8.8	Inlet is being replaced and the existing 18-inch CMP is being replaced by an 18-inch RCP.
System 17 – Node 040	186.7	New storm drain is being proposed along Maple Street and tying into the existing 36-inch RCP storm drain but is intended to tie into the ultimate condition storm drain as proposed by Maple Canyon Watershed Master Plan.

Notes

1. Q_{100}, per AES Rational Method. Refer to Appendix A.

3.0 HYDRAULICS

3.1 Hydraulic Methodology and Criteria

The 100-year post-project peak flow rates determined using the Modified Rational Method were used for inlet sizing, storm drain sizing, energy dissipater design, and normal depth channel capacity for the proposed channel restoration downstream of System 13. AES Pipe Flow Hydraulics computer program was used to analyze hydraulic losses that occur within the proposed storm drain system to determine the hydraulic grade lines (HGLs).

3.2 Inlet Design

Inlet design calculations were completed using a spreadsheet based on the following equations from Chapter 3 of the City of San Diego Drainage Design Manual (January 2017) for grated inlets in a sump:

Curb Inlets on Grade

$$Q/L_T = 0.7\ (a+y)^{3/2}$$

Where: Q = interception capacity of the curb inlet (cfs)

y = depth of flow approaching the curb inlet (ft; maximum of $y = 0.4$)

a = depth of depression of curb at inlet (ft; use $a = 0.33$)

L_T = length of clear opening of inlet for total interception (ft)

Curb Inlets in Sump

<u>Curb Inlet Capacity Operating as Shallow Depth Weir</u>

$$Q = C_w L_w d^{3/2}$$

Where: Q = inlet capacity of the curb inlet, in cubic feet per second (cfs)

C_w = weir coefficient (3.0)

L_w = weir length, in feet (ft)

d = flow depth approaching inlet, in feet (ft)

Curb Inlet Capacity Operating as Orifice

$$Q = 0.67hL(2gd_0)^{1/2}$$

$$d_0 = (y+a) - (h/2) \sin \Theta$$

Where: Q = inlet capacity of the curb inlet, in cubic feet per second (cfs)

h = curb opening height (ft)

L = curb opening height

g = gravitational acceleration (32.2 ft/s^2)

d_0 = flow depth above inlet, in feet (ft)

y = depth of flow in adjacent gutter, in feet (ft)

a = curb inlet depression

(h/2)SinΘ =adjustment for curb inlet throat width (h) and angle of throat incline Θ

The capacity of the curb inlet on grade as a weir and orifice was calculated and the conservative of the two results were used to size the inlet. The depth of flow in the adjacent gutter (y) was calculated using Federal Highway Administration (FHWA) Hydraulic Toolbox, Version 2.1 and then used as an input in the spreadsheet. Combination inlets were proposed in areas where there are utility conflicts to provide enhance the interception capacity. The combination inlets were sized using Federal Highway Administration (FHWA) Hydraulic Toolbox, Version 2.1.

Inlet Results

The inlet design calculations along with back-up information are provided in Appendix D. Inlets were sized for the 100-year storm event for the governing (maximum) condition. Each inlet was sized to provide 100% capture of the flow draining to the inlet (no bypass flow at any inlet), except where bypass flow occurs a downstream inlet was sized to capture the bypass flow. Bypass flows occurred in regions where the contributing area is large (System 6, 13 and 15) and the maximum opening length of 20 feet did not provide 100% capture. Refer to the drainage study map provided in Map Pocket 2 for the location of each inlet.

3.3 Storm Drain Design

As a part of this project, storm drain systems in the canyon were aligned perpendicular to the slope wherever feasible and would outfall near the flowline of the canyon. The jurisdictional waters are a constraint and hence efforts were made so that systems were outside the jurisdictional waters. The storm drain system in the canyon includes an additional cleanout in the middle of the slope, a cleanout near the toe of the slope with an approximate 60-degree angle and a last pipe provided at a flat slope (i.e., approximately 0.5% to 1.0%) to further reduce the velocities prior to the energy dissipater at the outfall.

The proposed storm drains conveying the 100-year storm event were analyzed using AES Pipe Flow based on 100-year peak flow rates estimated by the Modified Rational Method.

AES Pipe Flow

The AES Pipe Flow Hydraulics computer program was used to calculate the hydraulic and energy grade lines for the proposed storm drain systems. The program performs gradually varied flow and pressure flow profile computations. The results are provided in an incremental and summarized form, and indicate reaches of open channel and pressure flow within a given reach of pipe. The program also accounts for losses that may occur due to friction, junction structures, pipe bends, etc. The codes and an explanation of their function are as follows:

Pipe Flow Hydraulic Processes (Codes)

Code 1:	Friction Losses
Code 2:	Manhole Losses
Code 3:	Pipe-bend Losses
Code 4:	Sudden Pipe-enlargement
Code 5:	Junction Losses
Code 6:	Angle-point Losses
Code 7:	Sudden Pipe-reduction
Code 8:	Catch Basin Entrance Losses
Code 9:	Transition Losses

The storm drain system will be constructed of Reinforced Concrete (RCP) or equivalent. The Manning's roughness coefficient “n” used for the hydraulic calculations for RCP is 0.013.

Pipe Flow Results

The AES Pipe Flow computer outputs for the post-project condition are provided in Appendix D of this report. Node numbering used in the AES Pipe Flow computer analyses corresponds to the rational method node numbering used on the drainage study map, located in Map Pocket 2.

Specifically, AES Pipe Flow analysis was completed for System 17 to reflect the immediate post project condition and the ultimate condition. The immediate post project condition proposes a 48-inch RCP along Maple Street tying into an existing 36-inch RCP. The ultimate condition, as reflected in the WMP, proposes a 48-inch RCP tying into a proposed 96-inch RCP along State Street. The results of the AES Pipe Flow analysis for both of the above described conditions are included in Appendix D.

3.4 Energy Dissipater Design

Rip-rap Energy Dissipater (SDD-104)

Energy dissipater (i.e. riprap) at the storm drain outfall will be specified using the City of San Diego – Standard Drawing Supplemental to Regional Standard Drawing (“D” Series) drawing number SDD-104, which provides rock classifications for design velocities entering riprap outfalls.

The design velocity was determined from both the AES Pipe Flow hydraulic analyses for flow in the final reach of storm drain pipe leading to the outfall, and HEC-RAS hydraulic analyses for flow across the riprap pad immediately downstream of the outfall. The AES Pipe Flow hydraulic analyses were used to determine the velocities of flow exiting the pipe at the outfall location and the HEC-RAS hydraulic analyses were used to determine the velocity of flow across the riprap pad and exiting the downstream end of the riprap pad.

HEC-RAS cross sections were taken at 1-foot intervals across the riprap pad in order to determine the location of the hydraulic jump that is expected to occur on the riprap pad. The flow regime after the hydraulic jump is subcritical flow at normal depth, and the flow velocity after the hydraulic jump is expected to be less than 5 feet per second. The riprap pad length was then specified to be 5 feet past where the velocity is less than 5 feet per second. The riprap pad width is based on City of San Diego Regional Standard Drawing Riprap Energy Dissipation, drawing number SDD-104.

Concrete Energy Dissipater (SDD-105)

Concrete Energy dissipater at the storm drain outfalls will be specified using the City of San Diego – Standard Drawing Supplemental to Regional Standard Drawing ("D" Series) drawing number SDD-105. Please refer to civil plans for the details of the SDD-105.

The design velocity of the SDD 105 should not exceed more than 35 fps based on the City of San Diego Standard Drawing (2018). Hence, the design velocity was determined from the AES Pipe Flow hydraulic analysis for flow in the final reach of the storm drain pipes leading to the outfalls. For System 6, the velocity into the proposed SDD-105 exceeds 35 fps as listed on the standard drawings. We recommend additional coordination with the City of San Diego Transportation and Storm Water (TSW) Department to determine whether this is an acceptable approach or whether further modifications to the design and layout are required for the final design submittal.

Assuming, the flow off of all the proposed SDD-105 are subcritical and the flow weirs on to the riprap, the weir equation was used to calculate the depth (H) of the weir flow. The area of the weir (A) was then calculated and used to determine the velocity off of each of the dissipater (V=Q/A). Based on the exit velocity, the downstream riprap rock class was estimated using Table 200-1.7 of "The Whitebook" (2018 Edition).

Energy Dissipater Results

Rip-rap energy dissipater (SDD-104) has been proposed for majority of the systems which include Systems 1, 2, 3, 4, 5, 7, 9, 10, 11, 12, 15. Concrete energy dissipater (SDD-105) has been provided for Systems 6 and 13 due to the location of the outfall. The structure will be recessed into the slope and will not plainly visible to community members using the trails within the canyon, as was expressed by community members. System 8 has an existing SDD-105 that will remain in place but the riprap pad at the end of the SDD-105 will be replaced.

The energy dissipater design calculations are presented in Appendix E. The dimensions and size of the dissipaters specified meet or exceed the requirements indicated on SDD-105. The final energy dissipater dimensions are shown on the grading plans.

3.5 Channel Capacity Analysis

Normal Depth

Normal depth calculations were conducted to size the proposed channel downstream of System 13. The depth of flow in the channels was calculated using FHWA Hydraulic Toolbox, Version 2.1.

Channel Capacity Results

The results of the normal depth hydraulic calculations using Hydraulic Toolbox for the post-project condition are provided in Appendix F. An exceedance graph for the low-water crossing is also provided and reflects which storm will overtop the low-water crossing under various roughness values.

4.0 FEMA FLOODPLAIN

Portions of Maple Canyon and the surrounding streets downstream of the canyon, specifically Maple Street, Dove Street, and State Street, are identified by FEMA FIRM Panel 06073C1885G to be in a Zone A floodplain. It is understood that the improvements associated with the Phase 2 project include grading of the canyon and the installation of pre-cast concrete block grade control structures to flatten the effective slope of the canyon. It is recommended that detailed hydraulic analysis, via HECRAS or similar software, be performed for the proposed Phase 2 improvements to ensure compliance with FEMA NFIP regulations and the City of San Diego Floodplain ordinance.

5.0 CONCLUSION

This design report summarizes the design approach and criteria utilized to address drainage components of this storm drain replacement project. The 100-year pre- and post-project condition hydrologic analyses have been performed. The 100-year post-project peak flow rates were utilized to size the proposed drainage system. The peak discharge rates were determined using the Modified Rational Method based on the hydrologic methodology and criteria described in the City of San Diego, Drainage Design Manual January 2017 edition.

Since this is a storm drain replacement project, existing impervious area as well as the hydrology of the basins is not anticipated to change. Hence, post-project runoff remains similar to pre-project runoff.

The 100-year, post-project peak flow rates were utilized to size the proposed drainage systems. The HGLs were determined for the proposed storm drain systems. Concrete energy dissipaters (SDD-105) have been proposed at the outfall locations to help reduce exit velocities from the outfall to non-erosive conditions. The dimensions and size of riprap (downstream of SDD-105) specified meets or exceeds the requirements indicated on SDD-105.

The project is not subject to “Permanent Storm Water Requirements” according to the City of San Diego Storm Water Standards (SWS) Manual, (October 2018). There are no proposed impervious surfaces and it only includes the removal and replacement of drainage infrastructure (i.e., inlets, storm drains, and outfall energy dissipation). Therefore, the project does not require a Standard Development Project Storm Water Quality Management Plan (SDP SWQMP) or Priority Development Project Storm Water Quality Management Plan (PDP SWQMP).

APPENDIX A

Modified Rational Method Analyses (100-year, 6-hour)
[Pre-project Condition]

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 0 CANYON HYDROLOGY                                                *
 **************************************************************************

  FILE NAME: MCPRE0.RAT
  TIME/DATE OF STUDY: 14:45 05/08/2019
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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 =  0.10 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      0.00 TO NODE      5.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
```

```
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   110.00
 UPSTREAM ELEVATION(FEET) =    283.00
 DOWNSTREAM ELEVATION(FEET) =    281.00
 ELEVATION DIFFERENCE(FEET) =      2.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.867
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.36
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
 FLOW PROCESS FROM NODE      5.00 TO NODE    695.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    281.00  DOWNSTREAM(FEET) =    221.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   360.00   CHANNEL SLOPE =  0.1667
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.973
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.98
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.81
 AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   1.25
 Tc(MIN.) =   7.25
 SUBAREA AREA(ACRES) =     1.80       SUBAREA RUNOFF(CFS) =    3.22
 TOTAL AREA(ACRES) =      1.90         PEAK FLOW RATE(CFS) =       3.58

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.18   FLOW VELOCITY(FEET/SEC.) =   5.90
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE    695.00 =   470.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    695.00 TO NODE    695.00 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.) =   7.25
 RAINFALL INTENSITY(INCH/HR) =   3.97
 TOTAL STREAM AREA(ACRES) =     1.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.58

****************************************************************************
 FLOW PROCESS FROM NODE    695.00 TO NODE    695.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  16.92   RAIN INTENSITY(INCH/HOUR) =  2.75
 TOTAL AREA(ACRES) =    21.60   TOTAL RUNOFF(CFS) =     54.72

****************************************************************************
 FLOW PROCESS FROM NODE    695.00 TO NODE    695.00 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.) =  16.92
  RAINFALL INTENSITY(INCH/HR) =   2.75
  TOTAL STREAM AREA(ACRES) =    21.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     54.72

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1        3.58     7.25        3.973          1.90
     2       54.72    16.92        2.746         21.60

  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       41.40     7.25       3.973
     2       57.19    16.92       2.746

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     57.19   Tc(MIN.) =   16.92
  TOTAL AREA(ACRES) =     23.50
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    695.00 =   470.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    695.00 TO NODE    525.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    221.00  DOWNSTREAM(FEET) =    213.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   115.00   CHANNEL SLOPE =  0.0696
  CHANNEL BASE(FEET) =    3.50   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.732
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     57.62
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.31
  AVERAGE FLOW DEPTH(FEET) =   1.01   TRAVEL TIME(MIN.) =   0.19
  Tc(MIN.) =  17.11
  SUBAREA AREA(ACRES) =     0.70       SUBAREA RUNOFF(CFS) =    0.86
  TOTAL AREA(ACRES) =     24.20         PEAK FLOW RATE(CFS) =      58.05

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.02   FLOW VELOCITY(FEET/SEC.) =  10.31
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    525.00 =   585.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    525.00 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.) =  17.11
  RAINFALL INTENSITY(INCH/HR) =   2.73
```

```
  TOTAL STREAM AREA(ACRES) =    24.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     58.05

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    525.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   6.54   RAIN INTENSITY(INCH/HOUR) =  4.11
  TOTAL AREA(ACRES) =     0.40   TOTAL RUNOFF(CFS) =      1.41

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    525.00 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.) =   6.54
  RAINFALL INTENSITY(INCH/HR) =   4.11
  TOTAL STREAM AREA(ACRES) =     0.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.41

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       58.05    17.11        2.732         24.20
      2        1.41     6.54        4.107          0.40

  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       40.02     6.54       4.107
      2       58.99    17.11       2.732

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     58.99   Tc(MIN.) =   17.11
  TOTAL AREA(ACRES) =     24.60
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    525.00 =   585.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    755.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    213.00  DOWNSTREAM(FEET) =    199.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   174.00   CHANNEL SLOPE =  0.0805
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.709
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     59.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.48
  AVERAGE FLOW DEPTH(FEET) =   0.85   TRAVEL TIME(MIN.) =   0.28
  Tc(MIN.) =  17.38
```

```
  SUBAREA AREA(ACRES) =     1.10       SUBAREA RUNOFF(CFS) =    1.34
  TOTAL AREA(ACRES) =     25.70         PEAK FLOW RATE(CFS) =      60.33

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.85   FLOW VELOCITY(FEET/SEC.) =  10.57
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    755.00 =   759.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    755.00 TO NODE    755.00 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.) =  17.38
  RAINFALL INTENSITY(INCH/HR) =   2.71
  TOTAL STREAM AREA(ACRES) =    25.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     60.33

****************************************************************************
  FLOW PROCESS FROM NODE    755.00 TO NODE    755.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   9.14   RAIN INTENSITY(INCH/HOUR) =  3.61
  TOTAL AREA(ACRES) =     1.80   TOTAL RUNOFF(CFS) =      5.63

****************************************************************************
  FLOW PROCESS FROM NODE    755.00 TO NODE    755.00 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.) =   9.14
  RAINFALL INTENSITY(INCH/HR) =   3.61
  TOTAL STREAM AREA(ACRES) =     1.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.63

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       60.33    17.38        2.709         25.70
      2        5.63     9.14        3.613          1.80

  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       50.87     9.14       3.613
      2       64.55    17.38       2.709

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     64.55   Tc(MIN.) =   17.38
  TOTAL AREA(ACRES) =     27.50
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    755.00 =   759.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    755.00 TO NODE    430.00 IS CODE =  51
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    199.00  DOWNSTREAM(FEET) =    195.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   133.00   CHANNEL SLOPE =  0.0301
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.686
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     65.04
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.46
  AVERAGE FLOW DEPTH(FEET) =   1.07   TRAVEL TIME(MIN.) =   0.30
  Tc(MIN.) =  17.68
  SUBAREA AREA(ACRES) =     0.80       SUBAREA RUNOFF(CFS) =    0.97
  TOTAL AREA(ACRES) =     28.30         PEAK FLOW RATE(CFS) =      65.52

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.08   FLOW VELOCITY(FEET/SEC.) =   7.45
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    430.00 =   892.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 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.) =  17.68
  RAINFALL INTENSITY(INCH/HR) =   2.69
  TOTAL STREAM AREA(ACRES) =    28.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     65.52

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   6.76   RAIN INTENSITY(INCH/HOUR) =  4.07
  TOTAL AREA(ACRES) =     0.60   TOTAL RUNOFF(CFS) =      2.10

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 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.) =   6.76
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     0.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.10

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       65.52    17.68        2.686         28.30
      2        2.10     6.76        4.066          0.60
```

```
  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       45.38     6.76       4.066
      2       66.91    17.68       2.686

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     66.91   Tc(MIN.) =   17.68
  TOTAL AREA(ACRES) =     28.90
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    430.00 =   892.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    925.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    195.00  DOWNSTREAM(FEET) =    168.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   395.00   CHANNEL SLOPE =  0.0684
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.635
   *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     68.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.39
  AVERAGE FLOW DEPTH(FEET) =   0.96   TRAVEL TIME(MIN.) =   0.63
  Tc(MIN.) =  18.31
  SUBAREA AREA(ACRES) =     3.30       SUBAREA RUNOFF(CFS) =    3.91
  TOTAL AREA(ACRES) =     32.20         PEAK FLOW RATE(CFS) =      70.82

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.97   FLOW VELOCITY(FEET/SEC.) =  10.47
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    925.00 =  1287.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    925.00 TO NODE    925.00 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.) =  18.31
  RAINFALL INTENSITY(INCH/HR) =   2.63
  TOTAL STREAM AREA(ACRES) =    32.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     70.82

****************************************************************************
  FLOW PROCESS FROM NODE    925.00 TO NODE    925.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   6.82   RAIN INTENSITY(INCH/HOUR) =  4.05
  TOTAL AREA(ACRES) =     0.30   TOTAL RUNOFF(CFS) =      1.10

****************************************************************************
  FLOW PROCESS FROM NODE    925.00 TO NODE    925.00 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.) =   6.82
  RAINFALL INTENSITY(INCH/HR) =   4.05
  TOTAL STREAM AREA(ACRES) =     0.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.10

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       70.82    18.31        2.635         32.20
      2        1.10     6.82        4.054          0.30

  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       47.13     6.82       4.054
      2       71.53    18.31       2.635

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     71.53   Tc(MIN.) =   18.31
  TOTAL AREA(ACRES) =     32.50
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    925.00 =  1287.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    925.00 TO NODE    335.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    168.00  DOWNSTREAM(FEET) =    164.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    75.00   CHANNEL SLOPE =  0.0533
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.625
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     71.89
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.64
  AVERAGE FLOW DEPTH(FEET) =   1.05   TRAVEL TIME(MIN.) =   0.13
  Tc(MIN.) =  18.44
  SUBAREA AREA(ACRES) =     0.60       SUBAREA RUNOFF(CFS) =    0.71
  TOTAL AREA(ACRES) =     33.10         PEAK FLOW RATE(CFS) =      72.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.06   FLOW VELOCITY(FEET/SEC.) =   9.62
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    335.00 =  1362.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE    335.00 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.) =  18.44
```

```
  RAINFALL INTENSITY(INCH/HR) =   2.62
  TOTAL STREAM AREA(ACRES) =    33.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     72.24

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE    335.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  11.67   RAIN INTENSITY(INCH/HOUR) =  3.27
  TOTAL AREA(ACRES) =     2.00   TOTAL RUNOFF(CFS) =      5.86

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE    335.00 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.) =  11.67
  RAINFALL INTENSITY(INCH/HR) =   3.27
  TOTAL STREAM AREA(ACRES) =     2.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.86

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       72.24    18.44        2.625         33.10
     2        5.86    11.67        3.266          2.00

  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       63.91    11.67       3.266
     2       76.95    18.44       2.625

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     76.95   Tc(MIN.) =   18.44
  TOTAL AREA(ACRES) =     35.10
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    335.00 =  1362.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE   1045.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    164.00  DOWNSTREAM(FEET) =    161.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    80.00   CHANNEL SLOPE =  0.0375
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   1.500
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.613
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     77.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.98
  AVERAGE FLOW DEPTH(FEET) =   1.26   TRAVEL TIME(MIN.) =   0.15
```

```
  Tc(MIN.) =  18.59
  SUBAREA AREA(ACRES) =     1.20       SUBAREA RUNOFF(CFS) =    1.41
  TOTAL AREA(ACRES) =     36.30         PEAK FLOW RATE(CFS) =      78.36

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.26   FLOW VELOCITY(FEET/SEC.) =   9.01
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1045.00 =  1442.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1045.00 TO NODE   1045.00 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.) =  18.59
  RAINFALL INTENSITY(INCH/HR) =   2.61
  TOTAL STREAM AREA(ACRES) =    36.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     78.36

****************************************************************************
  FLOW PROCESS FROM NODE   1045.00 TO NODE   1045.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   9.70   RAIN INTENSITY(INCH/HOUR) =  3.51
  TOTAL AREA(ACRES) =     1.50   TOTAL RUNOFF(CFS) =      4.53

****************************************************************************
  FLOW PROCESS FROM NODE   1045.00 TO NODE   1045.00 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.) =   9.70
  RAINFALL INTENSITY(INCH/HR) =   3.51
  TOTAL STREAM AREA(ACRES) =     1.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.53

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       78.36    18.59        2.613         36.30
      2        4.53     9.70        3.507          1.50

  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       62.91     9.70       3.507
      2       81.74    18.59       2.613

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     81.74   Tc(MIN.) =   18.59
  TOTAL AREA(ACRES) =     37.80
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1045.00 =  1442.00 FEET.

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

```
  FLOW PROCESS FROM NODE   1045.00 TO NODE   1125.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    161.00  DOWNSTREAM(FEET) =    151.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   182.00   CHANNEL SLOPE =  0.0549
  CHANNEL BASE(FEET) =    7.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.588
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     82.79
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.69
  AVERAGE FLOW DEPTH(FEET) =   0.96   TRAVEL TIME(MIN.) =   0.31
  Tc(MIN.) =  18.90
  SUBAREA AREA(ACRES) =     1.80       SUBAREA RUNOFF(CFS) =    2.10
  TOTAL AREA(ACRES) =     39.60         PEAK FLOW RATE(CFS) =      83.83

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.97   FLOW VELOCITY(FEET/SEC.) =   9.72
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1125.00 =  1624.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1125.00 TO NODE   1125.00 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.) =  18.90
  RAINFALL INTENSITY(INCH/HR) =   2.59
  TOTAL STREAM AREA(ACRES) =    39.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     83.83

****************************************************************************
  FLOW PROCESS FROM NODE   1125.00 TO NODE   1125.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   6.27   RAIN INTENSITY(INCH/HOUR) =  4.16
  TOTAL AREA(ACRES) =     0.50   TOTAL RUNOFF(CFS) =      7.77

****************************************************************************
  FLOW PROCESS FROM NODE   1125.00 TO NODE   1125.00 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.) =   6.27
  RAINFALL INTENSITY(INCH/HR) =   4.16
  TOTAL STREAM AREA(ACRES) =     0.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.77

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       83.83    18.90        2.588         39.60
      2        7.77     6.27        4.159          0.50
```

```
  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       59.93     6.27       4.159
      2       88.67    18.90       2.588

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     88.67   Tc(MIN.) =   18.90
  TOTAL AREA(ACRES) =     40.10
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1125.00 =  1624.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1125.00 TO NODE   1230.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    151.00  DOWNSTREAM(FEET) =    136.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   332.00   CHANNEL SLOPE =  0.0452
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.541
   *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     91.01
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.48
  AVERAGE FLOW DEPTH(FEET) =   1.15   TRAVEL TIME(MIN.) =   0.58
  Tc(MIN.) =  19.49
  SUBAREA AREA(ACRES) =     4.10       SUBAREA RUNOFF(CFS) =    4.69
  TOTAL AREA(ACRES) =     44.20         PEAK FLOW RATE(CFS) =      93.36

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.17   FLOW VELOCITY(FEET/SEC.) =   9.57
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1230.00 =  1956.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1230.00 TO NODE   1230.00 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.) =  19.49
  RAINFALL INTENSITY(INCH/HR) =   2.54
  TOTAL STREAM AREA(ACRES) =    44.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     93.36

****************************************************************************
  FLOW PROCESS FROM NODE   1230.00 TO NODE   1230.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   8.51   RAIN INTENSITY(INCH/HOUR) =  3.73
  TOTAL AREA(ACRES) =     1.60   TOTAL RUNOFF(CFS) =      5.12

****************************************************************************
  FLOW PROCESS FROM NODE   1230.00 TO NODE   1230.00 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.) =   8.51
  RAINFALL INTENSITY(INCH/HR) =   3.73
  TOTAL STREAM AREA(ACRES) =     1.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.12

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       93.36    19.49        2.541         44.20
      2        5.12     8.51        3.733          1.60

  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       68.66     8.51       3.733
      2       96.84    19.49       2.541

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     96.84   Tc(MIN.) =   19.49
  TOTAL AREA(ACRES) =     45.80
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1230.00 =  1956.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1230.00 TO NODE    225.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    136.00  DOWNSTREAM(FEET) =    128.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   388.00   CHANNEL SLOPE =  0.0206
  CHANNEL BASE(FEET) =    4.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.476
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    100.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.11
  AVERAGE FLOW DEPTH(FEET) =   1.60   TRAVEL TIME(MIN.) =   0.91
  Tc(MIN.) =  20.40
  SUBAREA AREA(ACRES) =     5.80       SUBAREA RUNOFF(CFS) =    6.46
  TOTAL AREA(ACRES) =     51.60         PEAK FLOW RATE(CFS) =     103.30

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.63   FLOW VELOCITY(FEET/SEC.) =   7.14
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    225.00 =  2344.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    225.00 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.) =  20.40
  RAINFALL INTENSITY(INCH/HR) =   2.48
  TOTAL STREAM AREA(ACRES) =    51.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    103.30

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    225.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.58   RAIN INTENSITY(INCH/HOUR) =  3.39
  TOTAL AREA(ACRES) =     1.00   TOTAL RUNOFF(CFS) =      2.95

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    225.00 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.) =  10.58
  RAINFALL INTENSITY(INCH/HR) =   3.39
  TOTAL STREAM AREA(ACRES) =     1.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.95

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1      103.30    20.40        2.476        51.60
      2        2.95    10.58        3.386         1.00

  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       78.49    10.58       3.386
      2      105.46    20.40       2.476

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    105.46   Tc(MIN.) =   20.40
  TOTAL AREA(ACRES) =     52.60
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    225.00 =  2344.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE   1355.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    128.00  DOWNSTREAM(FEET) =    121.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   190.00   CHANNEL SLOPE =  0.0368
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   1.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.458
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    108.28
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  10.63
```

```
  AVERAGE FLOW DEPTH(FEET) =   2.35   TRAVEL TIME(MIN.) =   0.30
  Tc(MIN.) =  20.70
  SUBAREA AREA(ACRES) =     5.10       SUBAREA RUNOFF(CFS) =    5.64
  TOTAL AREA(ACRES) =     57.70         PEAK FLOW RATE(CFS) =     111.10

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  2.38   FLOW VELOCITY(FEET/SEC.) =  10.69
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1355.00 =  2534.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1355.00 TO NODE   1355.00 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.) =  20.70
  RAINFALL INTENSITY(INCH/HR) =   2.46
  TOTAL STREAM AREA(ACRES) =    57.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    111.10

****************************************************************************
  FLOW PROCESS FROM NODE   1355.00 TO NODE   1355.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  11.16   RAIN INTENSITY(INCH/HOUR) =  3.32
  TOTAL AREA(ACRES) =    14.60   TOTAL RUNOFF(CFS) =     41.93

****************************************************************************
  FLOW PROCESS FROM NODE   1355.00 TO NODE   1355.00 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.) =  11.16
  RAINFALL INTENSITY(INCH/HR) =   3.32
  TOTAL STREAM AREA(ACRES) =    14.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     41.93

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1      111.10    20.70        2.458         57.70
      2       41.93    11.16        3.322         14.60

  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      124.14    11.16       3.322
      2      142.13    20.70       2.458

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    142.13   Tc(MIN.) =   20.70
  TOTAL AREA(ACRES) =     72.30
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1355.00 =  2534.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE   1355.00 TO NODE   1570.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    121.00  DOWNSTREAM(FEET) =    102.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   561.00   CHANNEL SLOPE =  0.0339
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.401
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    145.31
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.83
  AVERAGE FLOW DEPTH(FEET) =   1.61   TRAVEL TIME(MIN.) =   0.95
  Tc(MIN.) =  21.65
  SUBAREA AREA(ACRES) =     5.90       SUBAREA RUNOFF(CFS) =    6.38
  TOTAL AREA(ACRES) =     78.20         PEAK FLOW RATE(CFS) =     148.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.62   FLOW VELOCITY(FEET/SEC.) =   9.90
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1570.00 =  3095.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1570.00 TO NODE   1570.00 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.) =  21.65
  RAINFALL INTENSITY(INCH/HR) =   2.40
  TOTAL STREAM AREA(ACRES) =    78.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    148.50

****************************************************************************
  FLOW PROCESS FROM NODE   1570.00 TO NODE   1570.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  11.89   RAIN INTENSITY(INCH/HOUR) =  3.24
  TOTAL AREA(ACRES) =    12.90   TOTAL RUNOFF(CFS) =     36.94

****************************************************************************
  FLOW PROCESS FROM NODE   1570.00 TO NODE   1570.00 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.) =  11.89
  RAINFALL INTENSITY(INCH/HR) =   3.24
  TOTAL STREAM AREA(ACRES) =    12.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     36.94

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE   1570.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
```

```
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  14.45   RAIN INTENSITY(INCH/HOUR) =  2.96
  TOTAL AREA(ACRES) =     3.30   TOTAL RUNOFF(CFS) =      8.79

****************************************************************************
  FLOW PROCESS FROM NODE   1570.00 TO NODE   1570.00 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.) =  14.45
  RAINFALL INTENSITY(INCH/HR) =   2.96
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.79

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1      148.50    21.65        2.401         78.20
      2       36.94    11.89        3.242         12.90
      3        8.79    14.45        2.961          3.30

  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      154.95    11.89       3.242
      2      162.97    14.45       2.961
      3      182.99    21.65       2.401

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    182.99   Tc(MIN.) =   21.65
  TOTAL AREA(ACRES) =     94.40
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1570.00 =  3095.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1570.00 TO NODE     10.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    102.00  DOWNSTREAM(FEET) =     91.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   242.00   CHANNEL SLOPE =  0.0455
  CHANNEL BASE(FEET) =    4.50   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.381
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    184.12
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  11.93
  AVERAGE FLOW DEPTH(FEET) =   1.87   TRAVEL TIME(MIN.) =   0.34
  Tc(MIN.) =  21.98
  SUBAREA AREA(ACRES) =     2.10       SUBAREA RUNOFF(CFS) =    2.25
  TOTAL AREA(ACRES) =     96.50         PEAK FLOW RATE(CFS) =     185.24

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.88   FLOW VELOCITY(FEET/SEC.) =  11.93
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE     10.00 =  3337.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE   1615.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    91.00  DOWNSTREAM(FEET) =    90.00
  FLOW LENGTH(FEET) =   100.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.74
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    185.24
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  22.10
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1615.00 =  3437.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1615.00 TO NODE   1615.00 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.) =  22.10
  RAINFALL INTENSITY(INCH/HR) =   2.37
  TOTAL STREAM AREA(ACRES) =    96.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    185.24

****************************************************************************
  FLOW PROCESS FROM NODE   1615.00 TO NODE   1615.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   7.10   RAIN INTENSITY(INCH/HOUR) =  4.00
  TOTAL AREA(ACRES) =     0.70   TOTAL RUNOFF(CFS) =      2.40

****************************************************************************
  FLOW PROCESS FROM NODE   1615.00 TO NODE   1615.00 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.) =   7.10
  RAINFALL INTENSITY(INCH/HR) =   4.00
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1      185.24    22.10        2.374         96.50
      2        2.40     7.10        4.001          0.70

  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      112.32     7.10       4.001
      2      186.66    22.10       2.374

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    186.66   Tc(MIN.) =   22.10
  TOTAL AREA(ACRES) =     97.20
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1615.00 =  3437.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     97.20  TC(MIN.) =     22.10
  PEAK FLOW RATE(CFS)   =    186.66
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

♀
```

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                   2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                         Analysis prepared by:

                        RICK ENGINEERING COMPANY
                            5620 Friars Road
                      San Diego, California 92110
                    619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 1                                                                 *
 **************************************************************************

  FILE NAME: MCPRE1.RAT
  TIME/DATE OF STUDY: 10:29 11/16/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    105.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    252.00
  DOWNSTREAM ELEVATION(FEET) =    250.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.119
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  250.00  DOWNSTREAM ELEVATION(FEET) =  196.00
  STREET LENGTH(FEET) =  1079.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.21
    HALFSTREET FLOOD WIDTH(FEET) =    5.20
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.03
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
  STREET FLOW TRAVEL TIME(MIN.) =   5.93   Tc(MIN.) =  11.93
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.238
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    3.58
  TOTAL AREA(ACRES) =      1.40        PEAK FLOW RATE(CFS) =       3.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   6.99
  FLOW VELOCITY(FEET/SEC.) =  3.42   DEPTH*VELOCITY(FT*FT/SEC.) =   0.84
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =  1164.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    115.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  196.00  DOWNSTREAM ELEVATION(FEET) =  191.00
  STREET LENGTH(FEET) =   323.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.70
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    9.73
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.27
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   2.37   Tc(MIN.) =  14.30
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.978
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    1.52
  TOTAL AREA(ACRES) =      2.00        PEAK FLOW RATE(CFS) =       5.45

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.35
  FLOW VELOCITY(FEET/SEC.) =  2.36   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    115.00 =  1487.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    140.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   188.00  DOWNSTREAM(FEET) =   155.00
  FLOW LENGTH(FEET) =   102.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.29
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      5.45
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  14.38
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =  1589.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    140.00 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.) =  14.38
  RAINFALL INTENSITY(INCH/HR) =   2.97
  TOTAL STREAM AREA(ACRES) =     2.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.45

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    125.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
  UPSTREAM ELEVATION(FEET) =    209.00
  DOWNSTREAM ELEVATION(FEET) =    207.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.422
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    135.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  207.00  DOWNSTREAM ELEVATION(FEET) =  191.00
  STREET LENGTH(FEET) =   477.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.21
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.22
    HALFSTREET FLOOD WIDTH(FEET) =    5.82
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.58
  STREET FLOW TRAVEL TIME(MIN.) =   3.05   Tc(MIN.) =   9.05
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.630
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.20      SUBAREA RUNOFF(CFS) =    3.70
  TOTAL AREA(ACRES) =      1.30        PEAK FLOW RATE(CFS) =       4.06

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   7.77
  FLOW VELOCITY(FEET/SEC.) =  2.94   DEPTH*VELOCITY(FT*FT/SEC.) =   0.77
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    135.00 =   572.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    140.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   188.00  DOWNSTREAM(FEET) =   155.00
  FLOW LENGTH(FEET) =    78.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.44
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      4.06
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   9.12
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    140.00 =   650.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    140.00 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.) =   9.12
  RAINFALL INTENSITY(INCH/HR) =   3.62
  TOTAL STREAM AREA(ACRES) =     1.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.06

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.45    14.38        2.968          2.00
      2        4.06     9.12        3.618          1.30

  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        8.54     9.12       3.618
      2        8.79    14.38       2.968

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      8.79   Tc(MIN.) =   14.38
  TOTAL AREA(ACRES) =      3.30
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =  1589.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    145.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   155.00  DOWNSTREAM(FEET) =   103.00
  FLOW LENGTH(FEET) =   118.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  26.00
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.79
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  14.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    145.00 =  1707.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      3.30  TC(MIN.) =     14.45
  PEAK FLOW RATE(CFS)   =      8.79
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 2                                                                 *
 **************************************************************************

  FILE NAME: MCPRE2.RAT
  TIME/DATE OF STUDY: 10:39 11/16/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    200.00 TO NODE    205.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    252.00
  DOWNSTREAM ELEVATION(FEET) =    250.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.119
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    210.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  250.00  DOWNSTREAM ELEVATION(FEET) =  209.00
  STREET LENGTH(FEET) =   795.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.66
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    4.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.89
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
  STREET FLOW TRAVEL TIME(MIN.) =   4.58   Tc(MIN.) =  10.58
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.386
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    2.59
  TOTAL AREA(ACRES) =      1.00        PEAK FLOW RATE(CFS) =       2.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.23   HALFSTREET FLOOD WIDTH(FEET) =   6.05
  FLOW VELOCITY(FEET/SEC.) =  3.26   DEPTH*VELOCITY(FT*FT/SEC.) =   0.74
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    210.00 =   880.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      1.00  TC(MIN.) =     10.58
  PEAK FLOW RATE(CFS)   =      2.95
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

♀
```

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 3                                                                 *
 **************************************************************************

  FILE NAME: MCPRE3.RAT
  TIME/DATE OF STUDY: 10:48 10/25/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160

  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    300.00 TO NODE    305.00 IS CODE =  21
----------------------------------------------------------------------------
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  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    82.00
  UPSTREAM ELEVATION(FEET) =    277.00
  DOWNSTREAM ELEVATION(FEET) =    274.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.645
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    310.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  274.00  DOWNSTREAM ELEVATION(FEET) =  270.00
  STREET LENGTH(FEET) =   460.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  25.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.29
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =   10.38
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.62
  STREET FLOW TRAVEL TIME(MIN.) =   3.89   Tc(MIN.) =   9.89
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.471
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    3.84
  TOTAL AREA(ACRES) =      1.40        PEAK FLOW RATE(CFS) =       4.19

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  13.22
  FLOW VELOCITY(FEET/SEC.) =  2.29   DEPTH*VELOCITY(FT*FT/SEC.) =   0.84
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    310.00 =   542.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    315.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  270.00  DOWNSTREAM ELEVATION(FEET) =  268.00
  STREET LENGTH(FEET) =   220.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00
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  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  25.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =   10.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.06
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
  STREET FLOW TRAVEL TIME(MIN.) =   1.78   Tc(MIN.) =  11.67
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.266
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    1.67
  TOTAL AREA(ACRES) =      2.00        PEAK FLOW RATE(CFS) =       5.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  11.38
  FLOW VELOCITY(FEET/SEC.) =  2.12   DEPTH*VELOCITY(FT*FT/SEC.) =   0.71
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    315.00 =   762.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      2.00  TC(MIN.) =     11.67
  PEAK FLOW RATE(CFS)   =      5.86
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 4                                                                 *
 **************************************************************************

  FILE NAME: MCPRE4.RAT
  TIME/DATE OF STUDY: 10:57 10/25/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160

  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    400.00 TO NODE    405.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    81.00
 UPSTREAM ELEVATION(FEET) =    276.00
 DOWNSTREAM ELEVATION(FEET) =    272.00
 ELEVATION DIFFERENCE(FEET) =      4.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.378
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.36
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
 FLOW PROCESS FROM NODE    405.00 TO NODE    410.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  272.00  DOWNSTREAM ELEVATION(FEET) =  266.60
 STREET LENGTH(FEET) =   140.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 25.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.22
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.22
   HALFSTREET FLOOD WIDTH(FEET) =    5.58
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.07
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.66
 STREET FLOW TRAVEL TIME(MIN.) =   0.76   Tc(MIN.) =   6.76
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.066
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    1.73
 TOTAL AREA(ACRES) =      0.60        PEAK FLOW RATE(CFS) =       2.09

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   7.24
 FLOW VELOCITY(FEET/SEC.) =  3.42   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    410.00 =   221.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =      0.60  TC(MIN.) =      6.76
 PEAK FLOW RATE(CFS)   =      2.09
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                       *
* SYSTEM 5                                                                  *
 **************************************************************************

  FILE NAME: MCPRE5.RAT
  TIME/DATE OF STUDY: 10:47 11/16/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    500.00 TO NODE    505.00 IS CODE =  21
```

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----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    277.00
  DOWNSTREAM ELEVATION(FEET) =    274.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.455
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    510.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  274.00  DOWNSTREAM ELEVATION(FEET) =  268.00
  STREET LENGTH(FEET) =    97.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.15
    HALFSTREET FLOOD WIDTH(FEET) =    2.46
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.01
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.46
  STREET FLOW TRAVEL TIME(MIN.) =   0.54   Tc(MIN.) =   6.54
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.108
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    1.05
  TOTAL AREA(ACRES) =      0.40        PEAK FLOW RATE(CFS) =       1.41

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.18   HALFSTREET FLOOD WIDTH(FEET) =   3.77
  FLOW VELOCITY(FEET/SEC.) =  3.08   DEPTH*VELOCITY(FT*FT/SEC.) =   0.56
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    510.00 =   172.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      0.40  TC(MIN.) =      6.54
  PEAK FLOW RATE(CFS)   =      1.41
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
* POST-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 6                                                                  *
 **************************************************************************

  FILE NAME: MCPRE6.RAT
  TIME/DATE OF STUDY: 14:46 03/27/2019
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    600.00 TO NODE    605.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    96.00
  UPSTREAM ELEVATION(FEET) =    296.00
  DOWNSTREAM ELEVATION(FEET) =    295.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.350
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    610.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  295.00  DOWNSTREAM ELEVATION(FEET) =  287.00
  STREET LENGTH(FEET) =   893.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.30
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   12.46
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.23
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
  STREET FLOW TRAVEL TIME(MIN.) =   6.68   Tc(MIN.) =  12.68
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.155
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    5.10      SUBAREA RUNOFF(CFS) =   13.68
  TOTAL AREA(ACRES) =      5.20        PEAK FLOW RATE(CFS) =      14.03

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.43   HALFSTREET FLOOD WIDTH(FEET) =  16.13
  FLOW VELOCITY(FEET/SEC.) =  2.61   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    610.00 =   989.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    615.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  287.00  DOWNSTREAM ELEVATION(FEET) =  286.00
  STREET LENGTH(FEET) =   347.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      17.04
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.54
    HALFSTREET FLOOD WIDTH(FEET) =   23.45
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.78
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
  STREET FLOW TRAVEL TIME(MIN.) =   3.25   Tc(MIN.) =  15.93
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.826
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.50      SUBAREA RUNOFF(CFS) =    6.00
  TOTAL AREA(ACRES) =      7.70        PEAK FLOW RATE(CFS) =      20.04

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.56   HALFSTREET FLOOD WIDTH(FEET) =  26.11
  FLOW VELOCITY(FEET/SEC.) =  1.84   DEPTH*VELOCITY(FT*FT/SEC.) =   1.04
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    615.00 =  1336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    615.00 TO NODE    675.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  286.00  DOWNSTREAM ELEVATION(FEET) =  276.00
  STREET LENGTH(FEET) =   263.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      21.10
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.48
    HALFSTREET FLOOD WIDTH(FEET) =   18.63
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.93
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.83
  STREET FLOW TRAVEL TIME(MIN.) =   0.74   Tc(MIN.) =  16.67
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.766
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    2.12
  TOTAL AREA(ACRES) =      8.60        PEAK FLOW RATE(CFS) =      22.16

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
  DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  19.02
  FLOW VELOCITY(FEET/SEC.) =  5.98   DEPTH*VELOCITY(FT*FT/SEC.) =   2.90
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    675.00 =  1599.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    675.00 TO NODE    675.00 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.) =  16.67
  RAINFALL INTENSITY(INCH/HR) =   2.77
  TOTAL STREAM AREA(ACRES) =     8.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     22.16

****************************************************************************
  FLOW PROCESS FROM NODE    620.00 TO NODE    621.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    292.00
  DOWNSTREAM ELEVATION(FEET) =    290.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.572
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    621.00 TO NODE    622.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  290.00  DOWNSTREAM ELEVATION(FEET) =  280.00
  STREET LENGTH(FEET) =   867.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.23
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.42
    HALFSTREET FLOOD WIDTH(FEET) =   15.51
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.90
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.21
  STREET FLOW TRAVEL TIME(MIN.) =   4.98   Tc(MIN.) =  10.98
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.343
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    4.80      SUBAREA RUNOFF(CFS) =   13.64
  TOTAL AREA(ACRES) =      4.90        PEAK FLOW RATE(CFS) =      14.00

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.51   HALFSTREET FLOOD WIDTH(FEET) =  20.33
  FLOW VELOCITY(FEET/SEC.) =  3.41   DEPTH*VELOCITY(FT*FT/SEC.) =   1.73
  LONGEST FLOWPATH FROM NODE    620.00 TO NODE    622.00 =   967.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    622.00 TO NODE    675.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  280.00  DOWNSTREAM ELEVATION(FEET) =  276.00
  STREET LENGTH(FEET) =   330.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      16.02
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.52
    HALFSTREET FLOOD WIDTH(FEET) =   22.05
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.59
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.88
  STREET FLOW TRAVEL TIME(MIN.) =   1.53   Tc(MIN.) =  12.51
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.174
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.50      SUBAREA RUNOFF(CFS) =    4.05
  TOTAL AREA(ACRES) =      6.40        PEAK FLOW RATE(CFS) =      18.04

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.54   HALFSTREET FLOOD WIDTH(FEET) =  24.08
  FLOW VELOCITY(FEET/SEC.) =  3.66   DEPTH*VELOCITY(FT*FT/SEC.) =   1.99
  LONGEST FLOWPATH FROM NODE    620.00 TO NODE    675.00 =  1297.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    675.00 TO NODE    675.00 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.) =  12.51
  RAINFALL INTENSITY(INCH/HR) =   3.17
  TOTAL STREAM AREA(ACRES) =     6.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.04

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
```

```
      1       22.16    16.67        2.766          8.60
      2       18.04    12.51        3.174          6.40

  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       37.35    12.51       3.174
      2       37.88    16.67       2.766

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     37.88    Tc(MIN.) =  16.67
  TOTAL AREA(ACRES) =     15.00
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    675.00 =  1599.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    675.00 TO NODE    680.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   276.00  DOWNSTREAM(FEET) =   275.50
  FLOW LENGTH(FEET) =    76.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  23.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.94
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.88
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =  16.83
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    680.00 =  1675.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    680.00 TO NODE    680.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.754
   *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    1.64
  TOTAL AREA(ACRES) =     15.70   TOTAL RUNOFF(CFS) =   39.52
  TC(MIN.) =  16.83

****************************************************************************
  FLOW PROCESS FROM NODE    680.00 TO NODE    685.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   275.50  DOWNSTREAM(FEET) =   275.00
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  20.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.44
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     39.52
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =  16.92
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    685.00 =  1725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    685.00 TO NODE    685.00 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.) =  16.92
  RAINFALL INTENSITY(INCH/HR) =   2.75
  TOTAL STREAM AREA(ACRES) =    15.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     39.52

****************************************************************************
  FLOW PROCESS FROM NODE    630.00 TO NODE    631.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   115.00
  UPSTREAM ELEVATION(FEET) =    291.00
  DOWNSTREAM ELEVATION(FEET) =    290.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.056
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    631.00 TO NODE    635.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  290.00  DOWNSTREAM ELEVATION(FEET) =  278.00
  STREET LENGTH(FEET) =   615.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =   14.49
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.42
  STREET FLOW TRAVEL TIME(MIN.) =   2.84   Tc(MIN.) =   8.84
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.670
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    4.80      SUBAREA RUNOFF(CFS) =   14.97
  TOTAL AREA(ACRES) =      4.90        PEAK FLOW RATE(CFS) =      15.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.48   HALFSTREET FLOOD WIDTH(FEET) =  18.79
  FLOW VELOCITY(FEET/SEC.) =  4.24   DEPTH*VELOCITY(FT*FT/SEC.) =   2.04
```

```
  LONGEST FLOWPATH FROM NODE    630.00 TO NODE    635.00 =   730.00 FEET.

*****************************************************************************
  FLOW PROCESS FROM NODE    635.00 TO NODE    685.00 IS CODE =  62
-----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
=============================================================================
  UPSTREAM ELEVATION(FEET) =  278.00  DOWNSTREAM ELEVATION(FEET) =  276.00
  STREET LENGTH(FEET) =   411.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      16.72
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.61   FLOOD WIDTH(FEET) =   30.25
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.48
    SPLIT DEPTH(FEET) =    0.20   SPLIT FLOOD WIDTH(FEET) =    4.70
    SPLIT FLOW(CFS) =    0.31   SPLIT VELOCITY(FEET/SEC.) =    1.02
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.61
    HALFSTREET FLOOD WIDTH(FEET) =   30.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.50
  STREET FLOW TRAVEL TIME(MIN.) =   2.76   Tc(MIN.) =  11.60
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.274
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.00      SUBAREA RUNOFF(CFS) =    2.78
  TOTAL AREA(ACRES) =      5.90        PEAK FLOW RATE(CFS) =      18.11

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.61   HALFSTREET FLOOD WIDTH(FEET) =  30.25
  FLOW VELOCITY(FEET/SEC.) =  2.48   DEPTH*VELOCITY(FT*FT/SEC.) =   1.50
  LONGEST FLOWPATH FROM NODE    630.00 TO NODE    685.00 =  1141.00 FEET.

*****************************************************************************
  FLOW PROCESS FROM NODE    685.00 TO NODE    685.00 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.) =  11.60
  RAINFALL INTENSITY(INCH/HR) =   3.27
  TOTAL STREAM AREA(ACRES) =     5.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.11

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       39.52    16.92        2.747         15.70
      2       18.11    11.60        3.274          5.90
```

```
  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       51.27    11.60       3.274
      2       54.72    16.92       2.747

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     54.72   Tc(MIN.) =   16.92
  TOTAL AREA(ACRES) =     21.60
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    685.00 =  1725.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     21.60  TC(MIN.) =     16.92
  PEAK FLOW RATE(CFS)   =     54.72
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 7                                                                 *
 **************************************************************************

  FILE NAME: MCPRE7.RAT
  TIME/DATE OF STUDY: 11:14 11/16/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    700.00 TO NODE    705.00 IS CODE =  21
```

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----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    98.00
  UPSTREAM ELEVATION(FEET) =    286.00
  DOWNSTREAM ELEVATION(FEET) =    285.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.425
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    705.00 TO NODE    710.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  285.00  DOWNSTREAM ELEVATION(FEET) =  276.00
  STREET LENGTH(FEET) =   422.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.23
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    6.21
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.36
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
  STREET FLOW TRAVEL TIME(MIN.) =   2.98   Tc(MIN.) =   8.98
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.643
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.20      SUBAREA RUNOFF(CFS) =    3.72
  TOTAL AREA(ACRES) =      1.30        PEAK FLOW RATE(CFS) =       4.07

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   8.16
  FLOW VELOCITY(FEET/SEC.) =  2.71   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    710.00 =   520.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    710.00 TO NODE    730.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   273.00  DOWNSTREAM(FEET) =   272.50
  FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.91
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      4.07
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   9.04
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    730.00 =   545.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    730.00 TO NODE    730.00 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.) =   9.04
  RAINFALL INTENSITY(INCH/HR) =   3.63
  TOTAL STREAM AREA(ACRES) =     1.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.07

****************************************************************************
  FLOW PROCESS FROM NODE    715.00 TO NODE    720.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    276.00
  DOWNSTREAM ELEVATION(FEET) =    275.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.198
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    720.00 TO NODE    725.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  275.00  DOWNSTREAM ELEVATION(FEET) =  274.00
  STREET LENGTH(FEET) =   215.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.66
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    4.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.20
  STREET FLOW TRAVEL TIME(MIN.) =   3.57   Tc(MIN.) =   9.57
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.532
```

```
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    0.60
  TOTAL AREA(ACRES) =      0.30        PEAK FLOW RATE(CFS) =       0.96

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   5.98
  FLOW VELOCITY(FEET/SEC.) =  1.08   DEPTH*VELOCITY(FT*FT/SEC.) =   0.24
  LONGEST FLOWPATH FROM NODE    715.00 TO NODE    725.00 =   307.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    725.00 TO NODE    730.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   273.00  DOWNSTREAM(FEET) =   272.50
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.46
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      0.96
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   9.61
  LONGEST FLOWPATH FROM NODE    715.00 TO NODE    730.00 =   322.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    730.00 TO NODE    730.00 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.) =   9.61
  RAINFALL INTENSITY(INCH/HR) =   3.52
  TOTAL STREAM AREA(ACRES) =     0.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.96

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.07     9.04        3.632          1.30
      2        0.96     9.61        3.524          0.30

  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        5.00     9.04       3.632
      2        4.91     9.61       3.524

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      5.00   Tc(MIN.) =    9.04
  TOTAL AREA(ACRES) =      1.60
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    730.00 =   545.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    730.00 TO NODE    745.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   272.50  DOWNSTREAM(FEET) =   272.00
  FLOW LENGTH(FEET) =    38.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.25
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      5.00
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   9.14
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    745.00 =   583.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    745.00 TO NODE    745.00 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.) =   9.14
  RAINFALL INTENSITY(INCH/HR) =   3.61
  TOTAL STREAM AREA(ACRES) =     1.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.00

****************************************************************************
  FLOW PROCESS FROM NODE    735.00 TO NODE    740.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    276.00
  DOWNSTREAM ELEVATION(FEET) =    275.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.198
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    740.00 TO NODE    745.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  275.00  DOWNSTREAM ELEVATION(FEET) =  274.00
  STREET LENGTH(FEET) =   224.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
```

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    HALFSTREET FLOOD WIDTH(FEET) =    4.26
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.94
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.18
  STREET FLOW TRAVEL TIME(MIN.) =   3.96   Tc(MIN.) =   9.96
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.458
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.29
  TOTAL AREA(ACRES) =      0.20        PEAK FLOW RATE(CFS) =       0.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   4.92
  FLOW VELOCITY(FEET/SEC.) =  0.99   DEPTH*VELOCITY(FT*FT/SEC.) =   0.20
  LONGEST FLOWPATH FROM NODE    735.00 TO NODE    745.00 =   316.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    745.00 TO NODE    745.00 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.) =   9.96
  RAINFALL INTENSITY(INCH/HR) =   3.46
  TOTAL STREAM AREA(ACRES) =     0.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.65

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.00     9.14        3.613         1.60
      2        0.65     9.96        3.458         0.20

  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        5.63     9.14       3.613
      2        5.44     9.96       3.458

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      5.63   Tc(MIN.) =    9.14
  TOTAL AREA(ACRES) =      1.80
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    745.00 =   583.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      1.80  TC(MIN.) =      9.14
  PEAK FLOW RATE(CFS)   =      5.63
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
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             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 8                                                                 *
 **************************************************************************

  FILE NAME: MCPRE8.RAT
  TIME/DATE OF STUDY: 11:24 11/16/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    800.00 TO NODE    805.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    285.00
  DOWNSTREAM ELEVATION(FEET) =    284.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.198
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    805.00 TO NODE    810.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  284.00  DOWNSTREAM ELEVATION(FEET) =  273.00
  STREET LENGTH(FEET) =   495.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.93
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    7.93
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.75
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.72
  STREET FLOW TRAVEL TIME(MIN.) =   3.00   Tc(MIN.) =   9.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.640
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    7.12
  TOTAL AREA(ACRES) =      2.40        PEAK FLOW RATE(CFS) =       7.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.43
  FLOW VELOCITY(FEET/SEC.) =  3.18   DEPTH*VELOCITY(FT*FT/SEC.) =   1.00
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    810.00 =   587.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    810.00 TO NODE    820.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   271.00  DOWNSTREAM(FEET) =   270.50
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.19
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.47
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =   9.14
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    820.00 =   637.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    815.00 TO NODE    820.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.614
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.30   SUBAREA RUNOFF(CFS) =    0.92
  TOTAL AREA(ACRES) =      2.70   TOTAL RUNOFF(CFS) =    8.40
  TC(MIN.) =   9.14

****************************************************************************
  FLOW PROCESS FROM NODE    820.00 TO NODE    830.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   270.50  DOWNSTREAM(FEET) =   269.50
  FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.48
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.40
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =   9.38
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    830.00 =   731.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    825.00 TO NODE    830.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.568
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    1.82
  TOTAL AREA(ACRES) =      3.30   TOTAL RUNOFF(CFS) =   10.21
  TC(MIN.) =   9.38

****************************************************************************
  FLOW PROCESS FROM NODE    830.00 TO NODE    850.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   269.50  DOWNSTREAM(FEET) =   268.50
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.77
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     10.21
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   9.60
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    850.00 =   821.00 FEET.

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

```
  FLOW PROCESS FROM NODE    835.00 TO NODE    850.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.526
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    1.80
  TOTAL AREA(ACRES) =      3.90   TOTAL RUNOFF(CFS) =   12.01
  TC(MIN.) =   9.60

****************************************************************************
  FLOW PROCESS FROM NODE    840.00 TO NODE    850.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.526
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.30   SUBAREA RUNOFF(CFS) =    0.90
  TOTAL AREA(ACRES) =      4.20   TOTAL RUNOFF(CFS) =   12.91
  TC(MIN.) =   9.60
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      4.20  TC(MIN.) =      9.60
  PEAK FLOW RATE(CFS)   =     12.91
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                       *
* SYSTEM 9                                                                  *
 **************************************************************************

  FILE NAME: MCPRE9.RAT
  TIME/DATE OF STUDY: 11:28 11/16/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160
  4   15.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  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    900.00 TO NODE    905.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    94.00
  UPSTREAM ELEVATION(FEET) =    272.00
  DOWNSTREAM ELEVATION(FEET) =    271.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.274
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    905.00 TO NODE    910.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  271.00  DOWNSTREAM ELEVATION(FEET) =  268.00
  STREET LENGTH(FEET) =   102.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.70
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.16
    HALFSTREET FLOOD WIDTH(FEET) =    2.89
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.07
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.34
  STREET FLOW TRAVEL TIME(MIN.) =   0.82   Tc(MIN.) =   6.82
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.054
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    0.69
  TOTAL AREA(ACRES) =      0.30        PEAK FLOW RATE(CFS) =       1.05

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.18   HALFSTREET FLOOD WIDTH(FEET) =   3.99
  FLOW VELOCITY(FEET/SEC.) =  2.13   DEPTH*VELOCITY(FT*FT/SEC.) =   0.39
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    910.00 =   196.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      0.30  TC(MIN.) =      6.82
  PEAK FLOW RATE(CFS)   =      1.05
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
 * PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
 * SYSTEM 10                                                                *
 **************************************************************************

  FILE NAME: MCPRE10.RAT
  TIME/DATE OF STUDY: 11:03 10/25/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160

  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   1000.00 TO NODE   1005.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    98.00
  UPSTREAM ELEVATION(FEET) =    273.00
  DOWNSTREAM ELEVATION(FEET) =    272.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.425
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1005.00 TO NODE   1010.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  272.00  DOWNSTREAM ELEVATION(FEET) =  268.00
  STREET LENGTH(FEET) =   449.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.46
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =   10.63
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   3.70   Tc(MIN.) =   9.70
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.507
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    4.17
  TOTAL AREA(ACRES) =      1.50        PEAK FLOW RATE(CFS) =       4.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  13.57
  FLOW VELOCITY(FEET/SEC.) =  2.35   DEPTH*VELOCITY(FT*FT/SEC.) =   0.88
  LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1010.00 =   547.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      1.50  TC(MIN.) =      9.70
  PEAK FLOW RATE(CFS)   =      4.53
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 11                                                                *
 **************************************************************************

  FILE NAME: MCPRE11.RAT
  TIME/DATE OF STUDY: 17:59 12/06/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160

  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   1100.00 TO NODE   1105.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    256.00
  DOWNSTREAM ELEVATION(FEET) =    255.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.343
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1105.00 TO NODE   1110.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  255.00  DOWNSTREAM ELEVATION(FEET) =  254.00
  STREET LENGTH(FEET) =    40.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  25.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.06
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.22
    HALFSTREET FLOOD WIDTH(FEET) =    5.81
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.51
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
  STREET FLOW TRAVEL TIME(MIN.) =   0.27   Tc(MIN.) =   6.27
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.160
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    1.41
  TOTAL AREA(ACRES) =      0.50        PEAK FLOW RATE(CFS) =       1.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   7.43
  FLOW VELOCITY(FEET/SEC.) =  2.78   DEPTH*VELOCITY(FT*FT/SEC.) =   0.70
  LONGEST FLOWPATH FROM NODE   1100.00 TO NODE   1110.00 =   110.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      0.50  TC(MIN.) =      6.27
  PEAK FLOW RATE(CFS)   =      1.77
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************* DESCRIPTION OF STUDY *************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 12                                                                *
 **************************************************************************

  FILE NAME: MCPRE12.RAT
  TIME/DATE OF STUDY: 17:56 12/06/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160

  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   1200.00 TO NODE   1205.00 IS CODE =  21
----------------------------------------------------------------------------
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```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    87.00
  UPSTREAM ELEVATION(FEET) =    253.00
  DOWNSTREAM ELEVATION(FEET) =    250.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.778
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1205.00 TO NODE   1210.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  250.00  DOWNSTREAM ELEVATION(FEET) =  236.00
  STREET LENGTH(FEET) =   410.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.79
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    4.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.73
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
  STREET FLOW TRAVEL TIME(MIN.) =   2.51   Tc(MIN.) =   8.51
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.734
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    2.86
  TOTAL AREA(ACRES) =      1.00        PEAK FLOW RATE(CFS) =       3.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   6.60
  FLOW VELOCITY(FEET/SEC.) =  3.08   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
  LONGEST FLOWPATH FROM NODE   1200.00 TO NODE   1210.00 =   497.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1210.00 TO NODE   1210.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.734
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    1.90
  TOTAL AREA(ACRES) =      1.60   TOTAL RUNOFF(CFS) =    5.12
  TC(MIN.) =   8.51
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      1.60  TC(MIN.) =      8.51
  PEAK FLOW RATE(CFS)   =      5.12
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                       *
* SYSTEM 13, 14                                                             *
 **************************************************************************

  FILE NAME: MCPRE14.RAT
  TIME/DATE OF STUDY: 13:54 03/31/2019
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160

  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   1300.00 TO NODE   1305.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    97.00
  UPSTREAM ELEVATION(FEET) =    271.00
  DOWNSTREAM ELEVATION(FEET) =    270.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.387
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1305.00 TO NODE   1310.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  270.00  DOWNSTREAM ELEVATION(FEET) =  236.00
  STREET LENGTH(FEET) =  1001.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   12.62
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.40
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.57
  STREET FLOW TRAVEL TIME(MIN.) =   3.79   Tc(MIN.) =   9.79
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.489
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    4.70      SUBAREA RUNOFF(CFS) =   13.94
  TOTAL AREA(ACRES) =      4.80        PEAK FLOW RATE(CFS) =      14.30

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.43   HALFSTREET FLOOD WIDTH(FEET) =  16.45
  FLOW VELOCITY(FEET/SEC.) =  5.12   DEPTH*VELOCITY(FT*FT/SEC.) =   2.22
  LONGEST FLOWPATH FROM NODE   1300.00 TO NODE   1310.00 =  1098.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1310.00 TO NODE   1310.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.489
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    2.08
```

```
  TOTAL AREA(ACRES) =      5.50   TOTAL RUNOFF(CFS) =   16.37
  TC(MIN.) =   9.79

****************************************************************************
  FLOW PROCESS FROM NODE   1310.00 TO NODE   1315.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   236.00  DOWNSTREAM(FEET) =   217.83
  FLOW LENGTH(FEET) =   121.27   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   7.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.56
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     16.37
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   9.89
  LONGEST FLOWPATH FROM NODE   1300.00 TO NODE   1315.00 =  1219.27 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1315.00 TO NODE   1315.00 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.) =   9.89
  RAINFALL INTENSITY(INCH/HR) =   3.47
  TOTAL STREAM AREA(ACRES) =     5.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.37

****************************************************************************
  FLOW PROCESS FROM NODE   1320.00 TO NODE   1325.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    87.00
  UPSTREAM ELEVATION(FEET) =    268.00
  DOWNSTREAM ELEVATION(FEET) =    266.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.180
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1325.00 TO NODE   1330.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  266.00  DOWNSTREAM ELEVATION(FEET) =  230.00
  STREET LENGTH(FEET) =  1250.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
```

```
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.40
    HALFSTREET FLOOD WIDTH(FEET) =   14.65
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.43
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.76
  STREET FLOW TRAVEL TIME(MIN.) =   4.70   Tc(MIN.) =  10.70
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.373
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    6.60      SUBAREA RUNOFF(CFS) =   18.92
  TOTAL AREA(ACRES) =      6.70        PEAK FLOW RATE(CFS) =      19.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  19.02
  FLOW VELOCITY(FEET/SEC.) =  5.20   DEPTH*VELOCITY(FT*FT/SEC.) =   2.53
  LONGEST FLOWPATH FROM NODE   1320.00 TO NODE   1330.00 =  1337.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1330.00 TO NODE   1335.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   230.00  DOWNSTREAM(FEET) =   218.50
  FLOW LENGTH(FEET) =    55.32   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.18
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     19.28
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =  10.74
  LONGEST FLOWPATH FROM NODE   1320.00 TO NODE   1335.00 =  1392.32 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1335.00 TO NODE   1335.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.368
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    1.72
  TOTAL AREA(ACRES) =      7.30   TOTAL RUNOFF(CFS) =   21.00
  TC(MIN.) =  10.74

****************************************************************************
  FLOW PROCESS FROM NODE   1335.00 TO NODE   1315.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   218.50  DOWNSTREAM(FEET) =   217.83
  FLOW LENGTH(FEET) =   100.83   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  16.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.92
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     21.00
```

```
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =  10.99
  LONGEST FLOWPATH FROM NODE   1320.00 TO NODE   1315.00 =  1493.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1315.00 TO NODE   1315.00 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.) =  10.99
  RAINFALL INTENSITY(INCH/HR) =   3.34
  TOTAL STREAM AREA(ACRES) =     7.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       16.37     9.89        3.470          5.50
      2       21.00    10.99        3.342          7.30

  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       36.59     9.89       3.470
      2       36.76    10.99       3.342

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     36.76   Tc(MIN.) =   10.99
  TOTAL AREA(ACRES) =     12.80
  LONGEST FLOWPATH FROM NODE   1320.00 TO NODE   1315.00 =  1493.15 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1315.00 TO NODE   1355.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   217.83  DOWNSTREAM(FEET) =   137.35
  FLOW LENGTH(FEET) =   309.24   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  30.33
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     36.76
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =  11.16
  LONGEST FLOWPATH FROM NODE   1320.00 TO NODE   1355.00 =  1802.39 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1355.00 TO NODE   1355.00 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.) =  11.16
  RAINFALL INTENSITY(INCH/HR) =   3.32
  TOTAL STREAM AREA(ACRES) =    12.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     36.76
```

```
****************************************************************************
  FLOW PROCESS FROM NODE   1400.00 TO NODE   1405.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.10
  UPSTREAM ELEVATION(FEET) =    232.00
  DOWNSTREAM ELEVATION(FEET) =    226.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.507
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1405.00 TO NODE   1410.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  226.00  DOWNSTREAM ELEVATION(FEET) =  211.00
  STREET LENGTH(FEET) =   485.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.75
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    4.97
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.62
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
  STREET FLOW TRAVEL TIME(MIN.) =   3.08   Tc(MIN.) =   9.08
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.625
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    2.77
  TOTAL AREA(ACRES) =      1.00        PEAK FLOW RATE(CFS) =       3.13

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   6.68
  FLOW VELOCITY(FEET/SEC.) =  2.94   DEPTH*VELOCITY(FT*FT/SEC.) =   0.70
  LONGEST FLOWPATH FROM NODE   1400.00 TO NODE   1410.00 =   540.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1410.00 TO NODE   1410.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.625
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.80   SUBAREA RUNOFF(CFS) =    2.46
 TOTAL AREA(ACRES) =      1.80   TOTAL RUNOFF(CFS) =    5.60
 TC(MIN.) =   9.08

****************************************************************************
 FLOW PROCESS FROM NODE   1410.00 TO NODE   1355.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   211.00  DOWNSTREAM(FEET) =   137.35
 FLOW LENGTH(FEET) =   162.97   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS   2.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  21.00
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      5.60
 PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =   9.21
 LONGEST FLOWPATH FROM NODE   1400.00 TO NODE   1355.00 =   703.07 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1355.00 TO NODE   1355.00 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.) =   9.21
 RAINFALL INTENSITY(INCH/HR) =   3.60
 TOTAL STREAM AREA(ACRES) =     1.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.60

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       36.76    11.16        3.323         12.80
     2        5.60     9.21        3.600          1.80

 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       39.53     9.21       3.600
     2       41.93    11.16       3.323

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     41.93   Tc(MIN.) =   11.16
 TOTAL AREA(ACRES) =     14.60
 LONGEST FLOWPATH FROM NODE   1320.00 TO NODE   1355.00 =  1802.39 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =     14.60  TC(MIN.) =     11.16
 PEAK FLOW RATE(CFS)   =     41.93
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
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****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
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             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                           Analysis prepared by:

                          RICK ENGINEERING COMPANY
                              5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 15                                                                *
 **************************************************************************

  FILE NAME: MCPRE15.RAT
  TIME/DATE OF STUDY: 11:21 10/25/2018
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   30.0     25.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160
  3   25.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0160

  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   1500.00 TO NODE   1505.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   123.00
  UPSTREAM ELEVATION(FEET) =    259.00
  DOWNSTREAM ELEVATION(FEET) =    256.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.708
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1505.00 TO NODE   1510.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  256.00  DOWNSTREAM ELEVATION(FEET) =  189.00
  STREET LENGTH(FEET) =  1580.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.87
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   16.37
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.74
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.48
  STREET FLOW TRAVEL TIME(MIN.) =   4.59   Tc(MIN.) =  10.59
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.385
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =   10.70      SUBAREA RUNOFF(CFS) =   30.79
  TOTAL AREA(ACRES) =     10.80        PEAK FLOW RATE(CFS) =      31.15

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.53   HALFSTREET FLOOD WIDTH(FEET) =  22.67
  FLOW VELOCITY(FEET/SEC.) =  6.76   DEPTH*VELOCITY(FT*FT/SEC.) =   3.58
  LONGEST FLOWPATH FROM NODE   1500.00 TO NODE   1510.00 =  1703.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1510.00 TO NODE   1515.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  189.00  DOWNSTREAM ELEVATION(FEET) =  184.00
  STREET LENGTH(FEET) =   338.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 25.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      34.04
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.61   FLOOD WIDTH(FEET) =   30.25
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    4.33
    SPLIT DEPTH(FEET) =    0.37   SPLIT FLOOD WIDTH(FEET) =   13.24
    SPLIT FLOW(CFS) =    5.43   SPLIT VELOCITY(FEET/SEC.) =    2.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.61
    HALFSTREET FLOOD WIDTH(FEET) =   30.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.33
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.62
  STREET FLOW TRAVEL TIME(MIN.) =   1.30   Tc(MIN.) =  11.89
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.242
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    5.79
  TOTAL AREA(ACRES) =     12.90        PEAK FLOW RATE(CFS) =      36.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.61   HALFSTREET FLOOD WIDTH(FEET) =  30.25
  FLOW VELOCITY(FEET/SEC.) =  4.33   DEPTH*VELOCITY(FT*FT/SEC.) =   2.62
  LONGEST FLOWPATH FROM NODE   1500.00 TO NODE   1515.00 =  2041.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     12.90  TC(MIN.) =     11.89
  PEAK FLOW RATE(CFS)   =     36.94
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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____________________________________________________________________________
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            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
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             Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                             Analysis prepared by:

                            RICK ENGINEERING COMPANY
                                5620 Friars Road
                          San Diego, California 92110
                        619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
* PRE-PROJECT CONDITION HYDROLOGY RUN                                      *
* SYSTEM 16                                                                *
 **************************************************************************

  FILE NAME: MCPRE16.RAT
  TIME/DATE OF STUDY: 11:37 05/08/2019
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *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
  2   20.0     15.0    0.020/0.020/ ---    0.50    1.50 0.0100 0.125 0.0160

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.10 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   1600.00 TO NODE   1605.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.00
  UPSTREAM ELEVATION(FEET) =    190.00
  DOWNSTREAM ELEVATION(FEET) =    176.00
  ELEVATION DIFFERENCE(FEET) =     14.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.914
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE   1605.00 TO NODE   1610.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  176.00  DOWNSTREAM ELEVATION(FEET) =  138.00
  STREET LENGTH(FEET) =   320.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    4.43
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.89
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.95
  STREET FLOW TRAVEL TIME(MIN.) =   1.09   Tc(MIN.) =   7.09
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.003
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    2.04
  TOTAL AREA(ACRES) =      0.70        PEAK FLOW RATE(CFS) =       2.40

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   5.94
  FLOW VELOCITY(FEET/SEC.) =  5.46   DEPTH*VELOCITY(FT*FT/SEC.) =   1.22
  LONGEST FLOWPATH FROM NODE   1600.00 TO NODE   1610.00 =   423.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      0.70  TC(MIN.) =      7.09
  PEAK FLOW RATE(CFS)   =      2.40
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

♀
```

APPENDIX B

Modified Rational Method Analyses (100-year, 6-hour)

[Post-project Condition]

Refer to Appendix A. Post-project runoff remains similar to pre-project runoff

APPENDIX C

Hydraulic Analyses – Inlet Sizing

[Post-project Condition]

Curb Inlets in Sag Sizing

Solve for Length using both weir and orifice equations and use the larger length for sizing purposes.

Inlet Sizing as Weir Equation

Equation 3-3. Shallow Depth Weir (City of San Diego, Drainage Design Manual (Jan 2018))

Equation 3-3 is valid only if flow depth, d < curb height , h or else use Equation 3-5

$$Q = C_w L_w d^{3/2}$$

Where,
Q = inlet capacity (cfs)
Cw = weir discharge coefficient
Lw = weir length
d = flow depth

Inlet Sizing as Orifice Equation

Equation 3-4. Higher Flow Depth Curb Inlet (City of San Diego, Drainage Design Manual (Jan 2018)

$$Q = 0.67hL(2gd_0)^{1/2}$$

Where,
Q = inlet capacity (cfs)
h = curb opening height (ft)
L = curb opening length (ft)
g = gravitational acceleration (32.2 ft/s^2)
d_0 = effective depth of flow at curb face (ft)

Equation 3-5. Effective Depth of Flow at Curb Face (City of San Diego, Drainage Design Manual (Jan 2018)

$$d_0 = (y+a) - (h/2)\sin\Theta$$

Where,
y = depth of flow in adjacent gutter (ft)
a = curb inlet depression
(h/2) sin Θ = adjustment for curb inlet throat width (h) and angle of throat incline (Θ). For a standard 6-inch curb inlet opening with a 4-inch depression (SD-RSD No. SDD 102), (h/2) sin Θ = 3.1 inches (0.26 ft)

Inlet ID	Depth of Flow in Adjacent Gutter, y (ft)	Curb Inlet Depression, a (ft)	(h/2) sin Θ (ft)	Effective Depth of Flow at Curb Face, d_0 (ft)	Inlet Flow, Q (cfs)	Curb Opening Height, h (ft)	Clogging Factor (%)	Curb Opening Length w/ Clogging[1]
System 1- Node 135	0.314	0.33	0.26	0.384	4.1	0.5	0%	5.7
System 3- Node 315	0.307	0.33	0.26	0.377	6.0	0.5	0%	8.6
System 4- Node 410	0.253	0.33	0.26	0.323	2.1	0.5	0%	4.0
System 10- Node 1010	0.313	0.33	0.26	0.383	4.5	0.5	0%	6.3
System 11- Node 1110	0.224	0.33	0.26	0.294	1.8	0.5	0%	4.0
System 14- Node 1410	0.353	0.33	0.26	0.423	5.6	0.6	0%	6.8

Note:
1. A minimum curb opening length of 4ft is used when the equations yield a opening length less than 4ft.

Curb Inlets on Grade Sizing

Equation 3-2. Capacity of Curb Inlet (City of San Diego, Drainage Design Manual (Jan 2018)

$$Q/L_T = 0.7\ (a+y)^{3/2}$$

Where,
Q = interception capacity of the curb inlet (cfs)
y = depth of flow approaching the curb inlet (ft; maximum of y = 0.4)
a = depth of depression of curb at inlet (ft; use a = 0.33)
L_T = length of clear opening of inlet for total interception (ft)

Inlet ID	Inlet Flow, Q (cfs)	Depth of Depression of Curb at Inlet, a (ft)	Depth of Flow Approaching the Curb Inlet, y (ft)	Length of Curb Inlet Opening, L_T, (ft)[1]
System 1- Node 115	5.5	0.33	0.335	14.5
System 2- Node 210	3	0.33	0.173	12.0
System 7- Node 710	4.1	0.33	0.258	13.0
System 7- Node 725	1	0.33	0.246	4.0
System 7- Node 745	0.7	0.33	0.205	4.0

Note:

1. A minimum curb opening length of 4ft is used when the equations yield a opening length less than 4ft.

Hydraulic Analysis Report

Project Data

Project Title: System 1

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System1_Node115

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0139 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 5.5000 cfs

Gutter Result Parameters

Width of Spread: 12.0340 ft

Gutter Depression: 1.1340 in

Area of Flow: 1.5191 ft^2

Eo (Gutter Flow to Total Flow): 0.3717

Gutter Depth at Curb: 4.0222 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 15.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 5.5000 cfs

Bypass Flow: 0.0000 cfs

Efficiency: 1.0000

Curb and Gutter Analysis: System1_Node135

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0120 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 4.1000 cfs

Gutter Result Parameters

Width of Spread: 10.9937 ft

Gutter Depression: 1.1340 in

Area of Flow: 1.2795 ft^2

Eo (Gutter Flow to Total Flow): 0.4066

Gutter Depth at Curb: 3.7725 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 6.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 8.7000 ft

Effective Perimeter: 8.7000 ft

Area: 5.0000 ft^2

Effective Area: 5.0000 ft^2

Depth at curb face (upstream of local depression): 0.3476 ft

Computed Width of Spread at Sag: 12.6528 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 2

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System2_Node210

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0300 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 7.8935 ft

Gutter Result Parameters

Design Flow: 3.0000 cfs

Gutter Depression: 1.1340 in

Area of Flow: 0.6939 ft^2

Eo (Gutter Flow to Total Flow): 0.5534

Gutter Depth at Curb: 3.0284 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 12.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 3.0000 cfs

Bypass Flow: 0.0000 cfs

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 3

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System3_Node315

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0140 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 4.1000 cfs

Gutter Result Parameters

Width of Spread: 10.6475 ft

Gutter Depression: 1.1340 in

Area of Flow: 1.2046 ft^2

Eo (Gutter Flow to Total Flow): 0.4195

Gutter Depth at Curb: 3.6894 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 9.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 11.7000 ft

Effective Perimeter: 11.7000 ft

Area: 7.5000 ft^2

Effective Area: 7.5000 ft^2

Depth at curb face (upstream of local depression): 0.2853 ft

Computed Width of Spread at Sag: 9.5382 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 4

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System4_Node410

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0142 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 2.1000 cfs

Gutter Result Parameters

Width of Spread: 7.9552 ft

Gutter Depression: 1.1340 in

Area of Flow: 0.7037 ft^2

Eo (Gutter Flow to Total Flow): 0.5497

Gutter Depth at Curb: 3.0432 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 4.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 6.7000 ft

Effective Perimeter: 6.7000 ft

Area: 3.3333 ft^2

Effective Area: 3.3333 ft^2

Depth at curb face (upstream of local depression): 0.2648 ft

Computed Width of Spread at Sag: 8.5158 ft

Flow type: Weir Flow

Efficiency: 1.0000

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System 5, System 9

Grate Inlet Sizing (Weir vs. Orifice)

Weir coefficient, C_w	3.0
Orifice coefficient, C_o	0.60
Available head, h (feet)	0.30

Inlet Type	Width (inches)	Capacity based on Weir Equation[3, 4], Q_{cap} (cfs[5])	Capacity based on Orifice Equation[3, 4], Q_{cap} (cfs[5])	Governing Equation
1212 Series - 12"x12" Catch Basin[1]	14.4375	1.05	1.47	Weir
1218 Series - 12"x18" Catch Basin[1]	19.1875	1.22	1.96	Weir
1818 Series - 18"x18" Catch Basin[1]	19.2500	1.38	2.50	Weir
2424 Series - 24"x24" Catch Basin[1]	25.1875	**1.78**	4.18	Weir
3636 Series - 36"x36" Catch Basin[1]	34.9375	**2.60**	8.72	Weir

Type 'I' Catch Basin[2]	22.5000	2.27	6.41	Weir

Note:

1. Based on Brooks Products, Inc. - H 20-44 Traffic, Steel Grate, not Parkway, Cast-iron grate
2. Based on Drawing Number D-13 & D-15 in the City of San Diego Regional Standard Drawings, dated April 2003
3. A reduction factor of 50% assumed for clogging.
4. Weir equation, $Q = C_w L_e (h)^{3/2}$; Orifice equation, $Q = C_o A_e (2gh)^{1/2}$
5. "cfs" = cubic feet per second

Hydraulic Analysis Report

Project Data

Project Title: System 6

Designer:

Project Date: Thursday, January 03, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: Node_675

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0450 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Design Flow: 18.1000 cfs

Gutter Result Parameters

Width of Spread: 15.0067 ft

Gutter Depression: 1.5120 in

Area of Flow: 2.3780 ft^2

Eo (Gutter Flow to Total Flow): 0.3973

Gutter Depth at Curb: 5.1136 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 20.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 13.6200 cfs

Bypass Flow: 4.4800 cfs

Efficiency: 0.7525

Curb and Gutter Analysis: Node_665

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0150 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Design Flow: 22.2000 cfs

Gutter Result Parameters

Width of Spread: 20.3251 ft

Gutter Depression: 1.5120 in

Area of Flow: 4.2571 ft^2

Eo (Gutter Flow to Total Flow): 0.2920

Gutter Depth at Curb: 6.3900 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 18.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 16.6057 cfs

Bypass Flow: 5.5943 cfs

Efficiency: 0.7480

Curb and Gutter Analysis: Node_680

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0070 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Design Flow: 12.8000 cfs

Gutter Result Parameters

Width of Spread: 19.0036 ft

Gutter Depression: 1.5120 in

Area of Flow: 3.7374 ft^2

Eo (Gutter Flow to Total Flow): 0.3130

Gutter Depth at Curb: 6.0729 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 10.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 8.9403 cfs

Bypass Flow: 3.8597 cfs

Efficiency: 0.6985

Curb and Gutter Analysis: Node_685

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0070 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Width of Spread: 21.7909 ft

Gutter Result Parameters

Design Flow: 18.1000 cfs

Gutter Depression: 1.5120 in

Area of Flow: 4.8744 ft^2

Eo (Gutter Flow to Total Flow): 0.2716

Gutter Depth at Curb: 6.7418 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 20.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 16.9862 cfs

Bypass Flow: 1.1138 cfs

Efficiency: 0.9385

Hydraulic Analysis Report

Project Data

Project Title: System 7

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System7_Node710

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0470 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 8.1835 ft

Gutter Result Parameters

Design Flow: 4.0700 cfs

Gutter Depression: 1.1340 in

Area of Flow: 0.7406 ft^2

Eo (Gutter Flow to Total Flow): 0.5362

Gutter Depth at Curb: 3.0980 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 14.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 4.0159 cfs

Bypass Flow: 0.0541 cfs

Efficiency: 0.9867

Curb and Gutter Analysis: System7_Node725

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0040 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 7.5736 ft

Gutter Result Parameters

Design Flow: 1.0000 cfs

Gutter Depression: 1.1340 in

Area of Flow: 0.6445 ft^2

Eo (Gutter Flow to Total Flow): 0.5734

Gutter Depth at Curb: 2.9517 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 4.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 1.0000 cfs

Bypass Flow: 0.0000 cfs

Efficiency: 1.0000

Curb and Gutter Analysis: System7_Node745

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0070 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 5.5540 ft

Gutter Result Parameters

Design Flow: 0.7000 cfs

Gutter Depression: 1.1340 in

Area of Flow: 0.3793 ft^2

Eo (Gutter Flow to Total Flow): 0.7259

Gutter Depth at Curb: 2.4670 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 4.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 0.7000 cfs

Bypass Flow: 0.0000 cfs

Efficiency: 1.0000

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System 5, System 9

Grate Inlet Sizing (Weir vs. Orifice)

Weir coefficient, C_w	3.0
Orifice coefficient, C_o	0.60
Available head, h (feet)	0.30

Inlet Type	Width (inches)	Capacity based on Weir Equation[3, 4], Q_{cap} (cfs[5])	Capacity based on Orifice Equation[3, 4], Q_{cap} (cfs[5])	Governing Equation
1212 Series - 12"x12" Catch Basin[1]	14.4375	1.05	1.47	Weir
1218 Series - 12"x18" Catch Basin[1]	19.1875	1.22	1.96	Weir
1818 Series - 18"x18" Catch Basin[1]	19.2500	1.38	2.50	Weir
2424 Series - 24"x24" Catch Basin[1]	25.1875	**1.78**	4.18	Weir
3636 Series - 36"x36" Catch Basin[1]	34.9375	**2.60**	8.72	Weir

Type 'I' Catch Basin[2]	22.5000	2.27	6.41	Weir

Note:

1. Based on Brooks Products, Inc. - H 20-44 Traffic, Steel Grate, not Parkway, Cast-iron grate
2. Based on Drawing Number D-13 & D-15 in the City of San Diego Regional Standard Drawings, dated April 2003
3. A reduction factor of 50% assumed for clogging.
4. Weir equation, $Q = C_w L_e (h)^{3/2}$; Orifice equation, $Q = C_o A_e (2gh)^{1/2}$
5. "cfs" = cubic feet per second

Hydraulic Analysis Report

Project Data

Project Title: System 10

Designer:

Project Date: Thursday, January 03, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System10_Node1010

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0150 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 10.9099 ft

Gutter Result Parameters

Design Flow: 4.5000 cfs

Gutter Depression: 1.1340 in

Area of Flow: 1.2611 ft^2

Eo (Gutter Flow to Total Flow): 0.4096

Gutter Depth at Curb: 3.7524 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 13.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 13.0000 ft

Effective Perimeter: 13.0000 ft

Area: 10.8333 ft^2

Effective Area: 10.8333 ft^2

Depth at curb face (upstream of local depression): 0.2370 ft

Computed Width of Spread at Sag: 7.1255 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 11

Designer:

Project Date: Thursday, January 03, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System11_Node1110

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0250 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 6.4883 ft

Gutter Result Parameters

Design Flow: 1.8000 cfs

Gutter Depression: 1.1340 in

Area of Flow: 0.4919 ft^2

Eo (Gutter Flow to Total Flow): 0.6496

Gutter Depth at Curb: 2.6912 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 13.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 13.0000 ft

Effective Perimeter: 13.0000 ft

Area: 10.8333 ft^2

Effective Area: 10.8333 ft^2

Depth at curb face (upstream of local depression): 0.1287 ft

Computed Width of Spread at Sag: 1.7084 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 12

Designer:

Project Date: Thursday, January 03, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System12_Node1210_ComboInlet

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0320 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 5.2000 cfs

Gutter Result Parameters

Width of Spread: 9.8908 ft

Gutter Depression: 1.1340 in

Area of Flow: 1.0492 ft^2

Eo (Gutter Flow to Total Flow): 0.4504

Gutter Depth at Curb: 3.5078 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 10.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 12.7000 ft

Effective Perimeter: 12.7000 ft

Area: 8.3333 ft^2

Effective Area: 8.3333 ft^2

Depth at curb face (upstream of local depression): 0.3165 ft

Computed Width of Spread at Sag: 11.0978 ft

Flow type: Weir Flow

Efficiency: 1.0000

Curb and Gutter Analysis: System13_Node1310_ComboInlet

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0420 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 14.3000 cfs

Gutter Result Parameters

Width of Spread: 14.1514 ft

Gutter Depression: 1.1340 in

Area of Flow: 2.0735 ft^2

Eo (Gutter Flow to Total Flow): 0.3153

Gutter Depth at Curb: 4.5303 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Sweeper Combo

Grate Type: P - 1-7/8

Grate Width: 1.5000 ft

Grate Length: 3.0000 ft

Length of Inlet: 20.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 12.6159 cfs

Bypass Flow: 1.6841 cfs

Approach Velocity: 5.2121 ft/s

Splash-over Velocity: 9.9703 ft/s

Efficiency: 0.8822

Curb and Gutter Analysis: System13_Node1311_ComboInlet

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0420 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 4.3200 cfs

Gutter Result Parameters

Width of Spread: 8.6132 ft

Gutter Depression: 1.1340 in

Area of Flow: 0.8128 ft^2

Eo (Gutter Flow to Total Flow): 0.5122

Gutter Depth at Curb: 3.2012 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Sweeper Combo

Grate Type: P - 1-7/8

Grate Width: 0.8000 ft

Grate Length: 1.5000 ft

Length of Inlet: 10.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 3.5392 cfs

Bypass Flow: 0.7808 cfs

Approach Velocity: 4.3045 ft/s

Splash-over Velocity: 6.9924 ft/s

Efficiency: 0.8193

Curb and Gutter Analysis: System13_Node1330_ComboInlet

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0100 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 2.0000 ft

Design Flow: 14.0000 cfs

Gutter Result Parameters

Width of Spread: 18.3429 ft

Gutter Depression: 1.5120 in

Area of Flow: 3.4906 ft^2

Eo (Gutter Flow to Total Flow): 0.3245

Gutter Depth at Curb: 5.9143 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 9.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 12.6000 ft

Effective Perimeter: 12.6000 ft

Area: 7.5000 ft^2

Effective Area: 7.5000 ft^2

Depth at curb face (upstream of local depression): 0.6157 ft

Computed Width of Spread at Sag: 24.4839 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 13

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System13_Node1331

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0440 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Uniform Gutter Geometry

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 9.7000 cfs

Gutter Result Parameters

Width of Spread: 12.4943 ft

Gutter Depression: 0.0000 in

Area of Flow: 1.5611 ft^2

Eo (Gutter Flow to Total Flow): 0.2893

Gutter Depth at Curb: 2.9986 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 9.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 11.7000 ft

Effective Perimeter: 11.7000 ft

Area: 7.5000 ft^2

Effective Area: 7.5000 ft^2

Depth at curb face (upstream of local depression): 0.5065 ft

Computed Width of Spread at Sag: 25.3246 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 14

Designer:

Project Date: Monday, March 04, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System14_Node1410

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0100 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 5.6000 cfs

Gutter Result Parameters

Width of Spread: 12.9582 ft

Gutter Depression: 1.1340 in

Area of Flow: 1.7500 ft^2

Eo (Gutter Flow to Total Flow): 0.3449

Gutter Depth at Curb: 4.2440 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 7.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 9.7000 ft

Effective Perimeter: 9.7000 ft

Area: 5.8333 ft^2

Effective Area: 5.8333 ft^2

Depth at curb face (upstream of local depression): 0.3979 ft

Computed Width of Spread at Sag: 15.1708 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 15

Designer:

Project Date: Wednesday, February 13, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System 15_Node1520

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0800 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 31.0000 cfs

Gutter Result Parameters

Width of Spread: 16.9110 ft

Gutter Depression: 1.1340 in

Area of Flow: 2.9307 ft^2

Eo (Gutter Flow to Total Flow): 0.2621

Gutter Depth at Curb: 5.1926 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 20.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 15.8833 cfs

Bypass Flow: 15.1167 cfs

Efficiency: 0.5124

Curb and Gutter Analysis: System 15_Node1530_Combo

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 21.1000 cfs

Gutter Result Parameters

Width of Spread: 24.8983 ft

Gutter Depression: 1.1340 in

Area of Flow: 6.2701 ft^2

Eo (Gutter Flow to Total Flow): 0.1745

Gutter Depth at Curb: 7.1096 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Sweeper Combo

Grate Type: P - 1-7/8

Grate Width: 1.5000 ft

Grate Length: 3.0000 ft

Length of Inlet: 20.0000 ft

Curb opening height: 7.2000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 23.0000 ft

Effective Perimeter: 23.0000 ft

Area: 22.7167 ft^2

Effective Area: 22.7167 ft^2

Depth at curb face (upstream of local depression): 0.4255 ft

Computed Width of Spread at Sag: 16.5516 ft

Flow type: Weir Flow

Efficiency: 1.0000

Hydraulic Analysis Report

Project Data

Project Title: System 16

Designer:

Project Date: Thursday, June 20, 2019

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: System 16_Node1610

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0080 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 2.4000 cfs

Gutter Result Parameters

Width of Spread: 9.5602 ft

Gutter Depression: 1.1340 in

Area of Flow: 0.9848 ft^2

Eo (Gutter Flow to Total Flow): 0.4651

Gutter Depth at Curb: 3.4284 in

Inlet Input Parameters

Inlet Location: Inlet in Sag

Percent Clogging: 0.0000 %

Inlet Type: Curb Opening

Length of Inlet: 4.0000 ft

Curb opening height: 6.0000 in

Local Depression: 4.0000 in

Inlet Result Parameters

Perimeter: 6.7000 ft

Effective Perimeter: 6.7000 ft

Area: 3.3333 ft^2

Effective Area: 3.3333 ft^2

Depth at curb face (upstream of local depression): 0.2895 ft

Computed Width of Spread at Sag: 9.7486 ft

Flow type: Weir Flow

Efficiency: 1.0000

APPENDIX D

Hydraulic Analyses – AES Pipeflow

[Post-project Condition]

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                          *
 * SYSTEM 1 - MAINLINE RUN FROM NODES 145 TO 115                             *
 * TAILWATER ASSUMED TO BE TOP OF THE PIPE                                   *
  **************************************************************************

   FILE NAME: 145.PIP
   TIME/DATE OF STUDY: 20:36 03/26/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                 DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+        FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   145.00-             1.50*            167.62       0.88             165.07
         } FRICTION        } HYDRAULIC JUMP
   140.00-             1.43             161.21       0.82*            174.11
         } JUNCTION
   140.00-             1.86             206.90       0.40*            404.13
         } FRICTION
   135.00-             1.15*Dc          150.14       1.15*Dc          150.14
         } JUNCTION
   135.00-             1.81*            149.52       0.78              82.53
         } FRICTION
   115.00-             1.55*            121.33       0.90 Dc           79.82
         } CATCH BASIN
   115.00-             1.73*            108.06       0.90 Dc           27.15
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   145.00            FLOWLINE ELEVATION =   101.16
  PIPE FLOW =       8.80 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   102.660 FEET
------------------------------------------------------------------------------
  NODE   145.00 : HGL = <  102.660>;EGL= <  103.045>;FLOWLINE= <  101.160>

******************************************************************************
  FLOW PROCESS FROM NODE   145.00 TO NODE   140.00 IS CODE =  1
  UPSTREAM NODE   140.00     ELEVATION =   101.32  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       8.80 CFS     PIPE DIAMETER =  18.00 INCHES
```

```
 PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
-------------------------------------------------------------------------------
 HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
-------------------------------------------------------------------------------
 NORMAL DEPTH(FT) =      1.05           CRITICAL DEPTH(FT) =      1.15
===============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.82
===============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-------------------------------------------------------------------------------
 DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
  CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.816      8.951          2.061          174.11
        2.348          0.826      8.826          2.036          172.54
        4.725          0.835      8.704          2.012          171.05
        7.133          0.844      8.585          1.990          169.62
        9.576          0.854      8.470          1.968          168.26
       12.058          0.863      8.358          1.948          166.96
       14.581          0.872      8.249          1.930          165.72
       16.000          0.878      8.191          1.920          165.07
-------------------------------------------------------------------------------
 HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
===============================================================================
 DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
===============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-------------------------------------------------------------------------------
 DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
  CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          1.500      4.978          1.885          167.62
        3.900          1.486      4.986          1.872          166.20
        7.191          1.472      5.000          1.860          164.90
       10.186          1.458      5.018          1.849          163.66
       12.971          1.444      5.040          1.838          162.50
       15.593          1.430      5.064          1.828          161.39
       16.000          1.427      5.069          1.826          161.21
------------------------END OF HYDRAULIC JUMP ANALYSIS-------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     3.04 FEET UPSTREAM OF NODE  145.00 |
|      DOWNSTREAM DEPTH = 1.489 FEET, UPSTREAM CONJUGATE DEPTH = 0.866 FEET |
-------------------------------------------------------------------------------
 NODE   140.00 : HGL = <  102.136>;EGL= <  103.381>;FLOWLINE= <  101.320>

*******************************************************************************
 FLOW PROCESS FROM NODE   140.00 TO NODE   140.00 IS CODE =  5
 UPSTREAM NODE   140.00     ELEVATION =   101.32  (FLOW IS SUPERCRITICAL)
-------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM      8.80    18.00     60.00    101.32      1.15       23.474
   DOWNSTREAM     8.80    18.00       -      101.32      1.15        8.954
   LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
   LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
      Q5          0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.29736
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02118
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.15927
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.637 FEET         ENTRANCE LOSSES =  0.000 FEET
```

```
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 6.892)+( 0.000) =   6.892
------------------------------------------------------------------------------
  NODE   140.00 : HGL = <  101.717>;EGL= <  110.274>;FLOWLINE= <  101.320>

******************************************************************************
  FLOW PROCESS FROM NODE   140.00 TO NODE   135.00 IS CODE =  1
  UPSTREAM NODE   135.00     ELEVATION =   184.15  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       8.80 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     201.42 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.37          CRITICAL DEPTH(FT) =      1.15
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.15
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.148      6.061          1.719            150.14
          0.005          1.117      6.235          1.721            150.30
          0.019          1.086      6.423          1.727            150.81
          0.045          1.054      6.629          1.737            151.68
          0.084          1.023      6.852          1.753            152.94
          0.137          0.992      7.096          1.774            154.63
          0.209          0.960      7.361          1.802            156.79
          0.300          0.929      7.652          1.839            159.45
          0.415          0.898      7.969          1.885            162.66
          0.559          0.867      8.317          1.941            166.49
          0.737          0.835      8.699          2.011            170.99
          0.956          0.804      9.120          2.096            176.25
          1.224          0.773      9.586          2.201            182.35
          1.554          0.741     10.102          2.327            189.42
          1.961          0.710     10.677          2.482            197.57
          2.464          0.679     11.320          2.670            206.98
          3.091          0.648     12.042          2.901            217.82
          3.881          0.616     12.858          3.185            230.35
          4.889          0.585     13.784          3.537            244.86
          6.199          0.554     14.843          3.977            261.73
          7.942          0.523     16.063          4.531            281.42
         10.345          0.491     17.479          5.238            304.56
         13.837          0.460     19.139          6.152            331.94
         19.390          0.429     21.107          7.350            364.64
         30.145          0.397     23.466          8.953            404.12
        201.420          0.397     23.466          8.954            404.13
------------------------------------------------------------------------------
  NODE   135.00 : HGL = <  185.298>;EGL= <  185.869>;FLOWLINE= <  184.150>

******************************************************************************
  FLOW PROCESS FROM NODE   135.00 TO NODE   135.00 IS CODE =  5
  UPSTREAM NODE   135.00     ELEVATION =   184.48  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.50    18.00     57.30    184.48      0.90        3.112
    DOWNSTREAM      8.80    18.00       -      184.15      1.15        6.063
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           3.30===Q5 EQUALS BASIN INPUT===
```

```
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00274
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00806
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00540
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.022 FEET         ENTRANCE LOSSES =  0.114 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.452)+( 0.114) =   0.567
------------------------------------------------------------------------------
  NODE   135.00 : HGL = <  186.285>;EGL= <  186.436>;FLOWLINE= <  184.480>

******************************************************************************
  FLOW PROCESS FROM NODE   135.00 TO NODE   115.00 IS CODE =  1
  UPSTREAM NODE   115.00     ELEVATION =   184.83  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.50 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      34.41 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((      5.50)/(   105.046))**2 = 0.00274
  HF=L*SF = (     34.41)*(0.00274) =      0.094
------------------------------------------------------------------------------
  NODE   115.00 : HGL = <  186.379>;EGL= <  186.530>;FLOWLINE= <  184.830>

******************************************************************************
  FLOW PROCESS FROM NODE   115.00 TO NODE   115.00 IS CODE =  8
  UPSTREAM NODE   115.00     ELEVATION =   184.83  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       5.50 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.11 FEET/SEC.    VELOCITY HEAD =  0.150 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.150) =  0.030
------------------------------------------------------------------------------
  NODE   115.00 : HGL = <  186.560>;EGL= <  186.560>;FLOWLINE= <  184.830>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   115.00            FLOWLINE ELEVATION =   184.83
  ASSUMED UPSTREAM CONTROL HGL =    185.73 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                           *
 * SYSTEM 2 - MAINLINE RUN FROM NODES 225 TO 210                              *
 * TAILWATER ASSUMED TO BE TOP OF THE PIPE                                    *
  **************************************************************************

   FILE NAME: 225.PIP
   TIME/DATE OF STUDY: 16:31 06/13/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   225.00-             1.50*             92.57        0.49              40.89
         } FRICTION
   220.00-             1.35*             76.55        0.45              44.62
         } JUNCTION
   220.00-             1.06              52.41        0.22*            107.23
         } FRICTION
   215.00-             0.66 Dc           36.26        0.25*             93.80
         } JUNCTION
   215.00-             0.66 Dc           36.26        0.22*            112.18
         } FRICTION
   210.00-             0.66*Dc           36.26        0.66*Dc           36.26
         } CATCH BASIN
   210.00-             0.63              12.29        0.66*Dc           12.89
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   225.00            FLOWLINE ELEVATION =   128.09
  PIPE FLOW =       3.00 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   129.590 FEET
------------------------------------------------------------------------------
  NODE   225.00 : HGL = <  129.590>;EGL= <  129.635>;FLOWLINE= <  128.090>

******************************************************************************
  FLOW PROCESS FROM NODE   225.00 TO NODE   220.00 IS CODE =  1
  UPSTREAM NODE   220.00     ELEVATION =   128.25  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       3.00 CFS     PIPE DIAMETER =  18.00 INCHES
```

```
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.55           CRITICAL DEPTH(FT) =      0.66
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          1.500     1.697          1.545            92.57
        3.588          1.466     1.707          1.512            88.92
        7.112          1.433     1.725          1.479            85.36
       10.598          1.399     1.748          1.446            81.86
       14.056          1.365     1.776          1.414            78.45
       16.000          1.346     1.794          1.396            76.55
------------------------------------------------------------------------------
  NODE   220.00 : HGL = <  129.596>;EGL= <  129.646>;FLOWLINE= <  128.250>

******************************************************************************
  FLOW PROCESS FROM NODE   220.00 TO NODE   220.00 IS CODE =  5
  UPSTREAM NODE   220.00     ELEVATION =   128.58  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      3.00    18.00     60.00    128.58      0.66      18.286
    DOWNSTREAM     3.00    18.00       -      128.25      0.66       1.794
    LATERAL #1     0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00       0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.35831
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00072
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.17952
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.718 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 4.349)+( 0.000) =   4.349
------------------------------------------------------------------------------
  NODE   220.00 : HGL = <  128.803>;EGL= <  133.995>;FLOWLINE= <  128.580>

******************************************************************************
  FLOW PROCESS FROM NODE   220.00 TO NODE   215.00 IS CODE =  1
  UPSTREAM NODE   215.00     ELEVATION =   156.94  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       3.00 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      78.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.22           CRITICAL DEPTH(FT) =      0.66
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.25
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.245    15.929          4.188            93.80
```

```
          0.353          0.244     16.016          4.230           94.30
          0.723          0.243     16.104          4.273           94.80
          1.112          0.242     16.192          4.316           95.30
          1.522          0.242     16.282          4.360           95.81
          1.954          0.241     16.372          4.405           96.33
          2.411          0.240     16.463          4.451           96.85
          2.895          0.239     16.555          4.497           97.37
          3.410          0.238     16.648          4.544           97.90
          3.960          0.237     16.742          4.592           98.44
          4.548          0.236     16.836          4.640           98.98
          5.181          0.235     16.932          4.690           99.52
          5.865          0.234     17.028          4.740          100.07
          6.608          0.233     17.126          4.790          100.63
          7.420          0.232     17.224          4.842          101.19
          8.315          0.231     17.324          4.895          101.76
          9.310          0.230     17.424          4.948          102.34
         10.429          0.230     17.526          5.002          102.92
         11.706          0.229     17.628          5.057          103.50
         13.187          0.228     17.732          5.113          104.09
         14.950          0.227     17.836          5.170          104.69
         17.121          0.226     17.942          5.228          105.30
         19.935          0.225     18.049          5.286          105.91
         23.926          0.224     18.156          5.346          106.52
         30.801          0.223     18.265          5.407          107.15
         78.000          0.223     18.280          5.415          107.23
------------------------------------------------------------------------------
  NODE   215.00 : HGL = <  157.185>;EGL= <  161.128>;FLOWLINE= <  156.940>

******************************************************************************
  FLOW PROCESS FROM NODE   215.00 TO NODE   215.00 IS CODE =  5
  UPSTREAM NODE   215.00     ELEVATION =   157.27  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       3.00    18.00     0.00    157.27      0.66       19.149
    DOWNSTREAM      3.00    18.00      -      156.94      0.66       15.934
    LATERAL #1      0.00     0.00     0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00     0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.40867
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.24216
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.32542
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.302 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.053)+( 0.000) =   2.053
------------------------------------------------------------------------------
  NODE   215.00 : HGL = <  157.486>;EGL= <  163.180>;FLOWLINE= <  157.270>

******************************************************************************
  FLOW PROCESS FROM NODE   215.00 TO NODE   210.00 IS CODE =  1
  UPSTREAM NODE   210.00     ELEVATION =   205.79  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       3.00 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      82.03 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.20          CRITICAL DEPTH(FT) =      0.66
```

```
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.66
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.658      4.017          0.909            36.26
          0.002          0.640      4.170          0.910            36.30
          0.007          0.622      4.335          0.914            36.45
          0.018          0.603      4.512          0.919            36.70
          0.033          0.585      4.703          0.928            37.06
          0.054          0.566      4.910          0.941            37.55
          0.083          0.548      5.135          0.958            38.17
          0.120          0.529      5.379          0.979            38.93
          0.167          0.511      5.646          1.006            39.86
          0.226          0.493      5.938          1.040            40.96
          0.299          0.474      6.258          1.083            42.25
          0.390          0.456      6.611          1.135            43.77
          0.503          0.437      7.001          1.199            45.53
          0.642          0.419      7.434          1.278            47.57
          0.815          0.400      7.918          1.374            49.93
          1.031          0.382      8.460          1.494            52.67
          1.302          0.363      9.072          1.642            55.83
          1.646          0.345      9.765          1.827            59.50
          2.089          0.327     10.558          2.059            63.76
          2.669          0.308     11.470          2.352            68.76
          3.449          0.290     12.529          2.729            74.62
          4.533          0.271     13.769          3.217            81.57
          6.125          0.253     15.238          3.861            89.88
          8.681          0.234     17.000          4.725            99.91
         13.679          0.216     19.143          5.910           112.18
         82.030          0.216     19.143          5.910           112.18
------------------------------------------------------------------------------
  NODE   210.00 : HGL = <  206.448>;EGL= <  206.699>;FLOWLINE= <  205.790>

******************************************************************************
  FLOW PROCESS FROM NODE   210.00 TO NODE   210.00 IS CODE =  8
  UPSTREAM NODE   210.00     ELEVATION =   206.12  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       3.00 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   5.05 FEET/SEC.    VELOCITY HEAD =  0.396 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.396) =  0.079
------------------------------------------------------------------------------
  NODE   210.00 : HGL = <  206.778>;EGL= <  206.778>;FLOWLINE= <  206.120>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   210.00            FLOWLINE ELEVATION =   206.12
  ASSUMED UPSTREAM CONTROL HGL =    206.78 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
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****************************************************************************
                PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
          (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                          Analysis prepared by:

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  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
 * SYSTEM 3 -  MAINLINE RUN FROM NODES 335 TO 315                           *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                      *
  **************************************************************************

   FILE NAME: 335.PIP
   TIME/DATE OF STUDY: 11:26 04/02/2019

****************************************************************************
               GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                         NODAL POINT STATUS TABLE
                (Note: "*" indicates nodal point data used.)
                      UPSTREAM RUN                    DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+        FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   335.00-             1.50*            120.88       0.74              95.02
         } FRICTION        } HYDRAULIC JUMP
   330.00-             1.07              90.05       0.59*            113.57
         } JUNCTION
   330.00-             1.07              89.86       0.31*            254.25
         } FRICTION
   320.00-             0.94 Dc           87.58       0.32*            246.31
         } JUNCTION
   320.00-             0.94 Dc           87.58       0.29*            281.65
         } FRICTION
   315.00-             0.94*Dc           87.58       0.94*Dc           87.58
         } CATCH BASIN
   315.00-             1.42*             49.55       0.94 Dc           29.54
----------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
****************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   335.00            FLOWLINE ELEVATION =   170.72
  PIPE FLOW =       5.90 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   172.220 FEET
----------------------------------------------------------------------------
  NODE   335.00 : HGL = <  172.220>;EGL= <  172.393>;FLOWLINE= <  170.720>

****************************************************************************
  FLOW PROCESS FROM NODE   335.00 TO NODE   330.00 IS CODE =  1
  UPSTREAM NODE   330.00     ELEVATION =   171.16  (HYDRAULIC JUMP OCCURS)
----------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.90 CFS     PIPE DIAMETER =  18.00 INCHES
```

```
  PIPE LENGTH =      44.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.80           CRITICAL DEPTH(FT) =      0.94
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.59
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.595      9.046          1.866           113.57
          2.129          0.603      8.878          1.828           111.99
          4.289          0.611      8.717          1.792           110.49
          6.483          0.620      8.560          1.758           109.06
          8.716          0.628      8.409          1.727           107.69
         10.990          0.636      8.263          1.697           106.39
         13.311          0.645      8.121          1.670           105.15
         15.684          0.653      7.984          1.644           103.96
         18.115          0.662      7.851          1.619           102.84
         20.611          0.670      7.723          1.597           101.76
         23.182          0.678      7.599          1.575           100.74
         25.837          0.687      7.478          1.556            99.77
         28.591          0.695      7.361          1.537            98.85
         31.458          0.703      7.247          1.520            97.98
         34.459          0.712      7.137          1.503            97.15
         37.620          0.720      7.030          1.488            96.36
         40.977          0.729      6.927          1.474            95.61
         44.000          0.736      6.842          1.463            95.02
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.500      3.338          1.673           120.88
          3.049          1.478      3.348          1.652           118.52
          5.902          1.455      3.367          1.631           116.27
          8.648          1.433      3.392          1.611           114.10
         11.311          1.410      3.421          1.592           112.01
         13.906          1.388      3.455          1.573           109.99
         16.440          1.365      3.493          1.555           108.04
         18.918          1.343      3.535          1.537           106.17
         21.344          1.320      3.581          1.519           104.36
         23.718          1.298      3.631          1.502           102.63
         26.041          1.275      3.684          1.486           100.98
         28.311          1.253      3.741          1.470            99.41
         30.527          1.230      3.803          1.455            97.92
         32.685          1.208      3.869          1.440            96.51
         34.780          1.185      3.939          1.426            95.19
         36.808          1.163      4.013          1.413            93.96
         38.761          1.140      4.092          1.400            92.83
         40.629          1.118      4.177          1.389            91.79
         42.400          1.095      4.266          1.378            90.85
         44.000          1.074      4.358          1.369            90.05
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    24.36 FEET UPSTREAM OF NODE  335.00 |
|      DOWNSTREAM DEPTH = 1.291 FEET, UPSTREAM CONJUGATE DEPTH = 0.667 FEET |
------------------------------------------------------------------------------
```

```
  NODE   330.00 : HGL = <  171.755>;EGL= <  173.026>;FLOWLINE= <  171.160>

******************************************************************************
  FLOW PROCESS FROM NODE   330.00 TO NODE   330.00 IS CODE =  5
  UPSTREAM NODE   330.00     ELEVATION =   171.49  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.90    18.00     60.00    171.49      0.94       22.050
    DOWNSTREAM      5.90    18.00       -      171.16      0.94        9.049
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34569
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02874
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.18721
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.749 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 6.327)+( 0.000) =   6.327
------------------------------------------------------------------------------
  NODE   330.00 : HGL = <  171.803>;EGL= <  179.353>;FLOWLINE= <  171.490>

******************************************************************************
  FLOW PROCESS FROM NODE   330.00 TO NODE   320.00 IS CODE =  1
  UPSTREAM NODE   320.00     ELEVATION =   209.64  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.90 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     110.00 FEET         MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.31          CRITICAL DEPTH(FT) =      0.94
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.32
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.320     21.339         7.396          246.31
         0.601          0.320     21.368         7.414          246.63
         1.228          0.320     21.396         7.433          246.96
         1.884          0.320     21.425         7.452          247.28
         2.571          0.319     21.453         7.470          247.60
         3.293          0.319     21.482         7.489          247.92
         4.053          0.319     21.511         7.508          248.25
         4.855          0.318     21.540         7.527          248.57
         5.704          0.318     21.568         7.546          248.90
         6.606          0.318     21.597         7.565          249.22
         7.567          0.317     21.626         7.584          249.55
         8.597          0.317     21.655         7.604          249.88
         9.703          0.317     21.685         7.623          250.20
        10.901          0.317     21.714         7.642          250.53
        12.204          0.316     21.743         7.662          250.86
        13.633          0.316     21.773         7.681          251.19
        15.215          0.316     21.802         7.701          251.53
        16.986          0.315     21.832         7.721          251.86
        18.997          0.315     21.861         7.741          252.19
```

```
       21.321          0.315     21.891          7.760           252.53
       24.074          0.314     21.920          7.780           252.86
       27.448          0.314     21.950          7.800           253.20
       31.803          0.314     21.980          7.820           253.53
       37.951          0.314     22.010          7.841           253.87
       48.493          0.313     22.040          7.861           254.21
      110.000          0.313     22.043          7.863           254.25
------------------------------------------------------------------------------
  NODE   320.00 : HGL = <  209.960>;EGL= <  217.036>;FLOWLINE= <  209.640>

******************************************************************************
  FLOW PROCESS FROM NODE   320.00 TO NODE   320.00 IS CODE =  5
  UPSTREAM NODE   320.00     ELEVATION =   209.97  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW   DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      5.90    18.00      0.00    209.97      0.94       24.477
    DOWNSTREAM     5.90    18.00       -      209.64      0.94       21.346
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.46457
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.31537
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.38997
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.560 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.529)+( 0.000) =   2.529
------------------------------------------------------------------------------
  NODE   320.00 : HGL = <  210.261>;EGL= <  219.565>;FLOWLINE= <  209.970>

******************************************************************************
  FLOW PROCESS FROM NODE   320.00 TO NODE   315.00 IS CODE =  1
  UPSTREAM NODE   315.00     ELEVATION =   262.11  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.90 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      80.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.27          CRITICAL DEPTH(FT) =      0.94
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.94
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.938      5.075          1.338            87.58
        0.002          0.911      5.251          1.339            87.69
        0.010          0.884      5.442          1.344            88.03
        0.024          0.857      5.649          1.353            88.62
        0.045          0.831      5.873          1.367            89.47
        0.074          0.804      6.117          1.385            90.61
        0.112          0.777      6.383          1.410            92.07
        0.162          0.750      6.673          1.442            93.88
        0.226          0.723      6.991          1.483            96.07
        0.306          0.697      7.340          1.534            98.69
        0.406          0.670      7.725          1.597           101.78
```

```
          0.530          0.643      8.151          1.675           105.40
          0.683          0.616      8.623          1.772           109.63
          0.873          0.589      9.150          1.890           114.55
          1.110          0.563      9.741          2.037           120.26
          1.406          0.536     10.407          2.219           126.90
          1.780          0.509     11.161          2.444           134.61
          2.256          0.482     12.021          2.727           143.59
          2.871          0.455     13.008          3.085           154.10
          3.681          0.429     14.152          3.541           166.45
          4.775          0.402     15.489          4.129           181.07
          6.306          0.375     17.067          4.901           198.51
          8.568          0.348     18.952          5.929           219.53
         12.227          0.321     21.236          7.329           245.16
         19.445          0.295     24.047          9.280           276.87
         80.000          0.291     24.470          9.595           281.65
------------------------------------------------------------------------------
  NODE   315.00 : HGL = <  263.048>;EGL= <  263.448>;FLOWLINE= <  262.110>

******************************************************************************
  FLOW PROCESS FROM NODE   315.00 TO NODE   315.00 IS CODE =  8
  UPSTREAM NODE   315.00     ELEVATION =   262.11  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       5.90 CFS         PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   5.08 FEET/SEC.    VELOCITY HEAD =  0.400 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.400) =  0.080
------------------------------------------------------------------------------
  NODE   315.00 : HGL = <  263.528>;EGL= <  263.528>;FLOWLINE= <  262.110>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   315.00           FLOWLINE ELEVATION =   262.11
  ASSUMED UPSTREAM CONTROL HGL =    263.05 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
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           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                           *
 * SYSTEM 4 - MAINLINE RUN FROM NODES 430 TO 410                              *
 * TAILWATER ASSUMED TO BE THE TOP OF PIPE                                    *
  **************************************************************************

   FILE NAME: 430.PIP
   TIME/DATE OF STUDY: 13:45 03/23/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   430.00-          1.50*             87.54        0.45              24.32
         } FRICTION
   425.00-          1.12*             50.46        0.40              26.51
         } JUNCTION
   425.00-          0.82              30.28        0.19*             65.98
         } FRICTION
   420.00-          0.55 Dc           22.94        0.20*             60.21
         } JUNCTION
   420.00-          0.55 Dc           22.94        0.17*             76.04
         } FRICTION
   415.00-          0.55 Dc           22.94        0.19*             66.49
         } JUNCTION
   415.00-          0.55 Dc           22.94        0.15*             95.12
         } FRICTION
   410.00-          0.55*Dc           22.94        0.55*Dc           22.94
         } CATCH BASIN
   410.00-          0.79*             12.23        0.55 Dc            8.27
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   430.00            FLOWLINE ELEVATION =   195.37
  PIPE FLOW =       2.10 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   196.870 FEET
------------------------------------------------------------------------------
  NODE   430.00 : HGL = <  196.870>;EGL= <  196.892>;FLOWLINE= <  195.370>

******************************************************************************
  FLOW PROCESS FROM NODE   430.00 TO NODE   425.00 IS CODE =  1
```

```
  UPSTREAM NODE   425.00     ELEVATION =   195.75  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      38.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.45           CRITICAL DEPTH(FT) =      0.55
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.500      1.188          1.522            87.54
         3.929          1.462      1.196          1.484            83.38
         7.821          1.424      1.211          1.447            79.29
        11.692          1.386      1.231          1.409            75.28
        15.547          1.347      1.255          1.372            71.36
        19.387          1.309      1.283          1.335            67.53
        23.212          1.271      1.315          1.298            63.82
        27.024          1.233      1.351          1.261            60.21
        30.821          1.195      1.391          1.225            56.73
        34.601          1.157      1.435          1.189            53.38
        38.000          1.122      1.480          1.156            50.46
------------------------------------------------------------------------------
  NODE   425.00 : HGL = <  196.872>;EGL= <  196.906>;FLOWLINE= <  195.750>

******************************************************************************
  FLOW PROCESS FROM NODE   425.00 TO NODE   425.00 IS CODE =  5
  UPSTREAM NODE   425.00     ELEVATION =   196.08  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      2.10    18.00     60.00    196.08      0.55       16.057
    DOWNSTREAM     2.10    18.00       -      195.75      0.55        1.481
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.33515
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00048
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.16782
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.671 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.368)+( 0.000) =   3.368
------------------------------------------------------------------------------
  NODE   425.00 : HGL = <  196.271>;EGL= <  200.274>;FLOWLINE= <  196.080>

******************************************************************************
  FLOW PROCESS FROM NODE   425.00 TO NODE   420.00 IS CODE =  1
  UPSTREAM NODE   420.00     ELEVATION =   205.91  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      29.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
```

```
  NORMAL DEPTH(FT) =      0.19          CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.20
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.204    14.609          3.520            60.21
         0.304          0.203    14.664          3.544            60.43
         0.622          0.202    14.720          3.569            60.65
         0.956          0.202    14.777          3.595            60.88
         1.307          0.201    14.834          3.620            61.11
         1.676          0.201    14.891          3.646            61.33
         2.066          0.200    14.948          3.672            61.56
         2.478          0.200    15.006          3.699            61.79
         2.916          0.199    15.064          3.725            62.03
         3.382          0.199    15.123          3.752            62.26
         3.881          0.198    15.182          3.780            62.50
         4.416          0.198    15.241          3.807            62.73
         4.992          0.197    15.301          3.835            62.97
         5.618          0.197    15.362          3.863            63.21
         6.300          0.196    15.422          3.892            63.46
         7.051          0.196    15.483          3.920            63.70
         7.884          0.195    15.545          3.950            63.95
         8.818          0.195    15.607          3.979            64.19
         9.882          0.194    15.669          4.009            64.44
        11.116          0.193    15.732          4.039            64.69
        12.580          0.193    15.795          4.069            64.95
        14.379          0.192    15.858          4.100            65.20
        16.709          0.192    15.922          4.131            65.46
        20.005          0.191    15.987          4.162            65.71
        25.673          0.191    16.052          4.194            65.97
        29.000          0.191    16.052          4.194            65.98
------------------------------------------------------------------------------
  NODE   420.00 : HGL = <  206.114>;EGL= <  209.430>;FLOWLINE= <  205.910>

******************************************************************************
  FLOW PROCESS FROM NODE   420.00 TO NODE   420.00 IS CODE =  5
  UPSTREAM NODE   420.00     ELEVATION =   206.24  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       2.10    18.00       0.00    206.24       0.55      18.563
    DOWNSTREAM      2.10    18.00        -      205.91       0.55      14.613
    LATERAL #1      0.00     0.00       0.00      0.00       0.00       0.000
    LATERAL #2      0.00     0.00       0.00      0.00       0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.50718
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.25613
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.38166
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.527 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.334)+( 0.000) =   2.334
------------------------------------------------------------------------------
  NODE   420.00 : HGL = <  206.413>;EGL= <  211.764>;FLOWLINE= <  206.240>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE   420.00 TO NODE   415.00 IS CODE =  1
  UPSTREAM NODE   415.00     ELEVATION =   234.55  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      55.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.17          CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.19
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.190     16.180          4.258            66.49
         0.258          0.189     16.268          4.301            66.84
         0.529          0.188     16.357          4.346            67.20
         0.813          0.188     16.447          4.391            67.56
         1.112          0.187     16.538          4.436            67.92
         1.428          0.186     16.629          4.483            68.29
         1.762          0.186     16.721          4.530            68.66
         2.115          0.185     16.814          4.578            69.03
         2.491          0.184     16.908          4.626            69.41
         2.893          0.183     17.003          4.676            69.79
         3.322          0.183     17.099          4.726            70.17
         3.784          0.182     17.196          4.776            70.56
         4.283          0.181     17.294          4.828            70.95
         4.825          0.181     17.392          4.881            71.35
         5.418          0.180     17.492          4.934            71.75
         6.070          0.179     17.592          4.988            72.16
         6.796          0.178     17.694          5.043            72.56
         7.612          0.178     17.797          5.099            72.98
         8.542          0.177     17.900          5.156            73.39
         9.623          0.176     18.005          5.213            73.81
        10.907          0.176     18.111          5.272            74.24
        12.489          0.175     18.217          5.331            74.67
        14.540          0.174     18.325          5.392            75.10
        17.447          0.174     18.434          5.453            75.54
        22.455          0.173     18.544          5.516            75.98
        55.000          0.173     18.558          5.524            76.04
------------------------------------------------------------------------------
  NODE   415.00 : HGL = <  234.740>;EGL= <  238.808>;FLOWLINE= <  234.550>

******************************************************************************
  FLOW PROCESS FROM NODE   415.00 TO NODE   415.00 IS CODE =  5
  UPSTREAM NODE   415.00     ELEVATION =   234.88  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       2.10    18.00     20.00    234.88      0.55      23.290
    DOWNSTREAM      2.10    18.00       -      234.55      0.55      16.185
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.97050
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34285
```

```
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.65667
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  2.627 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 4.643)+( 0.000) =   4.643
------------------------------------------------------------------------------
  NODE   415.00 : HGL = <  235.028>;EGL= <  243.451>;FLOWLINE= <  234.880>

******************************************************************************
  FLOW PROCESS FROM NODE   415.00 TO NODE   410.00 IS CODE =  1
  UPSTREAM NODE   410.00     ELEVATION =   259.36  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      25.23 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.15           CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.55
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.547       3.603           0.749             22.94
         0.001          0.531       3.751           0.750             22.97
         0.004          0.515       3.911           0.753             23.07
         0.010          0.499       4.083           0.758             23.25
         0.018          0.483       4.269           0.766             23.51
         0.030          0.467       4.472           0.778             23.86
         0.046          0.451       4.692           0.793             24.30
         0.067          0.435       4.933           0.813             24.84
         0.094          0.419       5.197           0.839             25.50
         0.128          0.403       5.487           0.871             26.29
         0.170          0.387       5.807           0.911             27.22
         0.222          0.371       6.161           0.961             28.32
         0.288          0.355       6.556           1.023             29.59
         0.370          0.339       6.997           1.100             31.08
         0.472          0.323       7.493           1.196             32.81
         0.601          0.308       8.053           1.315             34.82
         0.764          0.292       8.691           1.465             37.17
         0.974          0.276       9.422           1.655             39.92
         1.247          0.260      10.266           1.897             43.14
         1.610          0.244      11.250           2.210             46.95
         2.105          0.228      12.409           2.620             51.49
         2.803          0.212      13.788           3.166             56.94
         3.844          0.196      15.452           3.906             63.58
         5.544          0.180      17.492           4.934             71.75
         8.931          0.164      20.037           6.402             82.00
        25.230          0.148      23.283           8.571             95.12
------------------------------------------------------------------------------
  NODE   410.00 : HGL = <  259.907>;EGL= <  260.109>;FLOWLINE= <  259.360>

******************************************************************************
  FLOW PROCESS FROM NODE   410.00 TO NODE   410.00 IS CODE =  8
  UPSTREAM NODE   410.00     ELEVATION =   259.36  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       2.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.60 FEET/SEC.    VELOCITY HEAD =  0.202 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.202) =  0.040
------------------------------------------------------------------------------
  NODE   410.00 : HGL = <  260.149>;EGL= <  260.149>;FLOWLINE= <  259.360>
```

```
******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   410.00            FLOWLINE ELEVATION =   259.36
  ASSUMED UPSTREAM CONTROL HGL =    259.91 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
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           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************* DESCRIPTION OF STUDY ************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                           *
 * SYSTEM 5 - MAINLINE RUN FROM NODES 525 TO 510                              *
 * TAILWATER ASSUMED TO BE THE TOP OF PIPE                                    *
  **************************************************************************

   FILE NAME: 525.PIP
   TIME/DATE OF STUDY: 17:39 06/13/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+          FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   525.00-             1.50*             84.85        0.26              19.64
         } FRICTION
   520.00-             1.40*             74.12        0.22              24.89
         } JUNCTION
   520.00-             1.07*             42.96        0.15              41.93
         } FRICTION        } HYDRAULIC JUMP
   515.00-             0.44 Dc           13.68        0.31*             16.37
         } JUNCTION
   515.00-             0.44 Dc           13.68        0.37*             14.32
         } FRICTION
   510.00-             0.44*Dc           13.68        0.44*Dc           13.68
         } CATCH BASIN
   510.00-             0.36               4.07        0.44*Dc            4.98
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   525.00            FLOWLINE ELEVATION =   214.14
  PIPE FLOW =       1.40 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   215.640 FEET
------------------------------------------------------------------------------
  NODE   525.00 : HGL = <  215.640>;EGL= <  215.650>;FLOWLINE= <  214.140>

******************************************************************************
  FLOW PROCESS FROM NODE   525.00 TO NODE   520.00 IS CODE =  1
  UPSTREAM NODE   520.00     ELEVATION =   214.24  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.40 CFS     PIPE DIAMETER =  18.00 INCHES
```

```
  PIPE LENGTH =       9.67 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.37           CRITICAL DEPTH(FT) =      0.44
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.500      0.792          1.510            84.85
          4.138          1.458      0.798          1.468            80.22
          8.258          1.415      0.810          1.426            75.66
          9.670          1.401      0.815          1.411            74.12
------------------------------------------------------------------------------
  NODE   520.00 : HGL = <  215.641>;EGL= <  215.651>;FLOWLINE= <  214.240>

******************************************************************************
  FLOW PROCESS FROM NODE   520.00 TO NODE   520.00 IS CODE =  5
  UPSTREAM NODE   520.00     ELEVATION =   214.57  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.40    18.00     40.00    214.57      0.44        1.035
    DOWNSTREAM      1.40    18.00       -      214.24      0.44        0.816
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00024
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00015
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00020
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.001 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.008)+( 0.000) =   0.008
------------------------------------------------------------------------------
  NODE   520.00 : HGL = <  215.643>;EGL= <  215.659>;FLOWLINE= <  214.570>

******************************************************************************
  FLOW PROCESS FROM NODE   520.00 TO NODE   515.00 IS CODE =  1
  UPSTREAM NODE   515.00     ELEVATION =   261.27  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.40 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     100.75 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.15           CRITICAL DEPTH(FT) =      0.44
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.31
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.312      5.250          0.741            16.37
          0.046          0.306      5.415          0.761            16.71
```

```
          0.099          0.299      5.589          0.784            17.07
          0.157          0.292      5.772          0.810            17.47
          0.223          0.286      5.967          0.839            17.90
          0.297          0.279      6.173          0.871            18.36
          0.381          0.272      6.391          0.907            18.86
          0.475          0.266      6.624          0.947            19.40
          0.582          0.259      6.871          0.993            19.99
          0.703          0.252      7.135          1.043            20.62
          0.841          0.246      7.417          1.100            21.30
          0.998          0.239      7.718          1.165            22.04
          1.179          0.232      8.041          1.237            22.85
          1.387          0.226      8.388          1.319            23.72
          1.629          0.219      8.762          1.412            24.66
          1.912          0.212      9.165          1.517            25.69
          2.245          0.206      9.601          1.638            26.81
          2.643          0.199     10.074          1.776            28.04
          3.125          0.192     10.588          1.934            29.38
          3.719          0.186     11.148          2.117            30.84
          4.468          0.179     11.761          2.328            32.46
          5.447          0.172     12.434          2.574            34.23
          6.795          0.166     13.174          2.862            36.20
          8.822          0.159     13.994          3.201            38.38
         12.532          0.152     14.903          3.603            40.81
        100.750          0.149     15.324          3.798            41.93
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.07
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY     SPECIFIC       PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.073      1.035          1.089            42.96
          0.052          1.048      1.062          1.065            40.93
          0.105          1.022      1.091          1.041            38.97
          0.157          0.997      1.122          1.017            37.06
          0.209          0.972      1.155          0.993            35.22
          0.260          0.947      1.191          0.969            33.44
          0.311          0.922      1.229          0.945            31.73
          0.362          0.897      1.270          0.922            30.08
          0.413          0.871      1.314          0.898            28.50
          0.463          0.846      1.362          0.875            26.98
          0.512          0.821      1.414          0.852            25.54
          0.561          0.796      1.470          0.829            24.17
          0.610          0.771      1.530          0.807            22.86
          0.657          0.746      1.596          0.785            21.63
          0.704          0.720      1.668          0.764            20.48
          0.749          0.695      1.746          0.743            19.41
          0.793          0.670      1.832          0.722            18.41
          0.836          0.645      1.927          0.702            17.50
          0.876          0.620      2.031          0.684            16.67
          0.915          0.594      2.147          0.666            15.93
          0.950          0.569      2.275          0.650            15.28
          0.982          0.544      2.419          0.635            14.73
          1.009          0.519      2.580          0.622            14.29
          1.031          0.494      2.762          0.612            13.96
          1.046          0.469      2.968          0.605            13.75
          1.052          0.443      3.204          0.603            13.68
        100.750          0.443      3.204          0.603            13.68
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     0.03 FEET UPSTREAM OF NODE  520.00 |
|       DOWNSTREAM DEPTH = 1.060 FEET, UPSTREAM CONJUGATE DEPTH = 0.149 FEET |
```

```
------------------------------------------------------------------------------
  NODE   515.00 : HGL = <  261.582>;EGL= <  262.011>;FLOWLINE= <  261.270>

******************************************************************************
  FLOW PROCESS FROM NODE   515.00 TO NODE   515.00 IS CODE =  5
  UPSTREAM NODE   515.00     ELEVATION =   261.60  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.40    18.00     35.00    261.60      0.44       4.063
    DOWNSTREAM      1.40    18.00       -      261.27      0.44       5.252
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00954
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01967
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01460
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.058 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.220)+( 0.000) =   0.220
------------------------------------------------------------------------------
  NODE   515.00 : HGL = <  261.974>;EGL= <  262.231>;FLOWLINE= <  261.600>

******************************************************************************
  FLOW PROCESS FROM NODE   515.00 TO NODE   510.00 IS CODE =  1
  UPSTREAM NODE   510.00     ELEVATION =   261.97  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.40 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      37.69 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.37          CRITICAL DEPTH(FT) =      0.44
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.44
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.443       3.204          0.603            13.68
         0.008          0.440       3.233          0.603            13.68
         0.031          0.438       3.263          0.603            13.68
         0.072          0.435       3.293          0.603            13.69
         0.132          0.432       3.324          0.604            13.69
         0.213          0.429       3.355          0.604            13.70
         0.317          0.426       3.386          0.604            13.71
         0.447          0.423       3.418          0.605            13.73
         0.606          0.420       3.451          0.605            13.74
         0.797          0.418       3.484          0.606            13.76
         1.025          0.415       3.518          0.607            13.78
         1.294          0.412       3.552          0.608            13.80
         1.610          0.409       3.587          0.609            13.83
         1.983          0.406       3.623          0.610            13.85
         2.420          0.403       3.659          0.611            13.88
         2.936          0.400       3.696          0.613            13.92
         3.545          0.397       3.733          0.614            13.95
         4.271          0.395       3.772          0.616            13.99
```

```
          5.145          0.392      3.810          0.617           14.03
          6.213          0.389      3.850          0.619           14.07
          7.546          0.386      3.890          0.621           14.11
          9.263          0.383      3.931          0.623           14.16
         11.587          0.380      3.973          0.625           14.21
         15.021          0.377      4.016          0.628           14.26
         21.174          0.374      4.060          0.631           14.32
         37.690          0.374      4.062          0.631           14.32
------------------------------------------------------------------------------
  NODE   510.00 : HGL = <  262.413>;EGL= <  262.573>;FLOWLINE= <  261.970>

******************************************************************************
  FLOW PROCESS FROM NODE   510.00 TO NODE   510.00 IS CODE =  8
  UPSTREAM NODE   510.00     ELEVATION =   262.24  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.40 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   5.96 FEET/SEC.    VELOCITY HEAD =  0.552 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.552) =  0.110
------------------------------------------------------------------------------
  NODE   510.00 : HGL = <  262.683>;EGL= <  262.683>;FLOWLINE= <  262.240>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   510.00             FLOWLINE ELEVATION =   262.24
  ASSUMED UPSTREAM CONTROL HGL =    262.68 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

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******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                            Analysis prepared by:

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  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
 * SYSTEM 6 -  MAINLINE RUN FROM NODES 695 TO 665                            *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                       *
  **************************************************************************

   FILE NAME: 695.PIP
   TIME/DATE OF STUDY: 10:53 04/02/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   695.00-             3.50            1653.29        0.78*          3628.24
         } FRICTION
   690.00-             3.41            1601.06        0.74*          3933.09
         } JUNCTION
   690.00-             3.00            1421.95        0.72*          4106.40
         } FRICTION
   685.00-             2.31*Dc         1285.72        2.31*Dc        1285.72
         } JUNCTION
   685.00-             3.11*           1139.11        1.74            910.27
         } FRICTION
   680.00-             2.73*            991.82        2.05 Dc         877.18
         } JUNCTION
   680.00-             3.44*           1249.45        1.67            870.12
         } FRICTION
   675.00-             2.92*           1021.30        2.00 Dc         829.90
         } JUNCTION
   675.00-             3.56*            978.26        1.06            274.77
         } FRICTION
   665.00-             3.33*            874.31        1.26 Dc         262.39
         } CATCH BASIN
   665.00-             3.42*            847.28        1.26 Dc          93.64
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   695.00            FLOWLINE ELEVATION =   224.31
  PIPE FLOW =      54.70 CFS        PIPE DIAMETER =  42.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   227.810 FEET
------------------------------------------------------------------------------
```

```
  NODE   695.00 : HGL = <  225.095>;EGL= <  242.964>;FLOWLINE= <  224.310>

******************************************************************************
  FLOW PROCESS FROM NODE   695.00 TO NODE   690.00 IS CODE =  1
  UPSTREAM NODE   690.00     ELEVATION =   224.43  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      54.70 CFS     PIPE DIAMETER =  42.00 INCHES
  PIPE LENGTH =      12.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.84           CRITICAL DEPTH(FT) =      2.31
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.74
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000           0.741     36.828        21.814          3933.09
       11.941           0.785     33.926        18.668          3629.61
       12.000           0.785     33.913        18.654          3628.24
------------------------------------------------------------------------------
  NODE   690.00 : HGL = <  225.171>;EGL= <  246.244>;FLOWLINE= <  224.430>

******************************************************************************
  FLOW PROCESS FROM NODE   690.00 TO NODE   690.00 IS CODE =  5
  UPSTREAM NODE   690.00     ELEVATION =   224.76  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      54.70    42.00      0.00    224.76      2.31       38.494
    DOWNSTREAM     54.70    42.00       -      224.43      2.31       36.839
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34747
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.30688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.32718
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.309 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.243)+( 0.000) =   2.243
------------------------------------------------------------------------------
  NODE   690.00 : HGL = <  225.478>;EGL= <  248.487>;FLOWLINE= <  224.760>

******************************************************************************
  FLOW PROCESS FROM NODE   690.00 TO NODE   685.00 IS CODE =  1
  UPSTREAM NODE   685.00     ELEVATION =   264.86  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      54.70 CFS     PIPE DIAMETER =  42.00 INCHES
  PIPE LENGTH =      77.80 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.65           CRITICAL DEPTH(FT) =      2.31
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.31
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
```

```
----------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          2.315      8.099           3.334            1285.72
          0.008          2.248      8.374           3.338            1287.32
          0.032          2.182      8.672           3.350            1292.28
          0.076          2.115      8.995           3.372            1300.86
          0.142          2.049      9.347           3.406            1313.37
          0.234          1.982      9.729           3.453            1330.14
          0.357          1.916     10.147           3.515            1351.57
          0.517          1.849     10.604           3.596            1378.11
          0.720          1.783     11.105           3.698            1410.31
          0.975          1.716     11.656           3.827            1448.78
          1.292          1.649     12.264           3.986            1494.27
          1.687          1.583     12.937           4.184            1547.66
          2.176          1.516     13.686           4.427            1610.00
          2.783          1.450     14.522           4.727            1682.57
          3.539          1.383     15.461           5.097            1766.92
          4.485          1.317     16.519           5.557            1864.95
          5.680          1.250     17.721           6.129            1979.05
          7.204          1.184     19.093           6.848            2112.18
          9.176          1.117     20.671           7.756            2268.13
         11.777          1.051     22.502           8.918            2451.78
         15.296          0.984     24.647          10.423            2669.51
         20.232          0.918     27.184          12.400            2929.82
         27.537          0.851     30.225          15.045            3244.26
         39.384          0.785     33.918          18.660            3628.83
         62.808          0.718     38.482          23.727            4106.40
         77.800          0.718     38.482          23.727            4106.40
----------------------------------------------------------------------------
  NODE   685.00 : HGL = <  267.175>;EGL= <  268.194>;FLOWLINE= <  264.860>

****************************************************************************
  FLOW PROCESS FROM NODE   685.00 TO NODE   685.00 IS CODE =  5
  UPSTREAM NODE   685.00     ELEVATION =   265.36  (FLOW UNSEALS IN REACH)
----------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      39.50    36.00     19.65    265.36      2.05        5.588
    DOWNSTREAM     54.70    42.00       -      264.86      2.31        8.101
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5          15.20===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00351
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00492
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00421
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.017 FEET         ENTRANCE LOSSES =  0.204 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.560)+( 0.204) =   0.764
----------------------------------------------------------------------------
  NODE   685.00 : HGL = <  268.473>;EGL= <  268.958>;FLOWLINE= <  265.360>

****************************************************************************
  FLOW PROCESS FROM NODE   685.00 TO NODE   680.00 IS CODE =  1
  UPSTREAM NODE   680.00     ELEVATION =   265.86  (FLOW SEALS IN REACH)
----------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
```

```
  PIPE FLOW   =      39.50 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      49.95 FEET          MANNING'S N  =  0.01300
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     3.11
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          3.113      5.588          3.598          1139.11
         17.340          3.000      5.588          3.485          1089.37
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.66           CRITICAL DEPTH(FT) =      2.05
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     3.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)     (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         17.340          3.000      5.586          3.485          1089.37
         22.698          2.962      5.600          3.449          1073.59
         27.630          2.924      5.625          3.415          1058.74
         32.321          2.886      5.657          3.383          1044.54
         36.827          2.847      5.696          3.351          1030.92
         41.176          2.809      5.740          3.321          1017.84
         45.385          2.771      5.789          3.292          1005.29
         49.466          2.733      5.843          3.263           993.25
         49.950          2.728      5.850          3.260           991.82
------------------------------------------------------------------------------
  NODE   680.00 : HGL = <  268.588>;EGL= <  269.120>;FLOWLINE= <  265.860>

******************************************************************************
  FLOW PROCESS FROM NODE   680.00 TO NODE   680.00 IS CODE =  5
  UPSTREAM NODE   680.00     ELEVATION =   266.19  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      37.90    36.00     82.70    266.19      2.00        5.362
    DOWNSTREAM     39.50    36.00       -      265.86      2.05        5.851
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           1.60===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00323
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00306
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00315
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.013 FEET         ENTRANCE LOSSES =  0.106 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.850)+( 0.106) =   0.956
------------------------------------------------------------------------------
  NODE   680.00 : HGL = <  269.630>;EGL= <  270.076>;FLOWLINE= <  266.190>

******************************************************************************
  FLOW PROCESS FROM NODE   680.00 TO NODE   675.00 IS CODE =  1
  UPSTREAM NODE   675.00     ELEVATION =   266.95  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
```

```
  PIPE FLOW   =      37.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      76.00 FEET          MANNING'S N  =  0.01300
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     3.44
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          3.440      5.362          3.886          1249.45
         64.967          3.000      5.362          3.446          1055.42
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.62           CRITICAL DEPTH(FT) =      2.00
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     3.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         64.967          3.000      5.360          3.446          1055.42
         70.380          2.960      5.374          3.409          1038.87
         75.392          2.920      5.400          3.373          1023.24
         76.000          2.915      5.403          3.369          1021.30
------------------------------------------------------------------------------
  NODE   675.00 : HGL = <  269.865>;EGL= <  270.319>;FLOWLINE= <  266.950>

******************************************************************************
  FLOW PROCESS FROM NODE   675.00 TO NODE   675.00 IS CODE =  5
  UPSTREAM NODE   675.00     ELEVATION =   267.28  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      15.70    36.00     81.90    267.28      1.26        2.221
    DOWNSTREAM     37.90    36.00       -      266.95      2.00        5.405
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5          22.20===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00055
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00285
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00170
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.007 FEET         ENTRANCE LOSSES =  0.091 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.512)+( 0.091) =   0.602
------------------------------------------------------------------------------
  NODE   675.00 : HGL = <  270.845>;EGL= <  270.921>;FLOWLINE= <  267.280>

******************************************************************************
  FLOW PROCESS FROM NODE   675.00 TO NODE   665.00 IS CODE =  1
  UPSTREAM NODE   665.00     ELEVATION =   267.53  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      15.70 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      25.85 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     15.70)/(   666.509))**2 = 0.00055
  HF=L*SF = (     25.85)*(0.00055) =      0.014
------------------------------------------------------------------------------
```

```
  NODE   665.00 : HGL = <  270.859>;EGL= <  270.936>;FLOWLINE= <  267.530>

******************************************************************************
  FLOW PROCESS FROM NODE   665.00 TO NODE   665.00 IS CODE =  8
  UPSTREAM NODE   665.00     ELEVATION =   267.53  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      15.70 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =   2.22 FEET/SEC.    VELOCITY HEAD =  0.077 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.077) =  0.015
------------------------------------------------------------------------------
  NODE   665.00 : HGL = <  270.951>;EGL= <  270.951>;FLOWLINE= <  267.530>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   665.00            FLOWLINE ELEVATION =   267.53
  ASSUMED UPSTREAM CONTROL HGL =    268.79 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
______________________________________________________________________________
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                            Analysis prepared by:

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  ************************* DESCRIPTION OF STUDY *************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                            *
 * SYSTEM 7 - MAINLINE VELOCITY RUN FROM NODES 755 TO 710                  *
 * TAILWATER ASSUMED TO BE THE TOP OF PIPE                                *
  ************************************************************************

   FILE NAME: 755.PIP
   TIME/DATE OF STUDY: 21:34 04/02/2019
______________________________________________________________________________
******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+          FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   755.00-           1.50             118.33        0.42*            158.25
         } FRICTION
   750.00-           1.29              99.66        0.30*            248.21
         } JUNCTION
   750.00-           0.92 Dc           83.68        0.27*            287.40
         } FRICTION
   745.00-           0.92 Dc           83.68        0.59*            107.64
         } JUNCTION
   745.00-           1.09              78.43        0.45*            119.54
         } FRICTION
   730.00-           0.87 Dc           72.26        0.83*             72.52
         } JUNCTION
   730.00-           0.78 Dc           54.33        0.67*             56.15
         } FRICTION
   710.00-           0.78*Dc           54.33        0.78*Dc           54.33
         } CATCH BASIN
   710.00-           1.14*             29.55        0.78 Dc           18.98
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   755.00            FLOWLINE ELEVATION =   201.97
  PIPE FLOW =       5.70 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   203.470 FEET
------------------------------------------------------------------------------
  NODE   755.00 : HGL = <  202.393>;EGL= <  205.404>;FLOWLINE= <  201.970>

******************************************************************************
  FLOW PROCESS FROM NODE   755.00 TO NODE   750.00 IS CODE =  1
```

```
  UPSTREAM NODE   750.00     ELEVATION =   202.21  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.70 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      24.89 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.80           CRITICAL DEPTH(FT) =      0.92
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.30
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.303     22.285          8.020           248.21
         3.982          0.323     20.371          6.771           227.39
         8.009          0.343     18.726          5.791           209.57
        12.080          0.363     17.300          5.013           194.21
        16.195          0.382     16.055          4.387           180.87
        20.353          0.402     14.960          3.879           169.22
        24.558          0.422     13.991          3.463           159.00
        24.890          0.423     13.920          3.434           158.25
------------------------------------------------------------------------------
  NODE   750.00 : HGL = <  202.513>;EGL= <  210.230>;FLOWLINE= <  202.210>

******************************************************************************
  FLOW PROCESS FROM NODE   750.00 TO NODE   750.00 IS CODE =  5
  UPSTREAM NODE   750.00     ELEVATION =   202.54  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      5.70    18.00      0.00    202.54      0.92      25.880
    DOWNSTREAM     5.70    18.00      -       202.21      0.92      22.292
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.55997
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.36687
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.46342
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.854 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.984)+( 0.000) =   2.984
------------------------------------------------------------------------------
  NODE   750.00 : HGL = <  202.813>;EGL= <  213.214>;FLOWLINE= <  202.540>

******************************************************************************
  FLOW PROCESS FROM NODE   750.00 TO NODE   745.00 IS CODE =  1
  UPSTREAM NODE   745.00     ELEVATION =   266.28  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.70 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      96.27 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.26           CRITICAL DEPTH(FT) =      0.92
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.59
==============================================================================
```

```
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.589      8.847         1.805           107.64
        0.099          0.576      9.117         1.868           110.11
        0.208          0.563      9.403         1.937           112.77
        0.331          0.550      9.707         2.014           115.63
        0.468          0.537     10.028         2.099           118.72
        0.622          0.524     10.371         2.195           122.04
        0.794          0.511     10.735         2.301           125.62
        0.988          0.498     11.123         2.420           129.49
        1.207          0.485     11.537         2.553           133.65
        1.454          0.472     11.980         2.701           138.15
        1.736          0.458     12.455         2.869           143.02
        2.057          0.445     12.964         3.057           148.29
        2.425          0.432     13.513         3.269           153.99
        2.849          0.419     14.104         3.510           160.19
        3.342          0.406     14.743         3.783           166.93
        3.919          0.393     15.435         4.095           174.27
        4.601          0.380     16.187         4.451           182.28
        5.416          0.367     17.006         4.860           191.05
        6.405          0.354     17.901         5.333           200.67
        7.626          0.341     18.882         5.880           211.25
        9.172          0.328     19.961         6.518           222.94
       11.198          0.315     21.152         7.267           235.88
       13.997          0.302     22.474         8.149           250.27
       18.227          0.289     23.945         9.198           266.33
       25.999          0.275     25.593        10.453           284.34
       96.270          0.273     25.872        10.674           287.40
------------------------------------------------------------------------------
  NODE   745.00 : HGL = <  266.869>;EGL= <  268.085>;FLOWLINE= <  266.280>

******************************************************************************
  FLOW PROCESS FROM NODE   745.00 TO NODE   745.00 IS CODE =  5
  UPSTREAM NODE   745.00     ELEVATION =   266.61  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.10    18.00      0.00    266.61      0.87      11.584
    DOWNSTREAM      5.70    18.00       -      266.28      0.92       8.849
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.60===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.06368
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02773
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04571
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.183 FEET         ENTRANCE LOSSES =  0.243 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.811)+( 0.243) =   1.054
------------------------------------------------------------------------------
  NODE   745.00 : HGL = <  267.056>;EGL= <  269.139>;FLOWLINE= <  266.610>

******************************************************************************
  FLOW PROCESS FROM NODE   745.00 TO NODE   730.00 IS CODE =  1
  UPSTREAM NODE   730.00     ELEVATION =   269.83  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
```

```
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      43.90 FEET          MANNING'S N  =  0.01300
-------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.43           CRITICAL DEPTH(FT) =      0.87
===============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.83
===============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.828      5.093           1.232            72.52
         0.059          0.812      5.217           1.235            72.76
         0.143          0.797      5.348           1.241            73.09
         0.253          0.781      5.485           1.248            73.51
         0.392          0.765      5.630           1.257            74.03
         0.566          0.749      5.783           1.268            74.65
         0.777          0.733      5.944           1.282            75.38
         1.032          0.717      6.114           1.298            76.22
         1.335          0.701      6.294           1.316            77.18
         1.696          0.685      6.485           1.338            78.28
         2.121          0.669      6.688           1.364            79.51
         2.623          0.653      6.902           1.393            80.89
         3.214          0.637      7.131           1.427            82.42
         3.910          0.621      7.374           1.466            84.13
         4.734          0.605      7.634           1.511            86.02
         5.711          0.589      7.911           1.562            88.11
         6.878          0.573      8.208           1.620            90.41
         8.285          0.557      8.526           1.687            92.95
         9.999          0.542      8.867           1.763            95.74
        12.123          0.526      9.235           1.851            98.82
        14.814          0.510      9.632           1.951           102.20
        18.337          0.494     10.060           2.066           105.92
        23.189          0.478     10.525           2.199           110.02
        30.486          0.462     11.030           2.352           114.54
        43.817          0.446     11.580           2.529           119.54
        43.900          0.446     11.580           2.529           119.54
-------------------------------------------------------------------------------
  NODE   730.00 : HGL = <  270.658>;EGL= <  271.061>;FLOWLINE= <  269.830>

*******************************************************************************
  FLOW PROCESS FROM NODE   730.00 TO NODE   730.00 IS CODE =  5
  UPSTREAM NODE   730.00     ELEVATION =   270.16  (FLOW IS SUPERCRITICAL)
-------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      4.10    18.00       0.00    270.16      0.78       5.386
    DOWNSTREAM     5.10    18.00        -      269.83      0.87       5.095
    LATERAL #1     1.00    18.00      66.80    270.12      0.37       1.440
    LATERAL #2     0.00     0.00       0.00      0.00      0.00       0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00910
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00678
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00794
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.032 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
```

```
  JUNCTION LOSSES = ( 0.217)+( 0.000) =   0.217
------------------------------------------------------------------------------
  NODE   730.00 : HGL = <  270.828>;EGL= <  271.279>;FLOWLINE= <  270.160>

******************************************************************************
  FLOW PROCESS FROM NODE   730.00 TO NODE   710.00 IS CODE =  1
  UPSTREAM NODE   710.00     ELEVATION =   270.35  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      18.98 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.65           CRITICAL DEPTH(FT) =      0.78
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.78
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.775      4.448          1.083            54.33
         0.014          0.770      4.484          1.083            54.33
         0.057          0.765      4.521          1.083            54.34
         0.132          0.760      4.559          1.083            54.36
         0.242          0.755      4.597          1.084            54.38
         0.391          0.750      4.636          1.084            54.42
         0.582          0.745      4.675          1.085            54.46
         0.820          0.740      4.716          1.086            54.50
         1.111          0.735      4.757          1.087            54.56
         1.461          0.730      4.798          1.088            54.62
         1.879          0.725      4.841          1.090            54.70
         2.373          0.720      4.884          1.091            54.78
         2.954          0.715      4.928          1.093            54.87
         3.638          0.710      4.973          1.095            54.96
         4.442          0.705      5.018          1.097            55.07
         5.389          0.700      5.064          1.099            55.18
         6.510          0.695      5.112          1.101            55.31
         7.845          0.690      5.160          1.104            55.44
         9.453          0.685      5.208          1.107            55.58
        11.419          0.681      5.258          1.110            55.74
        13.872          0.676      5.309          1.113            55.90
        17.034          0.671      5.361          1.117            56.07
        18.980          0.668      5.385          1.119            56.15
------------------------------------------------------------------------------
  NODE   710.00 : HGL = <  271.125>;EGL= <  271.433>;FLOWLINE= <  270.350>

******************************************************************************
  FLOW PROCESS FROM NODE   710.00 TO NODE   710.00 IS CODE =  8
  UPSTREAM NODE   710.00     ELEVATION =   270.35  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       4.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.45 FEET/SEC.    VELOCITY HEAD =  0.307 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.307) =  0.061
------------------------------------------------------------------------------
  NODE   710.00 : HGL = <  271.494>;EGL= <  271.494>;FLOWLINE= <  270.350>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   710.00            FLOWLINE ELEVATION =   270.35
  ASSUMED UPSTREAM CONTROL HGL =    271.13 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
```

```
 END OF GRADUALLY VARIED FLOW ANALYSIS
♀
```

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
 * LATERAL RUN FROM NODES 730 TO 725                                         *
 * STARTING HGL = 271.274'                                                   *
  **************************************************************************

   FILE NAME: 730.LAT
   TIME/DATE OF STUDY: 20:32 03/25/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+        FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   730.00-             1.27*             59.95        0.32              9.31
         } FRICTION
   725.00-             1.15*             48.59        0.37 Dc           8.92
         } CATCH BASIN
   725.00-             1.16*             47.70        0.37 Dc           3.27
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   730.00            FLOWLINE ELEVATION =   270.00
  PIPE FLOW =       1.00 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   271.274 FEET
------------------------------------------------------------------------------
  NODE   730.00 : HGL = <  271.274>;EGL= <  271.280>;FLOWLINE= <  270.000>

******************************************************************************
  FLOW PROCESS FROM NODE   730.00 TO NODE   725.00 IS CODE =  1
  UPSTREAM NODE   725.00     ELEVATION =   270.12  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.00 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      12.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.31          CRITICAL DEPTH(FT) =      0.37
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.27
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
```

```
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.274      0.625          1.280            59.95
         3.605          1.238      0.641          1.244            56.43
         7.206          1.202      0.659          1.209            53.00
        10.805          1.166      0.678          1.173            49.67
        12.000          1.154      0.685          1.161            48.59
------------------------------------------------------------------------------
  NODE   725.00 : HGL = <  271.274>;EGL= <  271.281>;FLOWLINE= <  270.120>

******************************************************************************
  FLOW PROCESS FROM NODE   725.00 TO NODE   725.00 IS CODE =  8
  UPSTREAM NODE   725.00     ELEVATION =   270.12  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.00 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   0.69 FEET/SEC.    VELOCITY HEAD =  0.007 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.007) =  0.001
------------------------------------------------------------------------------
  NODE   725.00 : HGL = <  271.283>;EGL= <  271.283>;FLOWLINE= <  270.120>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   725.00            FLOWLINE ELEVATION =   270.12
  ASSUMED UPSTREAM CONTROL HGL =    270.49 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                             *
 * SYSTEM 9 -  MAINLINE RUN FROM NODES 925 TO 910                           *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                      *
  **************************************************************************

   FILE NAME: 925.PIP
   TIME/DATE OF STUDY: 19:00 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   925.00-             1.50*             84.03        0.33              10.55
         } FRICTION
   920.00-             1.32*             64.91        0.39 Dc           10.07
         } JUNCTION
   920.00-             1.00*             35.88        0.13              31.24
         } FRICTION        } HYDRAULIC JUMP
   915.00-             0.39 Dc           10.07        0.16*             24.01
         } JUNCTION
   915.00-             0.39 Dc           10.07        0.13*             33.30
         } FRICTION
   910.00-             0.39*Dc           10.07        0.39*Dc           10.07
         } CATCH BASIN
   910.00-             0.56*              5.33        0.39 Dc            3.68
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   925.00            FLOWLINE ELEVATION =   172.93
  PIPE FLOW =       1.10 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   174.430 FEET
------------------------------------------------------------------------------
  NODE   925.00 : HGL = <  174.430>;EGL= <  174.436>;FLOWLINE= <  172.930>

******************************************************************************
  FLOW PROCESS FROM NODE   925.00 TO NODE   920.00 IS CODE =  1
  UPSTREAM NODE   920.00     ELEVATION =   173.11  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.10 CFS     PIPE DIAMETER =  18.00 INCHES
```

```
  PIPE LENGTH =      18.00 FEET         MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.33          CRITICAL DEPTH(FT) =      0.39
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.500      0.622          1.506            84.03
         4.468          1.456      0.628          1.462            79.17
         8.925          1.411      0.638          1.418            74.38
        13.374          1.367      0.651          1.374            69.68
        17.818          1.323      0.667          1.330            65.09
        18.000          1.321      0.667          1.328            64.91
------------------------------------------------------------------------------
  NODE   920.00 : HGL = <  174.431>;EGL= <  174.438>;FLOWLINE= <  173.110>

******************************************************************************
  FLOW PROCESS FROM NODE   920.00 TO NODE   920.00 IS CODE =  5
  UPSTREAM NODE   920.00     ELEVATION =   173.44  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.10    18.00     60.00    173.44      0.39        0.882
    DOWNSTREAM      1.10    18.00       -      173.11      0.39        0.667
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00018
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00010
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00014
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.001 FEET        ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.011)+( 0.000) =   0.011
------------------------------------------------------------------------------
  NODE   920.00 : HGL = <  174.437>;EGL= <  174.449>;FLOWLINE= <  173.440>

******************************************************************************
  FLOW PROCESS FROM NODE   920.00 TO NODE   915.00 IS CODE =  1
  UPSTREAM NODE   915.00     ELEVATION =   226.08  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     117.89 FEET         MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.13          CRITICAL DEPTH(FT) =      0.39
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.16
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
```

```
          0.000          0.158     11.076          2.064            24.01
          0.157          0.157     11.188          2.102            24.25
          0.322          0.156     11.302          2.141            24.48
          0.497          0.155     11.419          2.181            24.72
          0.682          0.154     11.537          2.222            24.97
          0.878          0.153     11.658          2.264            25.22
          1.087          0.152     11.781          2.308            25.48
          1.309          0.150     11.906          2.353            25.74
          1.548          0.149     12.033          2.399            26.00
          1.803          0.148     12.163          2.447            26.27
          2.079          0.147     12.295          2.496            26.55
          2.377          0.146     12.429          2.546            26.83
          2.700          0.145     12.566          2.598            27.11
          3.054          0.144     12.706          2.652            27.41
          3.443          0.143     12.848          2.708            27.70
          3.874          0.142     12.993          2.765            28.01
          4.357          0.141     13.140          2.824            28.32
          4.902          0.140     13.291          2.884            28.63
          5.528          0.138     13.444          2.947            28.95
          6.259          0.137     13.601          3.012            29.28
          7.133          0.136     13.760          3.078            29.62
          8.216          0.135     13.923          3.147            29.96
          9.629          0.134     14.089          3.219            30.31
         11.644          0.133     14.259          3.292            30.66
         15.135          0.132     14.432          3.368            31.03
        117.890          0.131     14.533          3.413            31.24
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)   MOMENTUM(POUNDS)
          0.000          0.997      0.882          1.009            35.88
          0.053          0.973      0.907          0.986            34.08
          0.105          0.949      0.934          0.962            32.33
          0.158          0.924      0.962          0.939            30.63
          0.210          0.900      0.993          0.916            29.00
          0.262          0.876      1.026          0.892            27.42
          0.313          0.852      1.062          0.869            25.91
          0.365          0.828      1.100          0.846            24.45
          0.416          0.803      1.141          0.824            23.06
          0.467          0.779      1.186          0.801            21.72
          0.517          0.755      1.234          0.779            20.45
          0.566          0.731      1.287          0.756            19.24
          0.615          0.706      1.344          0.734            18.10
          0.664          0.682      1.406          0.713            17.03
          0.711          0.658      1.474          0.692            16.02
          0.758          0.634      1.549          0.671            15.08
          0.803          0.610      1.631          0.651            14.21
          0.847          0.585      1.722          0.631            13.41
          0.889          0.561      1.823          0.613            12.68
          0.928          0.537      1.935          0.595            12.04
          0.965          0.513      2.061          0.579            11.47
          0.999          0.488      2.202          0.564            10.99
          1.028          0.464      2.362          0.551            10.61
          1.051          0.440      2.544          0.541            10.32
          1.067          0.416      2.753          0.534            10.13
          1.073          0.392      2.995          0.531            10.07
        117.890          0.392      2.995          0.531            10.07
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
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```
| PRESSURE+MOMENTUM BALANCE OCCURS AT     0.14 FEET UPSTREAM OF NODE  920.00 |
|       DOWNSTREAM DEPTH = 0.933 FEET, UPSTREAM CONJUGATE DEPTH = 0.131 FEET |
------------------------------------------------------------------------------
  NODE   915.00 : HGL = <  226.238>;EGL= <  228.144>;FLOWLINE= <  226.080>

******************************************************************************
  FLOW PROCESS FROM NODE   915.00 TO NODE   915.00 IS CODE =  5
  UPSTREAM NODE   915.00     ELEVATION =   226.41  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM        1.10    18.00      0.00     226.41      0.39      15.518
    DOWNSTREAM       1.10    18.00       -       226.08      0.39      11.079
    LATERAL #1       0.00     0.00      0.00       0.00      0.00       0.000
    LATERAL #2       0.00     0.00      0.00       0.00      0.00       0.000
       Q5            0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.53056
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.20211
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.36634
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.465 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.131)+( 0.000) =   2.131
------------------------------------------------------------------------------
  NODE   915.00 : HGL = <  226.536>;EGL= <  230.275>;FLOWLINE= <  226.410>

******************************************************************************
  FLOW PROCESS FROM NODE   915.00 TO NODE   910.00 IS CODE =  1
  UPSTREAM NODE   910.00     ELEVATION =   258.07  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      44.61 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.12           CRITICAL DEPTH(FT) =      0.39
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.39
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.392      2.995          0.531            10.07
          0.001          0.381      3.117          0.532            10.08
          0.004          0.370      3.248          0.534            10.13
          0.009          0.359      3.389          0.537            10.20
          0.017          0.348      3.542          0.543            10.31
          0.027          0.337      3.707          0.550            10.45
          0.042          0.326      3.886          0.560            10.64
          0.061          0.315      4.080          0.573            10.86
          0.084          0.304      4.292          0.590            11.13
          0.114          0.293      4.524          0.611            11.46
          0.152          0.282      4.779          0.637            11.84
          0.198          0.271      5.059          0.669            12.28
          0.255          0.260      5.370          0.708            12.80
          0.326          0.249      5.714          0.756            13.40
          0.415          0.238      6.099          0.816            14.09
          0.525          0.227      6.530          0.890            14.89
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         0.663          0.216      7.017          0.981            15.82
         0.839          0.205      7.569          1.095            16.89
         1.066          0.194      8.200          1.239            18.14
         1.364          0.183      8.927          1.421            19.60
         1.765          0.172      9.770          1.655            21.32
         2.322          0.161     10.759          1.960            23.36
         3.141          0.150     11.931          2.362            25.79
         4.456          0.139     13.338          2.903            28.73
         7.029          0.128     15.050          3.648            32.33
        44.610          0.126     15.513          3.865            33.30
------------------------------------------------------------------------------
  NODE   910.00 : HGL = <  258.462>;EGL= <  258.601>;FLOWLINE= <  258.070>

******************************************************************************
  FLOW PROCESS FROM NODE   910.00 TO NODE   910.00 IS CODE =  8
  UPSTREAM NODE   910.00     ELEVATION =   258.07  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.00 FEET/SEC.    VELOCITY HEAD =  0.139 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.139) =  0.028
------------------------------------------------------------------------------
  NODE   910.00 : HGL = <  258.629>;EGL= <  258.629>;FLOWLINE= <  258.070>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   910.00            FLOWLINE ELEVATION =   258.07
  ASSUMED UPSTREAM CONTROL HGL =    258.46 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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******************************************************************************
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  ************************* DESCRIPTION OF STUDY *************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
 * SYSTEM 10 -  MAINLINE RUN FROM NODES 1045 TO 1010                         *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                       *
  **************************************************************************

   FILE NAME: 1045.PIP
   TIME/DATE OF STUDY: 18:41 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE    PRESSURE+           FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1045.00-             1.50*            105.91        0.66              68.00
         } FRICTION
  1040.00-             1.32*             88.10        0.61              71.29
         } JUNCTION
  1040.00-             1.11              72.57        0.33*            146.60
         } FRICTION
  1035.00-             0.82 Dc           63.12        0.31*            156.94
         } JUNCTION
  1035.00-             0.82 Dc           63.12        0.28*            182.92
         } FRICTION
  1030.00-             0.82 Dc           63.12        0.29*            174.25
         } JUNCTION
  1030.00-             0.82 Dc           63.12        0.26*            202.64
         } FRICTION
  1025.00-             0.82 Dc           63.12        0.75*             63.91
         } JUNCTION
  1025.00-             0.82 Dc           63.12        0.70*             65.44
         } FRICTION
  1020.00-             0.82*Dc           63.12        0.82*Dc           63.12
         } JUNCTION
  1020.00-             0.88              63.55        0.68*             66.46
         } FRICTION
  1015.00-             0.82 Dc           63.12        0.61*             71.51
         } JUNCTION
  1015.00-             0.82 Dc           63.12        0.72*             64.93
         } FRICTION
  1010.00-             0.82*Dc           63.12        0.82*Dc           63.12
         } CATCH BASIN
  1010.00-             1.22*             34.60        0.82 Dc           21.85
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
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  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1045.00            FLOWLINE ELEVATION =   166.71
  PIPE FLOW =       4.60 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   168.210 FEET
------------------------------------------------------------------------------
  NODE  1045.00 : HGL = <  168.210>;EGL= <  168.315>;FLOWLINE= <  166.710>

******************************************************************************
  FLOW PROCESS FROM NODE  1045.00 TO NODE  1040.00 IS CODE =  1
  UPSTREAM NODE  1040.00     ELEVATION =   166.91  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      20.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.69           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.500      2.602          1.605            105.91
          3.195          1.473      2.613          1.579            103.02
          6.262          1.446      2.633          1.554            100.24
          9.257          1.419      2.658          1.529             97.53
         12.195          1.392      2.689          1.504             94.90
         15.086          1.365      2.724          1.480             92.34
         17.934          1.338      2.764          1.456             89.87
         20.000          1.318      2.796          1.439             88.10
------------------------------------------------------------------------------
  NODE  1040.00 : HGL = <  168.228>;EGL= <  168.349>;FLOWLINE= <  166.910>

******************************************************************************
  FLOW PROCESS FROM NODE  1040.00 TO NODE  1040.00 IS CODE =  5
  UPSTREAM NODE  1040.00     ELEVATION =   167.24  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     60.00    167.24      0.82       16.180
    DOWNSTREAM      4.60    18.00       -      166.91      0.82        2.797
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.17704
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00173
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.08938
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.358 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.283)+( 0.000) =   3.283
------------------------------------------------------------------------------
  NODE  1040.00 : HGL = <  167.567>;EGL= <  171.632>;FLOWLINE= <  167.240>
```

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******************************************************************************
  FLOW PROCESS FROM NODE  1040.00 TO NODE  1035.00 IS CODE =  1
  UPSTREAM NODE  1035.00     ELEVATION =   178.83  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      66.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.33           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.31
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.311     17.365          4.996          156.94
         0.695          0.312     17.312          4.968          156.48
         1.417          0.312     17.260          4.941          156.03
         2.170          0.313     17.208          4.914          155.57
         2.955          0.314     17.156          4.887          155.12
         3.775          0.314     17.105          4.860          154.68
         4.636          0.315     17.054          4.834          154.23
         5.540          0.316     17.003          4.807          153.79
         6.493          0.316     16.952          4.781          153.35
         7.502          0.317     16.902          4.755          152.91
         8.572          0.318     16.851          4.730          152.47
         9.712          0.318     16.802          4.704          152.04
        10.933          0.319     16.752          4.679          151.61
        12.249          0.320     16.703          4.654          151.18
        13.675          0.320     16.654          4.629          150.75
        15.232          0.321     16.605          4.605          150.33
        16.948          0.322     16.556          4.580          149.91
        18.861          0.322     16.508          4.556          149.49
        21.023          0.323     16.460          4.532          149.07
        23.512          0.323     16.412          4.508          148.65
        26.446          0.324     16.364          4.485          148.24
        30.028          0.325     16.317          4.461          147.83
        34.632          0.325     16.270          4.438          147.42
        41.102          0.326     16.223          4.415          147.02
        52.148          0.327     16.176          4.392          146.61
        66.000          0.327     16.175          4.392          146.60
------------------------------------------------------------------------------
  NODE  1035.00 : HGL = <  179.141>;EGL= <  183.826>;FLOWLINE= <  178.830>

******************************************************************************
  FLOW PROCESS FROM NODE  1035.00 TO NODE  1035.00 IS CODE =  5
  UPSTREAM NODE  1035.00     ELEVATION =   179.16  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     12.00    179.16      0.82       20.340
    DOWNSTREAM      4.60    18.00       -      178.83      0.82       17.370
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.33831
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  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.21636
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.27733
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.109 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.036)+( 0.000) =   2.036
------------------------------------------------------------------------------
  NODE  1035.00 : HGL = <  179.439>;EGL= <  185.863>;FLOWLINE= <  179.160>

******************************************************************************
  FLOW PROCESS FROM NODE  1035.00 TO NODE  1030.00 IS CODE =  1
  UPSTREAM NODE  1030.00     ELEVATION =   215.88  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     108.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.28          CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.29
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.288     19.346          6.104            174.25
         0.511          0.288     19.386          6.127            174.60
         1.045          0.288     19.425          6.150            174.94
         1.604          0.287     19.464          6.174            175.29
         2.190          0.287     19.504          6.197            175.64
         2.806          0.286     19.544          6.221            175.99
         3.455          0.286     19.584          6.245            176.34
         4.141          0.285     19.624          6.269            176.69
         4.867          0.285     19.664          6.293            177.04
         5.639          0.285     19.705          6.317            177.39
         6.462          0.284     19.745          6.342            177.75
         7.344          0.284     19.786          6.366            178.11
         8.294          0.283     19.827          6.391            178.47
         9.321          0.283     19.867          6.416            178.82
        10.440          0.283     19.909          6.441            179.18
        11.669          0.282     19.950          6.466            179.55
        13.030          0.282     19.991          6.491            179.91
        14.555          0.281     20.033          6.517            180.27
        16.287          0.281     20.074          6.542            180.64
        18.290          0.281     20.116          6.568            181.01
        20.665          0.280     20.158          6.594            181.38
        23.577          0.280     20.200          6.620            181.75
        27.340          0.279     20.243          6.646            182.12
        32.656          0.279     20.285          6.673            182.49
        41.778          0.279     20.328          6.699            182.87
       108.000          0.278     20.334          6.703            182.92
------------------------------------------------------------------------------
  NODE  1030.00 : HGL = <  216.168>;EGL= <  221.984>;FLOWLINE= <  215.880>

******************************************************************************
  FLOW PROCESS FROM NODE  1030.00 TO NODE  1030.00 IS CODE =  5
  UPSTREAM NODE  1030.00     ELEVATION =   216.21  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00       0.00    216.21      0.82      22.582
    DOWNSTREAM      4.60    18.00        -      215.88      0.82      19.352
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    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.45519
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.29379
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.37449
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.498 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.404)+( 0.000) =   2.404
------------------------------------------------------------------------------
  NODE  1030.00 : HGL = <  216.469>;EGL= <  224.387>;FLOWLINE= <  216.210>

******************************************************************************
  FLOW PROCESS FROM NODE  1030.00 TO NODE  1025.00 IS CODE =  1
  UPSTREAM NODE  1025.00     ELEVATION =   260.03  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      72.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.24           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.75
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.752      5.187          1.170            63.91
          0.017          0.732      5.373          1.180            64.46
          0.039          0.711      5.572          1.194            65.17
          0.068          0.691      5.787          1.211            66.04
          0.105          0.670      6.018          1.233            67.11
          0.151          0.650      6.267          1.260            68.38
          0.206          0.629      6.537          1.293            69.87
          0.275          0.609      6.830          1.334            71.61
          0.357          0.589      7.149          1.383            73.61
          0.457          0.568      7.496          1.441            75.91
          0.577          0.548      7.877          1.512            78.54
          0.722          0.527      8.294          1.596            81.53
          0.897          0.507      8.754          1.698            84.95
          1.109          0.486      9.263          1.819            88.83
          1.368          0.466      9.827          1.966            93.25
          1.685          0.446     10.457          2.145            98.29
          2.078          0.425     11.163          2.361           104.04
          2.570          0.405     11.959          2.627           110.63
          3.195          0.384     12.861          2.954           118.20
          4.003          0.364     13.891          3.362           126.95
          5.074          0.343     15.075          3.875           137.10
          6.546          0.323     16.449          4.527           148.98
          8.679          0.303     18.057          5.369           162.97
         12.061          0.282     19.959          6.472           179.63
         18.592          0.262     22.238          7.945           199.67
         72.000          0.259     22.575          8.177           202.64
------------------------------------------------------------------------------
  NODE  1025.00 : HGL = <  260.782>;EGL= <  261.200>;FLOWLINE= <  260.030>

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  FLOW PROCESS FROM NODE  1025.00 TO NODE  1025.00 IS CODE =  5
  UPSTREAM NODE  1025.00     ELEVATION =   260.36  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     47.00    260.36      0.82        5.643
    DOWNSTREAM      4.60    18.00       -      260.03      0.82        5.189
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00952
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00760
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00856
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.034 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.359)+( 0.000) =   0.359
------------------------------------------------------------------------------
  NODE  1025.00 : HGL = <  261.064>;EGL= <  261.559>;FLOWLINE= <  260.360>

******************************************************************************
  FLOW PROCESS FROM NODE  1025.00 TO NODE  1020.00 IS CODE =  1
  UPSTREAM NODE  1020.00     ELEVATION =   260.68  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      32.17 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.70           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.82
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.823      4.628          1.156             63.12
         0.014          0.818      4.664          1.156             63.13
         0.059          0.813      4.700          1.157             63.14
         0.138          0.808      4.737          1.157             63.16
         0.253          0.803      4.775          1.157             63.18
         0.408          0.798      4.813          1.158             63.22
         0.608          0.793      4.852          1.159             63.26
         0.857          0.788      4.892          1.159             63.31
         1.161          0.783      4.932          1.161             63.37
         1.526          0.777      4.973          1.162             63.44
         1.962          0.772      5.015          1.163             63.52
         2.478          0.767      5.057          1.165             63.60
         3.085          0.762      5.100          1.166             63.70
         3.799          0.757      5.144          1.168             63.80
         4.638          0.752      5.188          1.170             63.92
         5.626          0.747      5.234          1.172             64.04
         6.796          0.742      5.280          1.175             64.17
         8.189          0.736      5.327          1.177             64.31
         9.867          0.731      5.375          1.180             64.46
        11.918          0.726      5.423          1.183             64.63
        14.477          0.721      5.473          1.186             64.80
        17.776          0.716      5.523          1.190             64.98
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         22.242         0.711      5.574          1.194           65.17
         28.843         0.706      5.627          1.198           65.38
         32.170         0.704      5.642          1.199           65.44
------------------------------------------------------------------------------
  NODE  1020.00 : HGL = <  261.503>;EGL= <  261.836>;FLOWLINE= <  260.680>

******************************************************************************
  FLOW PROCESS FROM NODE  1020.00 TO NODE  1020.00 IS CODE =  5
  UPSTREAM NODE  1020.00     ELEVATION =   261.01  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     60.50    261.01      0.82       5.882
    DOWNSTREAM      4.60    18.00       -      260.68      0.82       4.629
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01065
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00562
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00814
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.033 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.393)+( 0.000) =   0.393
------------------------------------------------------------------------------
  NODE  1020.00 : HGL = <  261.692>;EGL= <  262.229>;FLOWLINE= <  261.010>

******************************************************************************
  FLOW PROCESS FROM NODE  1020.00 TO NODE  1015.00 IS CODE =  1
  UPSTREAM NODE  1015.00     ELEVATION =   261.51  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      49.42 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.69          CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.61
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000         0.610      6.814          1.331           71.51
          1.238         0.613      6.765          1.324           71.21
          2.508         0.617      6.717          1.318           70.93
          3.812         0.620      6.670          1.311           70.65
          5.153         0.623      6.624          1.305           70.37
          6.536         0.626      6.578          1.299           70.10
          7.964         0.630      6.532          1.293           69.84
          9.443         0.633      6.487          1.287           69.59
         10.979         0.636      6.443          1.281           69.34
         12.578         0.640      6.399          1.276           69.10
         14.248         0.643      6.356          1.271           68.86
         15.999         0.646      6.314          1.266           68.63
         17.845         0.649      6.272          1.261           68.40
         19.799         0.653      6.230          1.256           68.18
```

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         21.880          0.656      6.189          1.251            67.97
         24.114          0.659      6.149          1.247            67.76
         26.533          0.663      6.109          1.242            67.56
         29.179          0.666      6.069          1.238            67.36
         32.114          0.669      6.030          1.234            67.17
         35.429          0.672      5.992          1.230            66.99
         39.260          0.676      5.954          1.227            66.80
         43.843          0.679      5.916          1.223            66.63
         49.420          0.682      5.880          1.219            66.46
------------------------------------------------------------------------------
  NODE  1015.00 : HGL = <  262.120>;EGL= <  262.841>;FLOWLINE= <  261.510>

******************************************************************************
  FLOW PROCESS FROM NODE  1015.00 TO NODE  1015.00 IS CODE =  5
  UPSTREAM NODE  1015.00     ELEVATION =   261.84  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     24.30     261.84      0.82       5.512
    DOWNSTREAM      4.60    18.00       -       261.51      0.82       6.816
    LATERAL #1      0.00     0.00      0.00      0.00       0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00       0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00894
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01589
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01242
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.050 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.188)+( 0.000) =   0.188
------------------------------------------------------------------------------
  NODE  1015.00 : HGL = <  262.557>;EGL= <  263.029>;FLOWLINE= <  261.840>

******************************************************************************
  FLOW PROCESS FROM NODE  1015.00 TO NODE  1010.00 IS CODE =  1
  UPSTREAM NODE  1010.00     ELEVATION =   262.02  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      18.33 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.70           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.82
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.823      4.628          1.156            63.12
          0.014          0.818      4.663          1.156            63.13
          0.059          0.813      4.699          1.157            63.14
          0.136          0.808      4.735          1.157            63.16
          0.250          0.803      4.772          1.157            63.18
          0.404          0.798      4.810          1.158            63.22
          0.601          0.793      4.848          1.159            63.26
          0.847          0.788      4.886          1.159            63.31
          1.148          0.783      4.926          1.160            63.36
```

```
         1.510          0.778      4.966          1.161            63.43
         1.941          0.773      5.006          1.163            63.50
         2.450          0.768      5.048          1.164            63.59
         3.051          0.763      5.090          1.166            63.68
         3.757          0.758      5.132          1.168            63.78
         4.586          0.753      5.176          1.170            63.88
         5.563          0.748      5.220          1.172            64.00
         6.719          0.743      5.265          1.174            64.13
         8.097          0.738      5.311          1.176            64.26
         9.755          0.733      5.357          1.179            64.41
        11.782          0.728      5.404          1.182            64.56
        14.312          0.723      5.453          1.185            64.73
        17.572          0.718      5.502          1.188            64.90
        18.330          0.717      5.510          1.189            64.93
------------------------------------------------------------------------------
  NODE  1010.00 : HGL = <  262.843>;EGL= <  263.176>;FLOWLINE= <  262.020>

******************************************************************************
  FLOW PROCESS FROM NODE  1010.00 TO NODE  1010.00 IS CODE =  8
  UPSTREAM NODE  1010.00     ELEVATION =   262.02  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       4.60 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.63 FEET/SEC.    VELOCITY HEAD =  0.333 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.333) =  0.067
------------------------------------------------------------------------------
  NODE  1010.00 : HGL = <  263.243>;EGL= <  263.243>;FLOWLINE= <  262.020>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1010.00            FLOWLINE ELEVATION =   262.02
  ASSUMED UPSTREAM CONTROL HGL =    262.84 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

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******************************************************************************
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                                *
 * SYSTEM 11 - MAINLINE CAPACITY RUN FROM NODES 1125 TO 1115                 *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                       *
  **************************************************************************

   FILE NAME: 1125.PIP
   TIME/DATE OF STUDY: 18:16 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                         DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1125.00-             1.50*             86.26        0.41              20.15
         } FRICTION
  1120.00-             1.32*             67.44        0.38              21.09
         } JUNCTION
  1120.00-             1.01              39.91        0.18*             51.20
         } FRICTION
  1150.00-             0.50*Dc           18.84        0.50*Dc           18.84
         } CATCH BASIN
  1150.00-             0.73*             10.02        0.50 Dc            6.82
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1125.00            FLOWLINE ELEVATION =   154.55
  PIPE FLOW =       1.80 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   156.050 FEET
------------------------------------------------------------------------------
  NODE  1125.00 : HGL = <  156.050>;EGL= <  156.066>;FLOWLINE= <  154.550>

******************************************************************************
  FLOW PROCESS FROM NODE  1125.00 TO NODE  1120.00 IS CODE =  1
  UPSTREAM NODE  1120.00     ELEVATION =   154.73  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.80 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      18.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.42          CRITICAL DEPTH(FT) =      0.50
==============================================================================
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```
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.500      1.018          1.516            86.26
          4.068          1.460      1.026          1.477            81.90
          8.108          1.420      1.040          1.437            77.62
         12.132          1.381      1.058          1.398            73.42
         16.143          1.341      1.080          1.359            69.31
         18.000          1.322      1.091          1.341            67.44
------------------------------------------------------------------------------
  NODE  1120.00 : HGL = <  156.052>;EGL= <  156.071>;FLOWLINE= <  154.730>

******************************************************************************
  FLOW PROCESS FROM NODE  1120.00 TO NODE  1120.00 IS CODE =  5
  UPSTREAM NODE  1120.00     ELEVATION =   155.06  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.80    18.00     60.00    155.06      0.50      14.513
    DOWNSTREAM      1.80    18.00       -      154.73      0.50       1.091
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.28649
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00026
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.14338
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.574 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.444)+( 0.000) =   2.444
------------------------------------------------------------------------------
  NODE  1120.00 : HGL = <  155.244>;EGL= <  158.515>;FLOWLINE= <  155.060>

******************************************************************************
  FLOW PROCESS FROM NODE  1120.00 TO NODE  1150.00 IS CODE =  1
  UPSTREAM NODE  1150.00     ELEVATION =   202.18  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.80 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     140.78 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.18          CRITICAL DEPTH(FT) =      0.50
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.505      3.444          0.689            18.84
          0.002          0.492      3.570          0.690            18.86
          0.009          0.479      3.706          0.692            18.93
          0.021          0.466      3.850          0.696            19.04
          0.038          0.452      4.006          0.702            19.21
```

```
          0.063          0.439      4.173          0.710            19.43
          0.096          0.426      4.352          0.721            19.71
          0.138          0.413      4.546          0.734            20.06
          0.192          0.400      4.756          0.752            20.48
          0.258          0.387      4.984          0.773            20.97
          0.340          0.374      5.232          0.799            21.55
          0.441          0.361      5.502          0.831            22.21
          0.564          0.348      5.798          0.870            22.99
          0.715          0.334      6.124          0.917            23.87
          0.901          0.321      6.482          0.974            24.89
          1.129          0.308      6.879          1.043            26.05
          1.413          0.295      7.320          1.128            27.39
          1.767          0.282      7.812          1.230            28.91
          2.216          0.269      8.365          1.356            30.66
          2.794          0.256      8.989          1.511            32.66
          3.557          0.243      9.698          1.704            34.98
          4.598          0.230     10.508          1.945            37.66
          6.092          0.217     11.443          2.251            40.79
          8.438          0.203     12.530          2.643            44.46
         12.917          0.190     13.806          3.152            48.80
        140.780          0.184     14.508          3.455            51.20
------------------------------------------------------------------------------
  NODE  1150.00 : HGL = <  202.685>;EGL= <  202.869>;FLOWLINE= <  202.180>

******************************************************************************
  FLOW PROCESS FROM NODE  1150.00 TO NODE  1150.00 IS CODE =  8
  UPSTREAM NODE  1150.00     ELEVATION =   202.18  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.80 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.44 FEET/SEC.    VELOCITY HEAD =  0.184 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.184) =  0.037
------------------------------------------------------------------------------
  NODE  1150.00 : HGL = <  202.906>;EGL= <  202.906>;FLOWLINE= <  202.180>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1150.00           FLOWLINE ELEVATION =   202.18
  ASSUMED UPSTREAM CONTROL HGL =    202.68 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                          San Diego, California 92110
                        619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                               *
 * SYSTEM 12 - MAINLINE CAPACITY RUN FROM NODES 1230 TO 1210                *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                      *
  **************************************************************************

   FILE NAME: 1230.RAT
   TIME/DATE OF STUDY: 17:40 03/31/2019

******************************************************************************
               GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                         NODAL POINT STATUS TABLE
                (Note: "*" indicates nodal point data used.)
                      UPSTREAM RUN                   DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1230.00-           1.50*          112.36        0.59              90.71
         } FRICTION        } HYDRAULIC JUMP
  1225.00-           1.36            98.79        0.53*            101.26
         } JUNCTION
  1225.00-           1.18            85.08        0.27*            238.15
         } FRICTION
  1220.00-           0.88 Dc         74.13        0.32*            191.12
         } JUNCTION
  1220.00-           0.88 Dc         74.13        0.29*            225.48
         } FRICTION
  1215.00-           0.88*Dc         74.13        0.88*Dc           74.13
         } JUNCTION
  1215.00-           1.19            85.40        0.36*            163.80
         } FRICTION
  1210.00-           0.88*Dc         74.13        0.88*Dc           74.13
         } CATCH BASIN
  1210.00-           1.31*           41.13        0.88 Dc           25.37
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1230.00            FLOWLINE ELEVATION =   138.54
  PIPE FLOW =       5.20 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   140.040 FEET
------------------------------------------------------------------------------
  NODE  1230.00 : HGL = <  140.040>;EGL= <  140.174>;FLOWLINE= <  138.540>

******************************************************************************
  FLOW PROCESS FROM NODE  1230.00 TO NODE  1225.00 IS CODE =  1
```

```
  UPSTREAM NODE  1225.00     ELEVATION =   138.70  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.75           CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.53
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)         (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.531      9.280          1.869           101.26
          2.115          0.540      9.080          1.821            99.55
          4.260          0.548      8.888          1.776            97.92
          6.438          0.557      8.704          1.734            96.38
          8.653          0.566      8.526          1.695            94.91
         10.909          0.574      8.355          1.659            93.51
         13.209          0.583      8.190          1.625            92.19
         15.558          0.591      8.031          1.593            90.93
         16.000          0.593      8.003          1.588            90.71
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)         (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.500      2.942          1.634           112.36
          3.107          1.475      2.952          1.611           109.72
          6.058          1.450      2.972          1.587           107.19
          8.920          1.425      2.997          1.565           104.75
         11.715          1.400      3.028          1.543           102.37
         14.454          1.376      3.063          1.521           100.08
         16.000          1.361      3.085          1.509            98.79
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    14.50 FEET UPSTREAM OF NODE 1230.00 |
|       DOWNSTREAM DEPTH = 1.375 FEET, UPSTREAM CONJUGATE DEPTH = 0.537 FEET |
------------------------------------------------------------------------------
  NODE  1225.00 : HGL = <  139.231>;EGL= <  140.569>;FLOWLINE= <  138.700>

******************************************************************************
  FLOW PROCESS FROM NODE  1225.00 TO NODE  1225.00 IS CODE =  5
  UPSTREAM NODE  1225.00     ELEVATION =   139.03  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.20    18.00     60.00    139.03      0.88       23.480
    DOWNSTREAM      5.20    18.00       -      138.70      0.88        9.283
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
```

```
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.45880
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.03390
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.24635
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.985 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 7.296)+( 0.000) =   7.296
------------------------------------------------------------------------------
  NODE  1225.00 : HGL = <  139.304>;EGL= <  147.865>;FLOWLINE= <  139.030>

******************************************************************************
  FLOW PROCESS FROM NODE  1225.00 TO NODE  1220.00 IS CODE =  1
  UPSTREAM NODE  1220.00     ELEVATION =   204.71  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     140.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.27           CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.32
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.321     18.735          5.775           191.12
          0.414          0.319     18.896          5.867           192.72
          0.850          0.317     19.061          5.962           194.34
          1.310          0.315     19.228          6.060           195.99
          1.796          0.314     19.397          6.159           197.66
          2.311          0.312     19.569          6.262           199.37
          2.857          0.310     19.744          6.366           201.09
          3.439          0.308     19.921          6.474           202.85
          4.061          0.306     20.101          6.584           204.64
          4.726          0.304     20.284          6.697           206.45
          5.442          0.302     20.470          6.813           208.29
          6.215          0.300     20.659          6.931           210.17
          7.053          0.298     20.851          7.053           212.07
          7.967          0.296     21.046          7.178           214.01
          8.971          0.294     21.244          7.307           215.98
         10.082          0.292     21.446          7.439           217.98
         11.322          0.290     21.651          7.574           220.02
         12.722          0.288     21.859          7.713           222.09
         14.325          0.286     22.071          7.855           224.20
         16.193          0.285     22.287          8.002           226.34
         18.426          0.283     22.506          8.152           228.52
         21.185          0.281     22.728          8.307           230.74
         24.779          0.279     22.955          8.466           233.00
         29.895          0.277     23.186          8.630           235.29
         38.745          0.275     23.420          8.798           237.63
        140.000          0.274     23.473          8.835           238.15
------------------------------------------------------------------------------
  NODE  1220.00 : HGL = <  205.031>;EGL= <  210.485>;FLOWLINE= <  204.710>

******************************************************************************
  FLOW PROCESS FROM NODE  1220.00 TO NODE  1220.00 IS CODE =  5
  UPSTREAM NODE  1220.00     ELEVATION =   205.04  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.20    18.00     15.00    205.04      0.88      22.207
```

```
   DOWNSTREAM      5.20    18.00       -      204.71      0.88       18.740
   LATERAL #1      0.00     0.00     0.00      0.00      0.00        0.000
   LATERAL #2      0.00     0.00     0.00      0.00      0.00        0.000
      Q5           0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.39172
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.24231
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.31702
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  1.268 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 2.498)+( 0.000) =   2.498
-------------------------------------------------------------------------------
 NODE  1220.00 : HGL = <  205.325>;EGL= <  212.983>;FLOWLINE= <  205.040>

*******************************************************************************
 FLOW PROCESS FROM NODE  1220.00 TO NODE  1215.00 IS CODE =  1
 UPSTREAM NODE  1215.00     ELEVATION =   225.16  (FLOW IS SUPERCRITICAL)
-------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =      36.00 FEET          MANNING'S N  =  0.01300
-------------------------------------------------------------------------------
 NORMAL DEPTH(FT) =      0.26           CRITICAL DEPTH(FT) =      0.88
===============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.88
===============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-------------------------------------------------------------------------------
 DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
  CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.878      4.837          1.242            74.13
        0.003          0.853      5.007          1.243            74.22
        0.011          0.829      5.191          1.247            74.51
        0.025          0.804      5.389          1.255            74.99
        0.047          0.779      5.604          1.267            75.70
        0.077          0.755      5.837          1.284            76.65
        0.118          0.730      6.090          1.306            77.85
        0.170          0.705      6.365          1.335            79.34
        0.236          0.681      6.666          1.371            81.15
        0.320          0.656      6.996          1.417            83.30
        0.423          0.631      7.359          1.473            85.84
        0.552          0.607      7.759          1.542            88.82
        0.711          0.582      8.201          1.627            92.28
        0.907          0.557      8.694          1.732            96.30
        1.151          0.533      9.244          1.860           100.95
        1.455          0.508      9.862          2.019           106.33
        1.836          0.483     10.559          2.216           112.58
        2.321          0.459     11.350          2.460           119.82
        2.945          0.434     12.255          2.768           128.27
        3.763          0.409     13.298          3.157           138.15
        4.862          0.385     14.509          3.656           149.79
        6.392          0.360     15.930          4.303           163.58
        8.638          0.335     17.616          5.157           180.09
       12.248          0.311     19.640          6.304           200.07
       19.318          0.286     22.106          7.879           224.55
       36.000          0.285     22.200          7.943           225.48
-------------------------------------------------------------------------------
 NODE  1215.00 : HGL = <  226.038>;EGL= <  226.402>;FLOWLINE= <  225.160>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE  1215.00 TO NODE  1215.00 IS CODE =  5
  UPSTREAM NODE  1215.00     ELEVATION =   225.49  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      5.20    18.00     90.00    225.49      0.88       15.958
    DOWNSTREAM     5.20    18.00       -      225.16      0.88        4.839
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.15397
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00586
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.07992
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.320 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.402)+( 0.000) =   3.402
------------------------------------------------------------------------------
  NODE  1215.00 : HGL = <  225.850>;EGL= <  229.804>;FLOWLINE= <  225.490>

******************************************************************************
  FLOW PROCESS FROM NODE  1215.00 TO NODE  1210.00 IS CODE =  1
  UPSTREAM NODE  1210.00     ELEVATION =   229.08  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =       6.42 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.26          CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.88
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.878      4.837          1.242            74.13
         0.003          0.853      5.008          1.243            74.22
         0.011          0.829      5.191          1.247            74.51
         0.025          0.804      5.389          1.255            74.99
         0.047          0.779      5.604          1.267            75.70
         0.077          0.755      5.837          1.284            76.65
         0.117          0.730      6.090          1.306            77.85
         0.170          0.705      6.365          1.335            79.35
         0.236          0.681      6.666          1.371            81.15
         0.320          0.656      6.996          1.417            83.31
         0.423          0.631      7.359          1.473            85.85
         0.552          0.607      7.759          1.542            88.82
         0.710          0.582      8.202          1.627            92.28
         0.907          0.557      8.694          1.732            96.30
         1.150          0.533      9.244          1.861           100.95
         1.454          0.508      9.862          2.019           106.34
         1.836          0.483     10.559          2.216           112.58
         2.320          0.459     11.351          2.461           119.83
         2.944          0.434     12.256          2.768           128.28
         3.762          0.409     13.299          3.157           138.16
```

```
         4.860          0.385     14.511         3.656           149.80
         6.390          0.360     15.932         4.304           163.60
         6.420          0.360     15.953         4.314           163.80
------------------------------------------------------------------------------
  NODE  1210.00 : HGL = <  229.958>;EGL= <  230.322>;FLOWLINE= <  229.080>

******************************************************************************
  FLOW PROCESS FROM NODE  1210.00 TO NODE  1210.00 IS CODE =  8
  UPSTREAM NODE  1210.00     ELEVATION =   229.08  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       5.20 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.84 FEET/SEC.    VELOCITY HEAD =  0.364 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.364) =  0.073
------------------------------------------------------------------------------
  NODE  1210.00 : HGL = <  230.394>;EGL= <  230.394>;FLOWLINE= <  229.080>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1210.00            FLOWLINE ELEVATION =   229.08
  ASSUMED UPSTREAM CONTROL HGL =    229.96 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
****************************************************************************
               PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
         (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                          Analysis prepared by:

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  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                              *
 * SYSTEM 13 - MAINLINE CAPACITY RUN FROM NODES 1350 TO 1330               *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                     *
  **************************************************************************

   FILE NAME: 1350.PIP
   TIME/DATE OF STUDY: 16:16 06/13/2019

****************************************************************************
              GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                        NODAL POINT STATUS TABLE
               (Note: "*" indicates nodal point data used.)
                     UPSTREAM RUN                    DOWNSTREAM RUN
   NODE    MODEL   PRESSURE     PRESSURE+          FLOW        PRESSURE+
  NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1350.00-            3.00            1142.93        0.78*          2357.83
       } FRICTION
  1345.00-            2.89            1100.75        0.72*          2615.56
       } JUNCTION
  1345.00-            2.84             970.88        0.58*          2770.06
       } FRICTION
  1342.50-            1.97 Dc          797.87        0.65*          2352.18
       } JUNCTION
  1342.50-            1.97 Dc          797.87        0.62*          2503.68
       } FRICTION
  1340.00-            1.97 Dc          797.87        1.54*           868.19
       } JUNCTION
  1340.00-            1.97*Dc          797.87        1.97*Dc         797.87
       } FRICTION
  1335.00-            2.03*            798.73        1.97 Dc         797.87
       } JUNCTION
  1335.00-            2.80*            697.80        1.40            383.38
       } FRICTION
  1332.00-            2.24*            503.91        1.47 Dc         381.99
       } JUNCTION
  1332.00-            2.22             455.41        0.76*           601.45
       } FRICTION
  1330.00-            1.49*Dc          359.10        1.49*Dc         359.10
       } CATCH BASIN
  1330.00-            1.31             105.89        1.49*Dc         122.46
----------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
****************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
```

```
  NODE NUMBER =  1350.00            FLOWLINE ELEVATION =   138.62
  PIPE FLOW =      41.90 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   141.620 FEET
------------------------------------------------------------------------------
  NODE  1350.00 : HGL = <  139.400>;EGL= <  152.171>;FLOWLINE= <  138.620>

******************************************************************************
  FLOW PROCESS FROM NODE  1350.00 TO NODE  1345.00 IS CODE =  1
  UPSTREAM NODE  1345.00     ELEVATION =   138.77  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      41.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      15.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.72           CRITICAL DEPTH(FT) =      2.11
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.72
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.723     31.904        16.538          2615.56
       10.507          0.763     29.569        14.348          2429.35
       15.000          0.780     28.670        13.551          2357.83
------------------------------------------------------------------------------
  NODE  1345.00 : HGL = <  139.493>;EGL= <  155.308>;FLOWLINE= <  138.770>

******************************************************************************
  FLOW PROCESS FROM NODE  1345.00 TO NODE  1345.00 IS CODE =  5
  UPSTREAM NODE  1345.00     ELEVATION =   139.10  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     36.80    36.00      7.82    139.10      1.97       38.647
    DOWNSTREAM    41.90    36.00       -      138.77      2.11       31.913
    LATERAL #1     5.10    18.00     90.00    140.60      0.87        4.804
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.46438
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.24293
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.35365
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.415 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 7.562)+( 0.000) =   7.562
------------------------------------------------------------------------------
  NODE  1345.00 : HGL = <  139.677>;EGL= <  162.870>;FLOWLINE= <  139.100>

******************************************************************************
  FLOW PROCESS FROM NODE  1345.00 TO NODE  1342.50 IS CODE =  1
  UPSTREAM NODE  1342.50     ELEVATION =   188.05  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.80 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     102.94 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.57           CRITICAL DEPTH(FT) =      1.97
```

```
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.65
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.649     32.712          17.275           2352.18
          1.187          0.646     32.928          17.492           2367.36
          2.434          0.643     33.146          17.714           2382.72
          3.746          0.640     33.367          17.939           2398.27
          5.129          0.637     33.591          18.168           2414.00
          6.589          0.634     33.817          18.402           2429.92
          8.136          0.631     34.045          18.640           2446.03
          9.778          0.628     34.277          18.883           2462.33
         11.527          0.625     34.511          19.130           2478.83
         13.395          0.622     34.748          19.382           2495.54
         15.398          0.619     34.987          19.639           2512.44
         17.555          0.616     35.230          19.900           2529.56
         19.888          0.613     35.476          20.167           2546.89
         22.427          0.610     35.724          20.439           2564.43
         25.207          0.607     35.976          20.717           2582.19
         28.274          0.604     36.231          20.999           2600.17
         31.689          0.601     36.489          21.288           2618.38
         35.534          0.598     36.750          21.582           2636.82
         39.925          0.595     37.014          21.882           2655.49
         45.031          0.592     37.282          22.188           2674.40
         51.113          0.589     37.553          22.500           2693.56
         58.612          0.586     37.827          22.819           2712.96
         68.351          0.583     38.105          23.144           2732.61
         82.179          0.580     38.387          23.475           2752.52
        102.940          0.577     38.635          23.770           2770.06
------------------------------------------------------------------------------
  NODE  1342.50 : HGL = <  188.699>;EGL= <  205.325>;FLOWLINE= <  188.050>

******************************************************************************
  FLOW PROCESS FROM NODE  1342.50 TO NODE  1342.50 IS CODE =  5
  UPSTREAM NODE  1342.50     ELEVATION =   188.38  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.80    36.00      8.50    188.38      1.97       34.874
    DOWNSTREAM     36.80    36.00       -      188.05      1.97       32.723
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34719
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.29000
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.31859
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.274 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.560)+( 0.000) =   2.560
------------------------------------------------------------------------------
  NODE  1342.50 : HGL = <  189.000>;EGL= <  207.885>;FLOWLINE= <  188.380>

******************************************************************************
  FLOW PROCESS FROM NODE  1342.50 TO NODE  1340.00 IS CODE =  1
```

```
  UPSTREAM NODE  1340.00     ELEVATION =   214.96  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.80 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      50.03 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.56           CRITICAL DEPTH(FT) =      1.97
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.54
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.538     10.082          3.118            868.19
          0.130          1.499     10.418          3.185            883.35
          0.283          1.460     10.777          3.264            900.45
          0.460          1.421     11.161          3.356            919.65
          0.666          1.381     11.573          3.462            941.11
          0.905          1.342     12.015          3.585            965.04
          1.183          1.303     12.491          3.727            991.67
          1.505          1.264     13.005          3.892           1021.26
          1.879          1.225     13.560          4.082           1054.10
          2.315          1.185     14.162          4.302           1090.53
          2.823          1.146     14.816          4.557           1130.95
          3.420          1.107     15.528          4.853           1175.81
          4.121          1.068     16.306          5.199           1225.65
          4.951          1.029     17.158          5.603           1281.09
          5.940          0.990     18.096          6.077           1342.86
          7.126          0.950     19.131          6.637           1411.85
          8.563          0.911     20.278          7.300           1489.10
         10.326          0.872     21.554          8.091           1575.87
         12.519          0.833     22.982          9.039           1673.69
         15.299          0.794     24.588         10.187           1784.42
         18.913          0.754     26.403         11.586           1910.39
         23.780          0.715     28.469         13.308           2054.49
         30.688          0.676     30.837         15.451           2220.37
         41.423          0.637     33.572         18.149           2412.72
         50.030          0.620     34.863         19.505           2503.68
------------------------------------------------------------------------------
  NODE  1340.00 : HGL = <  216.498>;EGL= <  218.078>;FLOWLINE= <  214.960>

******************************************************************************
  FLOW PROCESS FROM NODE  1340.00 TO NODE  1340.00 IS CODE =  5
  UPSTREAM NODE  1340.00     ELEVATION =   215.29  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     36.80    36.00      0.00    215.29      1.97        7.466
    DOWNSTREAM    36.80    36.00       -      214.96      1.97        7.466
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00515
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00515
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00515
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.021 FEET         ENTRANCE LOSSES =  0.000 FEET
```

```
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.330)+( 0.000) =   0.330
------------------------------------------------------------------------------
  NODE  1340.00 : HGL = <  217.263>;EGL= <  218.128>;FLOWLINE= <  215.290>

******************************************************************************
  FLOW PROCESS FROM NODE  1340.00 TO NODE  1335.00 IS CODE =  1
  UPSTREAM NODE  1335.00     ELEVATION =   215.69  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.80 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      84.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      2.03          CRITICAL DEPTH(FT) =      1.97
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.97
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.973      7.464          2.838           797.87
          0.013          1.975      7.454          2.838           797.87
          0.054          1.977      7.445          2.838           797.88
          0.126          1.980      7.435          2.838           797.88
          0.230          1.982      7.425          2.838           797.89
          0.371          1.984      7.416          2.839           797.91
          0.552          1.986      7.406          2.839           797.92
          0.778          1.989      7.397          2.839           797.94
          1.054          1.991      7.387          2.839           797.97
          1.385          1.993      7.378          2.839           797.99
          1.779          1.995      7.369          2.839           798.02
          2.245          1.997      7.359          2.839           798.05
          2.793          2.000      7.350          2.839           798.09
          3.436          2.002      7.341          2.839           798.12
          4.191          2.004      7.331          2.839           798.16
          5.080          2.006      7.322          2.839           798.21
          6.131          2.009      7.313          2.840           798.25
          7.382          2.011      7.304          2.840           798.30
          8.886          2.013      7.295          2.840           798.36
         10.722          2.015      7.285          2.840           798.41
         13.011          2.018      7.276          2.840           798.47
         15.958          2.020      7.267          2.841           798.53
         19.944          2.022      7.258          2.841           798.59
         25.828          2.024      7.249          2.841           798.66
         36.364          2.027      7.240          2.841           798.73
         84.000          2.027      7.240          2.841           798.73
------------------------------------------------------------------------------
  NODE  1335.00 : HGL = <  217.717>;EGL= <  218.531>;FLOWLINE= <  215.690>

******************************************************************************
  FLOW PROCESS FROM NODE  1335.00 TO NODE  1335.00 IS CODE =  5
  UPSTREAM NODE  1335.00     ELEVATION =   216.06  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      21.00    36.00      90.00    216.06      1.47       3.060
    DOWNSTREAM     36.80    36.00        -      215.69      1.97       7.242
    LATERAL #1     14.30    24.00      48.30    216.69      1.36       5.317
    LATERAL #2      1.50    18.00      14.80    217.19      0.46       1.083
       Q5           0.00===Q5 EQUALS BASIN INPUT===
```

```
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00086
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00478
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00282
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.011 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.472)+( 0.000) =   0.472
------------------------------------------------------------------------------
  NODE  1335.00 : HGL = <  218.857>;EGL= <  219.003>;FLOWLINE= <  216.060>

******************************************************************************
  FLOW PROCESS FROM NODE  1335.00 TO NODE  1332.00 IS CODE =  1
  UPSTREAM NODE  1332.00     ELEVATION =   216.67  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      21.00 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     121.44 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.40           CRITICAL DEPTH(FT) =      1.47
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.80
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          2.797      3.059          2.943           697.80
         11.856          2.744      3.097          2.893           676.79
         23.612          2.691      3.140          2.845           656.27
         35.283          2.638      3.188          2.796           636.27
         46.878          2.585      3.241          2.748           616.80
         58.403          2.532      3.298          2.701           597.89
         69.863          2.479      3.360          2.655           579.57
         81.262          2.426      3.428          2.609           561.85
         92.600          2.373      3.500          2.564           544.76
        103.877          2.320      3.579          2.519           528.32
        115.091          2.267      3.663          2.476           512.57
        121.440          2.237      3.714          2.451           503.91
------------------------------------------------------------------------------
  NODE  1332.00 : HGL = <  218.907>;EGL= <  219.121>;FLOWLINE= <  216.670>

******************************************************************************
  FLOW PROCESS FROM NODE  1332.00 TO NODE  1332.00 IS CODE =  5
  UPSTREAM NODE  1332.00     ELEVATION =   217.17  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      19.30    30.00     90.00    217.17       1.49      15.431
    DOWNSTREAM     21.00    36.00       -      216.67       1.47       3.715
    LATERAL #1      1.70    36.00     58.70    217.00       0.40       0.518
    LATERAL #2      0.00     0.00      0.00      0.00       0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.05618
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00121
```

```
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.02869
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.115 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.501)+( 0.000) =   2.501
------------------------------------------------------------------------------
  NODE  1332.00 : HGL = <  217.925>;EGL= <  221.623>;FLOWLINE= <  217.170>

******************************************************************************
  FLOW PROCESS FROM NODE  1332.00 TO NODE  1330.00 IS CODE =  1
  UPSTREAM NODE  1330.00     ELEVATION =   220.17  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      19.30 CFS     PIPE DIAMETER =  30.00 INCHES
  PIPE LENGTH =      19.54 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.58          CRITICAL DEPTH(FT) =      1.49
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.49
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.490      6.325         2.111          359.10
         0.012          1.454      6.515         2.113          359.43
         0.049          1.417      6.718         2.119          360.44
         0.116          1.381      6.935         2.129          362.17
         0.216          1.345      7.168         2.143          364.68
         0.354          1.309      7.416         2.163          368.01
         0.536          1.273      7.683         2.190          372.23
         0.768          1.237      7.971         2.224          377.40
         1.060          1.200      8.280         2.266          383.61
         1.420          1.164      8.614         2.317          390.95
         1.862          1.128      8.975         2.380          399.51
         2.401          1.092      9.367         2.455          409.42
         3.056          1.056      9.793         2.546          420.80
         3.850          1.019     10.257         2.654          433.82
         4.817          0.983     10.765         2.784          448.66
         5.996          0.947     11.321         2.938          465.53
         7.444          0.911     11.934         3.124          484.69
         9.236          0.875     12.610         3.345          506.44
        11.482          0.838     13.360         3.612          531.14
        14.341          0.802     14.195         3.933          559.22
        18.066          0.766     15.130         4.323          591.21
        19.540          0.755     15.426         4.453          601.45
------------------------------------------------------------------------------
  NODE  1330.00 : HGL = <  221.660>;EGL= <  222.281>;FLOWLINE= <  220.170>

******************************************************************************
  FLOW PROCESS FROM NODE  1330.00 TO NODE  1330.00 IS CODE =  8
  UPSTREAM NODE  1330.00     ELEVATION =   221.10  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      19.30 CFS          PIPE DIAMETER =  30.00 INCHES
  FLOW VELOCITY =   9.96 FEET/SEC.    VELOCITY HEAD =  1.542 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  1.542) =  0.308
------------------------------------------------------------------------------
  NODE  1330.00 : HGL = <  222.590>;EGL= <  222.590>;FLOWLINE= <  221.100>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
```

```
  NODE NUMBER =  1330.00            FLOWLINE ELEVATION =   221.10
  ASSUMED UPSTREAM CONTROL HGL =    222.59 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
                PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                          San Diego, California 92110
                        619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                               *
 * SYSTEM 13 - LATERAL RUN FROM NODES 1335 TO 1310 (SYSTEM 13A)             *
 * TAILWATER HGL = 218.9 FT. AT NODE 1335 FROM MAINLINE RUN                 *
  **************************************************************************

   FILE NAME: 1335NE.LAT
   TIME/DATE OF STUDY: 16:55 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+        FLOW       PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1335.00-             2.21            363.34        0.55*           574.33
         } FRICTION
  1310.00-             1.36*Dc         259.08        1.36*Dc         259.08
         } CATCH BASIN
  1310.00-             2.10*           214.82        1.36 Dc          85.20
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1335.00            FLOWLINE ELEVATION =   216.69
  PIPE FLOW =      14.30 CFS        PIPE DIAMETER =  24.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   218.900 FEET
------------------------------------------------------------------------------
  NODE  1335.00 : HGL = <  217.240>;EGL= <  223.682>;FLOWLINE= <  216.690>

******************************************************************************
  FLOW PROCESS FROM NODE  1335.00 TO NODE  1310.00 IS CODE =  1
  UPSTREAM NODE  1310.00     ELEVATION =   227.54  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      14.30 CFS     PIPE DIAMETER =  24.00 INCHES
  PIPE LENGTH =      57.77 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.52          CRITICAL DEPTH(FT) =      1.36
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.36
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
```

```
 DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
  CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          1.362     6.272          1.974           259.08
        0.009          1.328     6.452          1.975           259.32
        0.039          1.295     6.645          1.981           260.05
        0.092          1.261     6.852          1.990           261.32
        0.172          1.227     7.075          2.005           263.15
        0.282          1.193     7.314          2.024           265.60
        0.427          1.159     7.573          2.050           268.70
        0.613          1.125     7.851          2.083           272.50
        0.846          1.091     8.153          2.124           277.08
        1.134          1.058     8.479          2.175           282.50
        1.487          1.024     8.833          2.236           288.83
        1.919          0.990     9.219          2.310           296.17
        2.444          0.956     9.639          2.400           304.63
        3.083          0.922    10.100          2.507           314.32
        3.861          0.888    10.604          2.636           325.40
        4.813          0.855    11.160          2.790           338.02
        5.984          0.821    11.774          2.975           352.41
        7.437          0.787    12.455          3.197           368.78
        9.262          0.753    13.213          3.466           387.45
       11.594          0.719    14.062          3.791           408.76
       14.642          0.685    15.016          4.189           433.13
       18.761          0.651    16.096          4.677           461.12
       24.622          0.618    17.325          5.281           493.38
       33.738          0.584    18.733          6.037           530.75
       50.976          0.550    20.361          6.992           574.33
       57.770          0.550    20.361          6.992           574.33
------------------------------------------------------------------------------
 NODE  1310.00 : HGL = <  228.902>;EGL= <  229.514>;FLOWLINE= <  227.540>

******************************************************************************
 FLOW PROCESS FROM NODE  1310.00 TO NODE  1310.00 IS CODE =  8
 UPSTREAM NODE  1310.00     ELEVATION =   227.54  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =      14.30 CFS          PIPE DIAMETER =  24.00 INCHES
 FLOW VELOCITY =   6.27 FEET/SEC.    VELOCITY HEAD =  0.611 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.611) =  0.122
------------------------------------------------------------------------------
 NODE  1310.00 : HGL = <  229.636>;EGL= <  229.636>;FLOWLINE= <  227.540>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1310.00            FLOWLINE ELEVATION =   227.54
 ASSUMED UPSTREAM CONTROL HGL =    228.90 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
♀
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******************************************************************************
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                                *
 * SYSTEM 13 - LATERAL RUN FROM NODES 1335 TO 1311 (SYSTEM 13B)              *
 * TAILWATER HGL = 218.9 FT. AT NODE 1335 FROM MAINLINE RUN                  *
  **************************************************************************

   FILE NAME: 1335SE.LAT
   TIME/DATE OF STUDY: 17:00 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE     PRESSURE+        FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1335.00-             1.71*           110.69       0.21              57.48
         } FRICTION        } HYDRAULIC JUMP
  1311.00-             0.55*Dc          22.94       0.55*Dc           22.94
         } CATCH BASIN
  1311.00-             0.79*            12.23       0.55 Dc            8.27
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1335.00            FLOWLINE ELEVATION =   217.19
  PIPE FLOW =       2.10 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   218.900 FEET
------------------------------------------------------------------------------
  NODE  1335.00 : HGL = <  218.900>;EGL= <  218.922>;FLOWLINE= <  217.190>

******************************************************************************
  FLOW PROCESS FROM NODE  1335.00 TO NODE  1311.00 IS CODE =  1
  UPSTREAM NODE  1311.00     ELEVATION =   229.62  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      42.98 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.20           CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.55
==============================================================================
```

```
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.547      3.603          0.749            22.94
          0.003          0.533      3.732          0.749            22.96
          0.011          0.519      3.870          0.752            23.04
          0.025          0.505      4.017          0.756            23.18
          0.047          0.491      4.174          0.762            23.37
          0.076          0.477      4.344          0.770            23.63
          0.116          0.463      4.526          0.781            23.96
          0.167          0.449      4.722          0.795            24.36
          0.231          0.435      4.934          0.813            24.84
          0.311          0.421      5.163          0.835            25.42
          0.409          0.407      5.413          0.862            26.09
          0.530          0.393      5.684          0.895            26.86
          0.677          0.379      5.981          0.935            27.75
          0.857          0.365      6.306          0.983            28.78
          1.078          0.351      6.664          1.041            29.95
          1.349          0.337      7.059          1.111            31.29
          1.684          0.323      7.496          1.196            32.82
          2.102          0.309      7.984          1.300            34.57
          2.630          0.295      8.529          1.426            36.57
          3.308          0.281      9.142          1.580            38.86
          4.199          0.268      9.836          1.771            41.49
          5.411          0.254     10.626          2.008            44.53
          7.144          0.240     11.533          2.306            48.05
          9.856          0.226     12.581          2.685            52.17
         15.014          0.212     13.804          3.172            57.01
         42.980          0.210     13.922          3.222            57.48
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     1.71
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)  (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.710      1.188          1.732           110.69
          0.727          1.500      1.188          1.522            87.54
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.727          1.500      1.188          1.522            87.54
          0.858          1.462      1.196          1.484            83.38
          0.988          1.424      1.211          1.447            79.29
          1.118          1.386      1.231          1.409            75.28
          1.246          1.347      1.255          1.372            71.36
          1.375          1.309      1.283          1.335            67.53
          1.502          1.271      1.315          1.298            63.82
          1.629          1.233      1.351          1.261            60.21
          1.755          1.195      1.391          1.225            56.73
          1.880          1.157      1.435          1.189            53.38
          2.004          1.119      1.485          1.153            50.16
          2.128          1.081      1.540          1.117            47.08
          2.249          1.042      1.601          1.082            44.15
          2.369          1.004      1.669          1.048            41.37
          2.488          0.966      1.745          1.014            38.75
```

```
        2.604          0.928      1.828         0.980            36.29
        2.717          0.890      1.922         0.947            34.01
        2.827          0.852      2.027         0.916            31.90
        2.933          0.814      2.144         0.885            29.98
        3.034          0.776      2.277         0.856            28.26
        3.128          0.737      2.428         0.829            26.75
        3.214          0.699      2.599         0.804            25.46
        3.289          0.661      2.796         0.783            24.41
        3.350          0.623      3.024         0.765            23.62
        3.393          0.585      3.290         0.753            23.11
        3.409          0.547      3.603         0.749            22.94
       42.980          0.547      3.603         0.749            22.94
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     1.73 FEET UPSTREAM OF NODE 1335.00 |
|      DOWNSTREAM DEPTH = 1.203 FEET, UPSTREAM CONJUGATE DEPTH = 0.210 FEET |
-----------------------------------------------------------------------------
  NODE  1311.00 : HGL = <  230.167>;EGL= <  230.369>;FLOWLINE= <  229.620>

*****************************************************************************
  FLOW PROCESS FROM NODE  1311.00 TO NODE  1311.00 IS CODE =  8
  UPSTREAM NODE  1311.00     ELEVATION =   229.62  (FLOW IS SUBCRITICAL)
-----------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       2.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.60 FEET/SEC.    VELOCITY HEAD =  0.202 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.202) =  0.040
-----------------------------------------------------------------------------
  NODE  1311.00 : HGL = <  230.409>;EGL= <  230.409>;FLOWLINE= <  229.620>

*****************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1311.00           FLOWLINE ELEVATION =   229.62
  ASSUMED UPSTREAM CONTROL HGL =    230.17 FOR DOWNSTREAM RUN ANALYSIS

=============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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```

```
******************************************************************************
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                          Analysis prepared by:

                         RICK ENGINEERING COMPANY
                             5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                              *
 * SYSTEM 13 - LATERAL RUN FROM NODES 1335 TO 1331 (SYSTEM 13)             *
 * TAILWATER HGL = 218.9 FT. AT NODE 1332 FROM MAINLINE RUN                *
  **************************************************************************

   FILE NAME: 1332.LAT
   TIME/DATE OF STUDY: 17:10 03/31/2019

******************************************************************************
              GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                        NODAL POINT STATUS TABLE
              (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                    DOWNSTREAM RUN
   NODE    MODEL   PRESSURE      PRESSURE+        FLOW       PRESSURE+
  NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1332.00-             1.90*         244.69        0.18            32.61
        } FRICTION        } HYDRAULIC JUMP
  1331.00-             0.40*Dc        15.66        0.40*Dc         15.66
        } CATCH BASIN
  1331.00-             0.57*           8.25        0.40 Dc          5.81
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1332.00            FLOWLINE ELEVATION =   217.00
  PIPE FLOW =       1.70 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   218.900 FEET
------------------------------------------------------------------------------
  NODE  1332.00 : HGL = <  218.900>;EGL= <  218.902>;FLOWLINE= <  217.000>

******************************************************************************
  FLOW PROCESS FROM NODE  1332.00 TO NODE  1331.00 IS CODE =  1
  UPSTREAM NODE  1331.00     ELEVATION =   220.60  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.70 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      23.54 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.17          CRITICAL DEPTH(FT) =      0.40
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.40
==============================================================================
```

```
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.404      2.989          0.543             15.66
          0.003          0.395      3.091          0.543             15.67
          0.012          0.386      3.200          0.545             15.72
          0.029          0.376      3.315          0.547             15.80
          0.053          0.367      3.437          0.551             15.91
          0.087          0.358      3.568          0.556             16.06
          0.132          0.349      3.707          0.562             16.25
          0.188          0.339      3.855          0.570             16.48
          0.259          0.330      4.014          0.581             16.75
          0.347          0.321      4.185          0.593             17.08
          0.454          0.312      4.368          0.608             17.45
          0.584          0.302      4.565          0.626             17.88
          0.742          0.293      4.778          0.648             18.37
          0.932          0.284      5.008          0.674             18.93
          1.162          0.275      5.257          0.704             19.56
          1.442          0.265      5.529          0.740             20.27
          1.783          0.256      5.825          0.783             21.08
          2.202          0.247      6.149          0.834             21.98
          2.724          0.238      6.504          0.895             23.00
          3.384          0.229      6.896          0.967             24.14
          4.237          0.219      7.329          1.054             25.43
          5.376          0.210      7.810          1.158             26.89
          6.976          0.201      8.347          1.283             28.53
          9.428          0.192      8.950          1.436             30.41
         13.996          0.182      9.629          1.623             32.54
         23.540          0.182      9.652          1.630             32.61
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.90
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.900      0.360          1.902            244.69
          0.390          1.840      0.374          1.842            227.43
          0.780          1.780      0.389          1.783            210.84
          1.170          1.720      0.405          1.723            194.90
          1.560          1.661      0.423          1.663            179.64
          1.950          1.601      0.443          1.604            165.04
          2.339          1.541      0.465          1.544            151.12
          2.728          1.481      0.489          1.485            137.88
          3.117          1.421      0.515          1.425            125.32
          3.505          1.361      0.545          1.366            113.44
          3.892          1.302      0.578          1.307            102.23
          4.279          1.242      0.615          1.248             91.71
          4.665          1.182      0.657          1.189             81.85
          5.050          1.122      0.704          1.130             72.68
          5.434          1.062      0.759          1.071             64.17
          5.815          1.002      0.821          1.013             56.33
          6.194          0.943      0.894          0.955             49.16
          6.570          0.883      0.979          0.898             42.65
          6.940          0.823      1.079          0.841             36.80
          7.304          0.763      1.200          0.785             31.62
          7.658          0.703      1.347          0.731             27.10
          7.998          0.643      1.528          0.680             23.27
          8.314          0.584      1.757          0.632             20.14
          8.593          0.524      2.053          0.589             17.77
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        8.808          0.464      2.446          0.557            16.22
        8.901          0.404      2.989          0.543            15.66
       23.540          0.404      2.989          0.543            15.66
------------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     7.24 FEET UPSTREAM OF NODE 1332.00 |
|      DOWNSTREAM DEPTH = 0.774 FEET, UPSTREAM CONJUGATE DEPTH = 0.182 FEET |
------------------------------------------------------------------------------
  NODE  1331.00 : HGL = <  221.004>;EGL= <  221.143>;FLOWLINE= <  220.600>

******************************************************************************
  FLOW PROCESS FROM NODE  1331.00 TO NODE  1331.00 IS CODE =  8
  UPSTREAM NODE  1331.00     ELEVATION =   220.60  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.70 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =   2.99 FEET/SEC.    VELOCITY HEAD =  0.139 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.139) =  0.028
------------------------------------------------------------------------------
  NODE  1331.00 : HGL = <  221.171>;EGL= <  221.171>;FLOWLINE= <  220.600>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1331.00            FLOWLINE ELEVATION =   220.60
  ASSUMED UPSTREAM CONTROL HGL =    221.00 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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```
******************************************************************************
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                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                                *
 * SYSTEM 15 - MAINLINE CAPACITY RUN FROM NODES 1570 TO 1520                 *
 * TAILWATER ASSUMED TO BE TOP OF PIPE                                       *
  ***************************************************************************

   FILE NAME: 1570.PIP
   TIME/DATE OF STUDY: 11:22 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1570.00-             3.00*           1034.91        1.50             888.73
         } FRICTION
  1565.00-             2.87*            984.18        1.47             897.98
         } JUNCTION
  1565.00-             2.96            1017.89        0.81*           1745.62
         } FRICTION
  1560.00-             2.73             935.57        0.71*           2076.68
         } JUNCTION
  1560.00-             2.42             851.28        0.64*           2395.34
         } FRICTION
  1555.00-             1.98 Dc          800.77        0.69*           2159.48
         } JUNCTION
  1555.00-             1.98 Dc          800.77        0.65*           2340.69
         } FRICTION
  1535.00-             1.98 Dc          800.77        1.93*            801.51
         } JUNCTION
  1535.00-             1.98 Dc          800.77        1.87*            804.38
         } FRICTION
  1530.00-             1.98*Dc          800.77        1.97*Dc          800.77
         } JUNCTION
  1530.00-             2.59*            894.13        1.64             839.60
         } FRICTION        } HYDRAULIC JUMP
  1525.00-             1.98 Dc          800.77        1.81*            809.96
         } JUNCTION
  1525.00-             1.98 Dc          800.77        1.73*            820.91
         } FRICTION
  1520.00-             1.98*Dc          800.77        1.98*Dc          800.77
         } CATCH BASIN
  1520.00-             3.02*            668.95        1.98 Dc          266.27
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
```

```
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1570.00            FLOWLINE ELEVATION =    99.75
  PIPE FLOW =      36.90 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   102.750 FEET
------------------------------------------------------------------------------
  NODE  1570.00 : HGL = <  102.750>;EGL= <  103.173>;FLOWLINE= <   99.750>

******************************************************************************
  FLOW PROCESS FROM NODE  1570.00 TO NODE  1565.00 IS CODE =  1
  UPSTREAM NODE  1565.00     ELEVATION =    99.91  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.59           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     3.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          3.000      5.219          3.423         1034.91
        5.448          2.959      5.233          3.384         1017.87
       10.513          2.918      5.259          3.348         1001.73
       15.359          2.877      5.292          3.312          986.26
       16.000          2.871      5.297          3.307          984.18
------------------------------------------------------------------------------
  NODE  1565.00 : HGL = <  102.781>;EGL= <  103.217>;FLOWLINE= <   99.910>

******************************************************************************
  FLOW PROCESS FROM NODE  1565.00 TO NODE  1565.00 IS CODE =  5
  UPSTREAM NODE  1565.00     ELEVATION =   100.28  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     36.90    36.00     60.00    100.28      1.98       23.964
    DOWNSTREAM    36.90    36.00       -       99.91      1.98        5.299
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.12039
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00266
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.06153
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.246 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 6.790)+( 0.000) =   6.790
------------------------------------------------------------------------------
  NODE  1565.00 : HGL = <  101.090>;EGL= <  110.007>;FLOWLINE= <  100.280>

******************************************************************************
  FLOW PROCESS FROM NODE  1565.00 TO NODE  1560.00 IS CODE =  1
```

```
  UPSTREAM NODE  1560.00     ELEVATION =   100.54  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      26.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.59           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.71
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.712     28.705         13.515          2076.68
        9.294          0.748     26.812         11.918          1944.21
       18.691          0.783     25.129         10.594          1826.92
       26.000          0.810     23.957          9.727          1745.62
------------------------------------------------------------------------------
  NODE  1560.00 : HGL = <  101.252>;EGL= <  114.055>;FLOWLINE= <  100.540>

******************************************************************************
  FLOW PROCESS FROM NODE  1560.00 TO NODE  1560.00 IS CODE =  5
  UPSTREAM NODE  1560.00     ELEVATION =   100.87  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     25.00    100.87      1.98       33.243
    DOWNSTREAM     36.90    36.00       -      100.54      1.98       28.714
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.30255
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.20013
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.25134
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.005 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 4.618)+( 0.000) =   4.618
------------------------------------------------------------------------------
  NODE  1560.00 : HGL = <  101.513>;EGL= <  118.673>;FLOWLINE= <  100.870>

******************************************************************************
  FLOW PROCESS FROM NODE  1560.00 TO NODE  1555.00 IS CODE =  1
  UPSTREAM NODE  1555.00     ELEVATION =   130.70  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      96.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.64           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.69
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
```

```
          0.000          0.692     29.885         14.569          2159.48
          1.428          0.690     30.018         14.691          2168.83
          2.924          0.688     30.152         14.814          2178.25
          4.494          0.686     30.287         14.938          2187.74
          6.145          0.684     30.423         15.065          2197.31
          7.884          0.682     30.560         15.192          2206.97
          9.722          0.679     30.698         15.322          2216.69
         11.669          0.677     30.838         15.453          2226.50
         13.736          0.675     30.978         15.586          2236.39
         15.939          0.673     31.120         15.720          2246.36
         18.296          0.671     31.263         15.856          2256.41
         20.828          0.669     31.406         15.994          2266.54
         23.560          0.666     31.551         16.134          2276.76
         26.525          0.664     31.698         16.276          2287.07
         29.764          0.662     31.845         16.419          2297.45
         33.329          0.660     31.994         16.564          2307.93
         37.288          0.658     32.144         16.711          2318.49
         41.736          0.656     32.295         16.861          2329.15
         46.802          0.653     32.447         17.012          2339.89
         52.679          0.651     32.601         17.165          2350.72
         59.662          0.649     32.755         17.320          2361.64
         68.251          0.647     32.912         17.477          2372.66
         79.377          0.645     33.069         17.636          2383.77
         95.137          0.643     33.228         17.798          2394.98
         96.000          0.643     33.233         17.803          2395.34
------------------------------------------------------------------------------
  NODE  1555.00 : HGL = <  131.392>;EGL= <  145.269>;FLOWLINE= <  130.700>

******************************************************************************
  FLOW PROCESS FROM NODE  1555.00 TO NODE  1555.00 IS CODE =  5
  UPSTREAM NODE  1555.00     ELEVATION =   131.03  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     15.10    131.03      1.98       32.469
    DOWNSTREAM     36.90    36.00       -      130.70      1.98       29.894
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.28305
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.22419
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.25362
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.014 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.784)+( 0.000) =   2.784
------------------------------------------------------------------------------
  NODE  1555.00 : HGL = <  131.683>;EGL= <  148.053>;FLOWLINE= <  131.030>

******************************************************************************
  FLOW PROCESS FROM NODE  1555.00 TO NODE  1535.00 IS CODE =  1
  UPSTREAM NODE  1535.00     ELEVATION =   174.49  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     109.11 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.60          CRITICAL DEPTH(FT) =      1.98
```

```
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.93
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.926      7.692          2.846           801.51
          0.022          1.873      7.946          2.854           804.07
          0.062          1.820      8.220          2.870           808.56
          0.124          1.767      8.516          2.894           815.14
          0.209          1.714      8.836          2.927           823.98
          0.322          1.661      9.183          2.972           835.27
          0.468          1.608      9.561          3.028           849.22
          0.653          1.555      9.971          3.100           866.08
          0.883          1.502     10.419          3.189           886.15
          1.167          1.449     10.910          3.298           909.76
          1.516          1.396     11.448          3.432           937.32
          1.943          1.343     12.040          3.595           969.28
          2.467          1.290     12.694          3.794          1006.21
          3.109          1.237     13.420          4.035          1048.75
          3.899          1.184     14.228          4.329          1097.72
          4.878          1.131     15.132          4.689          1154.07
          6.098          1.078     16.149          5.130          1218.98
          7.636          1.025     17.299          5.674          1293.91
          9.602          0.972     18.607          6.351          1380.69
         12.161          0.919     20.106          7.200          1481.62
         15.575          0.866     21.838          8.275          1599.64
         20.292          0.812     23.855          9.654          1738.57
         27.165          0.759     26.228         11.448          1903.45
         38.129          0.706     29.053         13.821          2101.05
         59.429          0.653     32.458         17.023          2340.68
        109.110          0.653     32.458         17.023          2340.69
------------------------------------------------------------------------------
  NODE  1535.00 : HGL = <  176.416>;EGL= <  177.336>;FLOWLINE= <  174.490>

******************************************************************************
  FLOW PROCESS FROM NODE  1535.00 TO NODE  1535.00 IS CODE =  5
  UPSTREAM NODE  1535.00     ELEVATION =   174.78  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     30.00    174.78      1.98       7.971
    DOWNSTREAM     36.90    36.00       -      174.49      1.98       7.694
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00606
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00554
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00580
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.023 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.300)+( 0.000) =   0.300
------------------------------------------------------------------------------
  NODE  1535.00 : HGL = <  176.649>;EGL= <  177.635>;FLOWLINE= <  174.780>

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

```
  FLOW PROCESS FROM NODE  1535.00 TO NODE  1530.00 IS CODE =  1
  UPSTREAM NODE  1530.00     ELEVATION =   174.82  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =       4.81 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.69           CRITICAL DEPTH(FT) =      1.98
================================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.97
================================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.975      7.475          2.843            800.77
         0.047          1.963      7.525          2.843            800.81
         0.185          1.952      7.576          2.844            800.94
         0.421          1.940      7.628          2.844            801.15
         0.765          1.929      7.681          2.845            801.44
         1.228          1.917      7.734          2.847            801.82
         1.822          1.906      7.788          2.848            802.29
         2.560          1.894      7.844          2.850            802.84
         3.461          1.883      7.900          2.852            803.49
         4.544          1.871      7.957          2.855            804.22
         4.810          1.869      7.969          2.855            804.38
--------------------------------------------------------------------------------
  NODE  1530.00 : HGL = <  176.795>;EGL= <  177.663>;FLOWLINE= <  174.820>

********************************************************************************
  FLOW PROCESS FROM NODE  1530.00 TO NODE  1530.00 IS CODE =  5
  UPSTREAM NODE  1530.00     ELEVATION =   175.19  (FLOW IS SUBCRITICAL)
--------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00    61.50    175.19      1.98        5.684
    DOWNSTREAM     36.90    36.00      -      174.82      1.98        7.475
    LATERAL #1      0.00     0.00     0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00     0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00282
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00516
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00399
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.016 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.621)+( 0.000) =   0.621
--------------------------------------------------------------------------------
  NODE  1530.00 : HGL = <  177.782>;EGL= <  178.284>;FLOWLINE= <  175.190>

********************************************************************************
  FLOW PROCESS FROM NODE  1530.00 TO NODE  1525.00 IS CODE =  1
  UPSTREAM NODE  1525.00     ELEVATION =   175.81  (HYDRAULIC JUMP OCCURS)
--------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      61.90 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
```

```
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
-------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.59           CRITICAL DEPTH(FT) =      1.98
===============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.81
===============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY       SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.807     8.289          2.875            809.96
          1.108          1.799     8.337          2.879            810.96
          2.322          1.790     8.384          2.883            812.02
          3.652          1.782     8.433          2.887            813.14
          5.108          1.773     8.482          2.891            814.31
          6.703          1.764     8.532          2.896            815.55
          8.451          1.756     8.582          2.900            816.84
         10.369          1.747     8.633          2.905            818.19
         12.477          1.739     8.685          2.911            819.61
         14.798          1.730     8.737          2.916            821.08
         17.359          1.722     8.790          2.922            822.62
         20.194          1.713     8.844          2.928            824.22
         23.345          1.704     8.899          2.935            825.89
         26.861          1.696     8.954          2.941            827.62
         30.807          1.687     9.010          2.948            829.42
         35.264          1.679     9.066          2.956            831.28
         40.343          1.670     9.124          2.963            833.21
         46.189          1.661     9.182          2.971            835.21
         53.008          1.653     9.241          2.980            837.28
         61.102          1.644     9.301          2.988            839.43
         61.900          1.644     9.306          2.989            839.60
-------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
===============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.59
===============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY       SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          2.592     5.682          3.094            894.13
          2.317          2.568     5.727          3.077            887.42
          4.591          2.543     5.774          3.061            880.92
          6.822          2.518     5.823          3.045            874.63
          9.007          2.494     5.874          3.030            868.56
         11.146          2.469     5.927          3.015            862.72
         13.237          2.444     5.982          3.000            857.10
         15.278          2.420     6.038          2.986            851.71
         17.265          2.395     6.097          2.973            846.56
         19.197          2.370     6.158          2.959            841.65
         21.070          2.346     6.221          2.947            836.99
         22.880          2.321     6.287          2.935            832.57
         24.624          2.296     6.354          2.924            828.42
         26.298          2.272     6.424          2.913            824.52
         27.895          2.247     6.496          2.903            820.90
         29.410          2.222     6.571          2.893            817.54
         30.838          2.198     6.648          2.884            814.47
         32.169          2.173     6.728          2.876            811.69
         33.396          2.148     6.810          2.869            809.21
         34.509          2.124     6.896          2.862            807.02
         35.497          2.099     6.984          2.857            805.15
         36.347          2.074     7.075          2.852            803.60
         37.044          2.050     7.169          2.848            802.37
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       37.570          2.025      7.267          2.845           801.49
       37.904          2.000      7.368          2.844           800.95
       38.022          1.976      7.472          2.843           800.77
       61.900          1.976      7.472          2.843           800.77
------------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    22.81 FEET UPSTREAM OF NODE 1530.00 |
|      DOWNSTREAM DEPTH = 2.322 FEET, UPSTREAM CONJUGATE DEPTH = 1.672 FEET |
----------------------------------------------------------------------------
  NODE  1525.00 : HGL = <  177.617>;EGL= <  178.685>;FLOWLINE= <  175.810>

****************************************************************************
  FLOW PROCESS FROM NODE  1525.00 TO NODE  1525.00 IS CODE =  5
  UPSTREAM NODE  1525.00     ELEVATION =   176.14  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW   DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     36.90    36.00     30.00     176.14     1.98        8.734
    DOWNSTREAM    36.90    36.00       -       175.81     1.98        8.292
    LATERAL #1     0.00     0.00      0.00       0.00     0.00        0.000
    LATERAL #2     0.00     0.00      0.00       0.00     0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00765
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00670
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00718
  JUNCTION LENGTH =   5.00 FEET
  FRICTION LOSSES =  0.036 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.371)+( 0.000) =   0.371
----------------------------------------------------------------------------
  NODE  1525.00 : HGL = <  177.871>;EGL= <  179.056>;FLOWLINE= <  176.140>

****************************************************************************
  FLOW PROCESS FROM NODE  1525.00 TO NODE  1520.00 IS CODE =  1
  UPSTREAM NODE  1520.00     ELEVATION =   176.36  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      21.53 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.58          CRITICAL DEPTH(FT) =      1.98
============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.98
============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
----------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          1.976      7.472          2.843           800.77
        0.049          1.960      7.541          2.843           800.84
        0.202          1.944      7.611          2.844           801.07
        0.470          1.928      7.682          2.845           801.45
        0.861          1.913      7.755          2.847           801.99
        1.390          1.897      7.830          2.850           802.69
        2.071          1.881      7.906          2.853           803.56
        2.920          1.866      7.984          2.856           804.59
        3.958          1.850      8.064          2.860           805.80
        5.207          1.834      8.145          2.865           807.18
        6.696          1.819      8.229          2.871           808.74
```

```
        8.459          1.803      8.314          2.877           810.49
       10.536          1.787      8.402          2.884           812.42
       12.980          1.771      8.491          2.892           814.54
       15.854          1.756      8.583          2.900           816.86
       19.242          1.740      8.677          2.910           819.38
       21.530          1.731      8.731          2.916           820.91
------------------------------------------------------------------------------
  NODE  1520.00 : HGL = <  178.336>;EGL= <  179.203>;FLOWLINE= <  176.360>

******************************************************************************
  FLOW PROCESS FROM NODE  1520.00 TO NODE  1520.00 IS CODE =  8
  UPSTREAM NODE  1520.00     ELEVATION =   176.36  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      36.90 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =   7.47 FEET/SEC.    VELOCITY HEAD =  0.868 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.868) =  0.174
------------------------------------------------------------------------------
  NODE  1520.00 : HGL = <  179.377>;EGL= <  179.377>;FLOWLINE= <  176.360>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1520.00            FLOWLINE ELEVATION =   176.36
  ASSUMED UPSTREAM CONTROL HGL =    178.34 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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                            Analysis prepared by:

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                         San Diego, California 92110
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  ************************** DESCRIPTION OF STUDY **************************
 * 18022-F Maple Canyon                                                     *
 * System 16 Q100 Proposed                                                  *
 * Tailwater from System 0000.pip node 20                                   *
  **************************************************************************

   FILE NAME: 1610.PIP
   TIME/DATE OF STUDY: 08:19 06/19/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+        FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1620.00-            10.21*          1049.47        0.19             83.53
         } FRICTION        } HYDRAULIC JUMP
  1610.00-             0.59*Dc          27.21        0.59*Dc          27.21
         } CATCH BASIN
  1610.00-             0.52              8.59        0.59*Dc           9.77
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1620.00            FLOWLINE ELEVATION =    70.69
  PIPE FLOW =       2.40 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    80.900 FEET
------------------------------------------------------------------------------
  NODE  1620.00 : HGL = <   80.900>;EGL= <   80.929>;FLOWLINE= <   70.690>

******************************************************************************
  FLOW PROCESS FROM NODE  1620.00 TO NODE  1610.00 IS CODE =  1
  UPSTREAM NODE  1610.00     ELEVATION =   131.70  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.40 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     151.64 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.19           CRITICAL DEPTH(FT) =      0.59
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.59
==============================================================================
```

```
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.586      3.750          0.805            27.21
          0.002          0.570      3.889          0.806            27.25
          0.009          0.555      4.038          0.808            27.35
          0.021          0.539      4.198          0.813            27.52
          0.039          0.524      4.370          0.820            27.77
          0.065          0.508      4.555          0.830            28.11
          0.098          0.492      4.755          0.843            28.54
          0.142          0.477      4.971          0.860            29.06
          0.197          0.461      5.206          0.882            29.69
          0.265          0.445      5.461          0.909            30.44
          0.350          0.430      5.740          0.942            31.32
          0.455          0.414      6.046          0.982            32.34
          0.584          0.398      6.381          1.031            33.53
          0.742          0.383      6.751          1.091            34.89
          0.937          0.367      7.161          1.164            36.46
          1.178          0.351      7.617          1.253            38.26
          1.478          0.336      8.126          1.362            40.33
          1.855          0.320      8.698          1.495            42.71
          2.336          0.304      9.344          1.661            45.46
          2.959          0.289     10.078          1.867            48.63
          3.786          0.273     10.918          2.125            52.32
          4.921          0.257     11.887          2.453            56.62
          6.564          0.242     13.015          2.874            61.68
          9.162          0.226     14.341          3.421            67.67
         14.162          0.210     15.916          4.146            74.85
        151.640          0.195     17.813          5.125            83.53
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =    10.21
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000         10.210      1.358         10.239          1049.47
         21.677          1.500      1.358          1.529            89.02
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     1.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         21.677          1.500      1.358          1.529            89.02
         21.767          1.463      1.366          1.492            85.04
         21.856          1.427      1.383          1.457            81.13
         21.945          1.390      1.404          1.421            77.30
         22.033          1.354      1.429          1.386            73.56
         22.121          1.317      1.459          1.350            69.90
         22.208          1.281      1.493          1.315            66.35
         22.294          1.244      1.531          1.281            62.91
         22.380          1.208      1.574          1.246            59.58
         22.465          1.171      1.621          1.212            56.37
         22.550          1.134      1.673          1.178            53.29
         22.633          1.098      1.731          1.144            50.35
         22.715          1.061      1.795          1.111            47.54
         22.796          1.025      1.865          1.079            44.87
         22.876          0.988      1.943          1.047            42.36
```

```
        22.954          0.952      2.029          1.016            40.00
        23.029          0.915      2.125          0.985            37.81
        23.103          0.879      2.231          0.956            35.79
        23.173          0.842      2.349          0.928            33.95
        23.239          0.805      2.482          0.901            32.30
        23.301          0.769      2.631          0.876            30.85
        23.357          0.732      2.799          0.854            29.61
        23.405          0.696      2.990          0.835            28.61
        23.444          0.659      3.209          0.819            27.86
        23.470          0.623      3.459          0.809            27.38
        23.480          0.586      3.750          0.805            27.21
       151.640          0.586      3.750          0.805            27.21
------------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    21.83 FEET UPSTREAM OF NODE 1620.00 |
|       DOWNSTREAM DEPTH = 1.436 FEET, UPSTREAM CONJUGATE DEPTH = 0.197 FEET |
------------------------------------------------------------------------------
  NODE  1610.00 : HGL = <  132.286>;EGL= <  132.505>;FLOWLINE= <  131.700>

******************************************************************************
  FLOW PROCESS FROM NODE  1610.00 TO NODE  1610.00 IS CODE =  8
  UPSTREAM NODE  1610.00     ELEVATION =   132.03  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       2.40 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   5.99 FEET/SEC.    VELOCITY HEAD =  0.557 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.557) =  0.111
------------------------------------------------------------------------------
  NODE  1610.00 : HGL = <  132.616>;EGL= <  132.616>;FLOWLINE= <  132.030>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1610.00           FLOWLINE ELEVATION =   132.03
  ASSUMED UPSTREAM CONTROL HGL =    132.62 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
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  ************************** DESCRIPTION OF STUDY **************************
 * 18022-F Maple Canyon                                                       *
 * System 0 Q100 Proposed                                                     *
 * Tailwater assumed to be top of 36" pipe at end of system.                  *
  **************************************************************************

   FILE NAME: 0000.PIP
   TIME/DATE OF STUDY: 17:00 06/18/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+          FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
     1.00-             3.00*Dc         10213.72       2.99*Dc        10212.41
         } FRICTION
     0.00-            10.23*           13403.57       2.99 Dc        10212.41
         } JUNCTION
     0.00-            25.68*           23945.30       2.56            8552.22
         } FRICTION
    10.00-            19.86*           19379.20       2.26            9649.55
         } JUNCTION
    10.00-            20.01*           19497.40       2.14           10245.46
         } FRICTION
    20.00-            13.08*           14058.69       2.18           10047.70
         } JUNCTION
    20.00-            12.99*           13990.59       2.13           10317.31
         } FRICTION
    30.00-             6.83*            9161.86       2.80            7916.98
         } JUNCTION
    30.00-             7.49*            9675.91       2.43            8975.12
         } FRICTION        } HYDRAULIC JUMP
    40.00-             3.80*Dc          6888.04       3.80*Dc         6888.04
         } CATCH BASIN
    40.00-             8.07*            4758.94       3.80 Dc         1414.30
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =     1.00            FLOWLINE ELEVATION =    43.27
  PIPE FLOW =     186.66 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    46.270 FEET
------------------------------------------------------------------------------
```

```
  NODE     1.00 : HGL = <   46.270>;EGL= <   57.098>;FLOWLINE= <   43.270>

******************************************************************************
  FLOW PROCESS FROM NODE     1.00 TO NODE     0.00 IS CODE =  1
  UPSTREAM NODE     0.00     ELEVATION =    43.87  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     100.00 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    186.66)/(   666.985))**2 = 0.07832
  HF=L*SF = (    100.00)*(0.07832) =      7.832
------------------------------------------------------------------------------
  NODE     0.00 : HGL = <   54.102>;EGL= <   64.930>;FLOWLINE= <   43.870>

******************************************************************************
  FLOW PROCESS FROM NODE     0.00 TO NODE     0.00 IS CODE =  5
  UPSTREAM NODE     0.00     ELEVATION =    44.20  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00     90.00     44.20      3.80       14.854
    DOWNSTREAM    186.66    36.00       -       43.87      2.99       26.407
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.07831
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04760
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.190 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 8.381)+( 0.000) =   8.381
------------------------------------------------------------------------------
  NODE     0.00 : HGL = <   69.885>;EGL= <   73.311>;FLOWLINE= <   44.200>

******************************************************************************
  FLOW PROCESS FROM NODE     0.00 TO NODE    10.00 IS CODE =  1
  UPSTREAM NODE    10.00     ELEVATION =    57.52  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     443.97 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    186.66)/(  1436.437))**2 = 0.01689
  HF=L*SF = (    443.97)*(0.01689) =      7.497
------------------------------------------------------------------------------
  NODE    10.00 : HGL = <   77.382>;EGL= <   80.808>;FLOWLINE= <   57.520>

******************************************************************************
  FLOW PROCESS FROM NODE    10.00 TO NODE    10.00 IS CODE =  5
  UPSTREAM NODE    10.00     ELEVATION =    57.85  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00     20.00     57.85      3.80       14.854
    DOWNSTREAM    186.66    48.00       -       57.52      3.80       14.854
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
```

```
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01688
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.068 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.481)+( 0.000) =   0.481
------------------------------------------------------------------------------
  NODE    10.00 : HGL = <   77.862>;EGL= <   81.289>;FLOWLINE= <   57.850>

******************************************************************************
  FLOW PROCESS FROM NODE    10.00 TO NODE    20.00 IS CODE =  1
  UPSTREAM NODE    20.00     ELEVATION =    67.86  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     182.05 FEET         MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    186.66)/(  1436.438))**2 = 0.01689
  HF=L*SF = (    182.05)*(0.01689) =      3.074
------------------------------------------------------------------------------
  NODE    20.00 : HGL = <   80.937>;EGL= <   84.363>;FLOWLINE= <   67.860>

******************************************************************************
  FLOW PROCESS FROM NODE    20.00 TO NODE    20.00 IS CODE =  5
  UPSTREAM NODE    20.00     ELEVATION =    68.19  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00       13.00    68.19      3.80       14.854
    DOWNSTREAM    186.66    48.00        -       67.86      3.80       14.854
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01688
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.068 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.243)+( 0.000) =   0.243
------------------------------------------------------------------------------
  NODE    20.00 : HGL = <   81.180>;EGL= <   84.606>;FLOWLINE= <   68.190>

******************************************************************************
  FLOW PROCESS FROM NODE    20.00 TO NODE    30.00 IS CODE =  1
  UPSTREAM NODE    30.00     ELEVATION =    75.26  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =      54.01 FEET         MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    186.66)/(  1436.437))**2 = 0.01689
  HF=L*SF = (     54.01)*(0.01689) =      0.912
------------------------------------------------------------------------------
```

```
  NODE    30.00 : HGL = <   82.092>;EGL= <   85.518>;FLOWLINE= <   75.260>

******************************************************************************
  FLOW PROCESS FROM NODE    30.00 TO NODE    30.00 IS CODE =  5
  UPSTREAM NODE    30.00     ELEVATION =    75.59  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00     30.00     75.59      3.80       14.854
    DOWNSTREAM    186.66    48.00       -       75.26      3.80       14.854
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01688
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.068 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.986)+( 0.000) =   0.986
------------------------------------------------------------------------------
  NODE    30.00 : HGL = <   83.077>;EGL= <   86.503>;FLOWLINE= <   75.590>

******************************************************************************
  FLOW PROCESS FROM NODE    30.00 TO NODE    40.00 IS CODE =  1
  UPSTREAM NODE    40.00     ELEVATION =    80.00  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =      33.57 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.66          CRITICAL DEPTH(FT) =      3.80
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     3.80
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          3.802    15.128          7.358          6888.04
         0.086          3.716    15.330          7.368          6895.73
         0.340          3.630    15.571          7.397          6918.00
         0.760          3.545    15.847          7.446          6954.25
         1.353          3.459    16.158          7.515          7004.35
         2.133          3.373    16.505          7.605          7068.54
         3.115          3.287    16.888          7.718          7147.27
         4.324          3.201    17.309          7.856          7241.19
         5.787          3.115    17.771          8.022          7351.17
         7.542          3.029    18.275          8.219          7478.24
         9.633          2.943    18.826          8.450          7623.64
        12.115          2.858    19.427          8.722          7788.83
        15.060          2.772    20.083          9.038          7975.50
        18.556          2.686    20.799          9.407          8185.62
        22.718          2.600    21.581          9.837          8421.49
        27.697          2.514    22.437         10.336          8685.76
        33.570          2.430    23.355         10.905          8975.12
```

```
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     7.49
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          7.487     14.854         10.913          9675.91
         30.462          4.000     14.854          7.426          6941.34
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     4.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         30.462          4.000     14.849          7.426          6941.34
         30.522          3.992     14.852          7.419          6935.94
         30.575          3.984     14.856          7.413          6931.20
         30.622          3.976     14.861          7.408          6926.90
         30.666          3.968     14.867          7.403          6922.94
         30.706          3.960     14.874          7.398          6919.30
         30.744          3.953     14.882          7.394          6915.92
         30.778          3.945     14.890          7.390          6912.80
         30.810          3.937     14.899          7.386          6909.90
         30.839          3.929     14.909          7.383          6907.22
         30.867          3.921     14.919          7.379          6904.75
         30.892          3.913     14.930          7.376          6902.48
         30.915          3.905     14.941          7.374          6900.39
         30.936          3.897     14.953          7.371          6898.49
         30.955          3.889     14.965          7.369          6896.76
         30.972          3.881     14.978          7.367          6895.20
         30.988          3.873     14.991          7.365          6893.80
         31.001          3.865     15.005          7.364          6892.56
         31.013          3.858     15.019          7.362          6891.48
         31.023          3.850     15.033          7.361          6890.55
         31.032          3.842     15.048          7.360          6889.77
         31.039          3.834     15.063          7.359          6889.14
         31.044          3.826     15.079          7.359          6888.66
         31.048          3.818     15.095          7.358          6888.31
         31.051          3.810     15.111          7.358          6888.10
         31.051          3.802     15.128          7.358          6888.04
         33.570          3.802     15.128          7.358          6888.04
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    19.98 FEET UPSTREAM OF NODE   30.00 |
|      DOWNSTREAM DEPTH = 5.200 FEET, UPSTREAM CONJUGATE DEPTH = 2.815 FEET |
------------------------------------------------------------------------------
  NODE    40.00 : HGL = <   83.802>;EGL= <   87.358>;FLOWLINE= <   80.000>

******************************************************************************
  FLOW PROCESS FROM NODE    40.00 TO NODE    40.00 IS CODE =  8
  UPSTREAM NODE    40.00     ELEVATION =    80.00  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =     186.66 CFS          PIPE DIAMETER =  48.00 INCHES
  FLOW VELOCITY =  15.13 FEET/SEC.    VELOCITY HEAD =  3.556 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  3.556) =  0.711
------------------------------------------------------------------------------
  NODE    40.00 : HGL = <   88.069>;EGL= <   88.069>;FLOWLINE= <   80.000>

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

```
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =    40.00            FLOWLINE ELEVATION =    80.00
  ASSUMED UPSTREAM CONTROL HGL =     83.80 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * 18022-F Maple Canyon                                                     *
 * System 0 Q100 Proposed                                                   *
 * Ultimate condition: tailwater assumed from max depth from WMP 8' pipe    *
  **************************************************************************

   FILE NAME: 0000_ULT.PIP
   TIME/DATE OF STUDY: 09:13 06/19/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+          FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
     2.00-            16.30*          16586.28        2.60            8408.75
         } FRICTION
     0.00-            14.93*          15508.25        2.54            8609.40
         } JUNCTION
     0.00-            14.66*          15302.43        2.56            8552.22
         } FRICTION
    10.00-             8.84*          10736.30        2.26            9649.55
         } JUNCTION
    10.00-             8.99*          10854.53        2.14           10245.46
         } FRICTION        } HYDRAULIC JUMP
    20.00-             3.80 Dc         6888.04        2.18*          10047.70
         } JUNCTION
    20.00-             3.80 Dc         6888.04        2.13*          10317.31
         } FRICTION
    30.00-             3.80 Dc         6888.04        2.80*           7916.98
         } JUNCTION
    30.00-             4.59            7405.01        2.43*           8975.12
         } FRICTION
    40.00-             3.80*Dc         6888.04        3.80*Dc         6888.04
         } CATCH BASIN
    40.00-             8.07*           4758.94        3.80 Dc         1414.30
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =     2.00            FLOWLINE ELEVATION =    40.30
  PIPE FLOW =     186.66 CFS        PIPE DIAMETER =  48.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    56.600 FEET
------------------------------------------------------------------------------
```

```
  NODE     2.00 : HGL = <   56.600>;EGL= <   60.026>;FLOWLINE= <   40.300>

******************************************************************************
  FLOW PROCESS FROM NODE     2.00 TO NODE     0.00 IS CODE =  1
  UPSTREAM NODE     0.00     ELEVATION =    43.87  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     130.00 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    186.66)/(  1436.438))**2 = 0.01689
  HF=L*SF = (    130.00)*(0.01689) =      2.195
------------------------------------------------------------------------------
  NODE     0.00 : HGL = <   58.795>;EGL= <   62.221>;FLOWLINE= <   43.870>

******************************************************************************
  FLOW PROCESS FROM NODE     0.00 TO NODE     0.00 IS CODE =  5
  UPSTREAM NODE     0.00     ELEVATION =    44.20  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL    VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00     0.00      44.20      3.80       14.854
    DOWNSTREAM    186.66    48.00      -        43.87      3.80       14.854
    LATERAL #1      0.00     0.00     0.00       0.00      0.00        0.000
    LATERAL #2      0.00     0.00     0.00       0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01688
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.068 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.068)+( 0.000) =   0.068
------------------------------------------------------------------------------
  NODE     0.00 : HGL = <   58.863>;EGL= <   62.289>;FLOWLINE= <   44.200>

******************************************************************************
  FLOW PROCESS FROM NODE     0.00 TO NODE    10.00 IS CODE =  1
  UPSTREAM NODE    10.00     ELEVATION =    57.52  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     443.97 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((    186.66)/(  1436.437))**2 = 0.01689
  HF=L*SF = (    443.97)*(0.01689) =      7.497
------------------------------------------------------------------------------
  NODE    10.00 : HGL = <   66.360>;EGL= <   69.786>;FLOWLINE= <   57.520>

******************************************************************************
  FLOW PROCESS FROM NODE    10.00 TO NODE    10.00 IS CODE =  5
  UPSTREAM NODE    10.00     ELEVATION =    57.85  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL    VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00    20.00      57.85      3.80       14.854
    DOWNSTREAM    186.66    48.00      -        57.52      3.80       14.854
    LATERAL #1      0.00     0.00     0.00       0.00      0.00        0.000
    LATERAL #2      0.00     0.00     0.00       0.00      0.00        0.000
```

```
     Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01688
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.068 FEET          ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.481)+( 0.000) =   0.481
------------------------------------------------------------------------------
  NODE    10.00 : HGL = <   66.840>;EGL= <   70.266>;FLOWLINE= <   57.850>

******************************************************************************
  FLOW PROCESS FROM NODE    10.00 TO NODE    20.00 IS CODE =  1
  UPSTREAM NODE    20.00     ELEVATION =    67.86  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =     182.05 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      2.13          CRITICAL DEPTH(FT) =      3.80
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.18
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM        FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)            (FT)     (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000           2.180     26.642        13.209         10047.70
         5.871           2.178     26.675        13.234         10058.56
        12.003           2.176     26.707        13.259         10069.44
        18.418           2.174     26.740        13.284         10080.37
        25.144           2.172     26.773        13.309         10091.32
        32.210           2.170     26.806        13.334         10102.30
        39.652           2.168     26.839        13.360         10113.31
        47.510           2.165     26.872        13.385         10124.36
        55.832           2.163     26.905        13.411         10135.44
        64.673           2.161     26.938        13.436         10146.54
        74.102           2.159     26.972        13.462         10157.69
        84.199           2.157     27.005        13.488         10168.86
        95.064           2.155     27.039        13.514         10180.07
       106.820           2.153     27.072        13.540         10191.31
       119.621           2.150     27.106        13.566         10202.58
       133.667           2.148     27.140        13.593         10213.88
       149.222           2.146     27.174        13.619         10225.22
       166.640           2.144     27.208        13.646         10236.58
       182.050           2.142     27.234        13.666         10245.46
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     8.99
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM         PRESSURE   VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000           8.990     14.854        12.416         10854.53
       130.986           4.000     14.854         7.426          6941.34
```

```
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     4.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        130.986          4.000     14.849          7.426          6941.34
        131.166          3.992     14.852          7.419          6935.94
        131.322          3.984     14.856          7.413          6931.20
        131.462          3.976     14.861          7.408          6926.90
        131.591          3.968     14.867          7.403          6922.94
        131.709          3.960     14.874          7.398          6919.30
        131.819          3.953     14.882          7.394          6915.92
        131.920          3.945     14.890          7.390          6912.80
        132.013          3.937     14.899          7.386          6909.90
        132.099          3.929     14.909          7.383          6907.22
        132.179          3.921     14.919          7.379          6904.75
        132.252          3.913     14.930          7.376          6902.48
        132.319          3.905     14.941          7.374          6900.39
        132.380          3.897     14.953          7.371          6898.49
        132.435          3.889     14.965          7.369          6896.76
        132.485          3.881     14.978          7.367          6895.20
        132.530          3.873     14.991          7.365          6893.80
        132.570          3.865     15.005          7.364          6892.56
        132.605          3.858     15.019          7.362          6891.48
        132.634          3.850     15.033          7.361          6890.55
        132.659          3.842     15.048          7.360          6889.77
        132.680          3.834     15.063          7.359          6889.14
        132.695          3.826     15.079          7.359          6888.66
        132.706          3.818     15.095          7.358          6888.31
        132.713          3.810     15.111          7.358          6888.10
        132.715          3.802     15.128          7.358          6888.04
        182.050          3.802     15.128          7.358          6888.04
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    20.80 FEET UPSTREAM OF NODE   10.00 |
|      DOWNSTREAM DEPTH = 8.198 FEET, UPSTREAM CONJUGATE DEPTH = 2.145 FEET |
------------------------------------------------------------------------------
  NODE    20.00 : HGL = <   70.040>;EGL= <   81.069>;FLOWLINE= <   67.860>

******************************************************************************
  FLOW PROCESS FROM NODE    20.00 TO NODE    20.00 IS CODE =  5
  UPSTREAM NODE    20.00     ELEVATION =    68.19  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL    VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     186.66    48.00     13.00     68.19      3.80       27.457
    DOWNSTREAM    186.66    48.00       -       67.86      3.80       26.650
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.05481
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.05067
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.05274
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.211 FEET          ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.956)+( 0.000) =   0.956
```

```
------------------------------------------------------------------------------
  NODE    20.00 : HGL = <   70.319>;EGL= <   82.025>;FLOWLINE= <   68.190>

******************************************************************************
  FLOW PROCESS FROM NODE    20.00 TO NODE    30.00 IS CODE =  1
  UPSTREAM NODE    30.00     ELEVATION =    75.26  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW    =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =       54.01 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.66          CRITICAL DEPTH(FT) =      3.80
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.80
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)     (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          2.798     19.880          8.938          7916.98
         1.700          2.752     20.242          9.118          8021.77
         3.562          2.706     20.622          9.314          8133.32
         5.605          2.661     21.021          9.526          8251.96
         7.847          2.615     21.439          9.756          8378.07
        10.311          2.569     21.877         10.006          8512.05
        13.025          2.524     22.336         10.276          8654.34
        16.019          2.478     22.819         10.569          8805.41
        19.330          2.433     23.326         10.886          8965.78
        23.002          2.387     23.858         11.231          9136.00
        27.088          2.341     24.419         11.606          9316.70
        31.651          2.296     25.008         12.013          9508.52
        36.769          2.250     25.629         12.456          9712.21
        42.541          2.204     26.283         12.938          9928.56
        49.091          2.159     26.974         13.464         10158.44
        54.010          2.129     27.448         13.835         10317.31
------------------------------------------------------------------------------
  NODE    30.00 : HGL = <   78.058>;EGL= <   84.198>;FLOWLINE= <   75.260>

******************************************************************************
  FLOW PROCESS FROM NODE    30.00 TO NODE    30.00 IS CODE =  5
  UPSTREAM NODE    30.00     ELEVATION =    75.59  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE         FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL    VELOCITY
                    (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       186.66    48.00    30.00      75.59      3.80       23.362
    DOWNSTREAM      186.66    48.00      -        75.26      3.80       19.886
    LATERAL #1        0.00     0.00     0.00       0.00      0.00        0.000
    LATERAL #2        0.00     0.00     0.00       0.00      0.00        0.000
       Q5             0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.03602
  DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02415
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03008
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.120 FEET          ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.297)+( 0.000) =   2.297
------------------------------------------------------------------------------
  NODE    30.00 : HGL = <   78.020>;EGL= <   86.495>;FLOWLINE= <   75.590>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE    30.00 TO NODE    40.00 IS CODE =  1
  UPSTREAM NODE    40.00     ELEVATION =    80.00  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW    =     186.66 CFS     PIPE DIAMETER =  48.00 INCHES
  PIPE LENGTH =       33.57 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.66          CRITICAL DEPTH(FT) =      3.80
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     3.80
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)     (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000         3.802     15.128         7.358          6888.04
          0.086         3.716     15.330         7.368          6895.73
          0.340         3.630     15.571         7.397          6918.00
          0.760         3.545     15.847         7.446          6954.25
          1.353         3.459     16.158         7.515          7004.35
          2.133         3.373     16.505         7.605          7068.54
          3.115         3.287     16.888         7.718          7147.27
          4.324         3.201     17.309         7.856          7241.19
          5.787         3.115     17.771         8.022          7351.17
          7.542         3.029     18.275         8.219          7478.24
          9.633         2.943     18.826         8.450          7623.64
         12.115         2.858     19.427         8.722          7788.83
         15.060         2.772     20.083         9.038          7975.50
         18.556         2.686     20.799         9.407          8185.62
         22.718         2.600     21.581         9.837          8421.49
         27.697         2.514     22.437        10.336          8685.76
         33.570         2.430     23.355        10.905          8975.12
------------------------------------------------------------------------------
  NODE    40.00 : HGL = <   83.802>;EGL= <   87.358>;FLOWLINE= <   80.000>

******************************************************************************
  FLOW PROCESS FROM NODE    40.00 TO NODE    40.00 IS CODE =  8
  UPSTREAM NODE    40.00     ELEVATION =    80.00  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =     186.66 CFS          PIPE DIAMETER =  48.00 INCHES
  FLOW VELOCITY =  15.13 FEET/SEC.    VELOCITY HEAD =  3.556 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  3.556) =  0.711
------------------------------------------------------------------------------
  NODE    40.00 : HGL = <   88.069>;EGL= <   88.069>;FLOWLINE= <   80.000>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =    40.00            FLOWLINE ELEVATION =    80.00
  ASSUMED UPSTREAM CONTROL HGL =     83.80 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

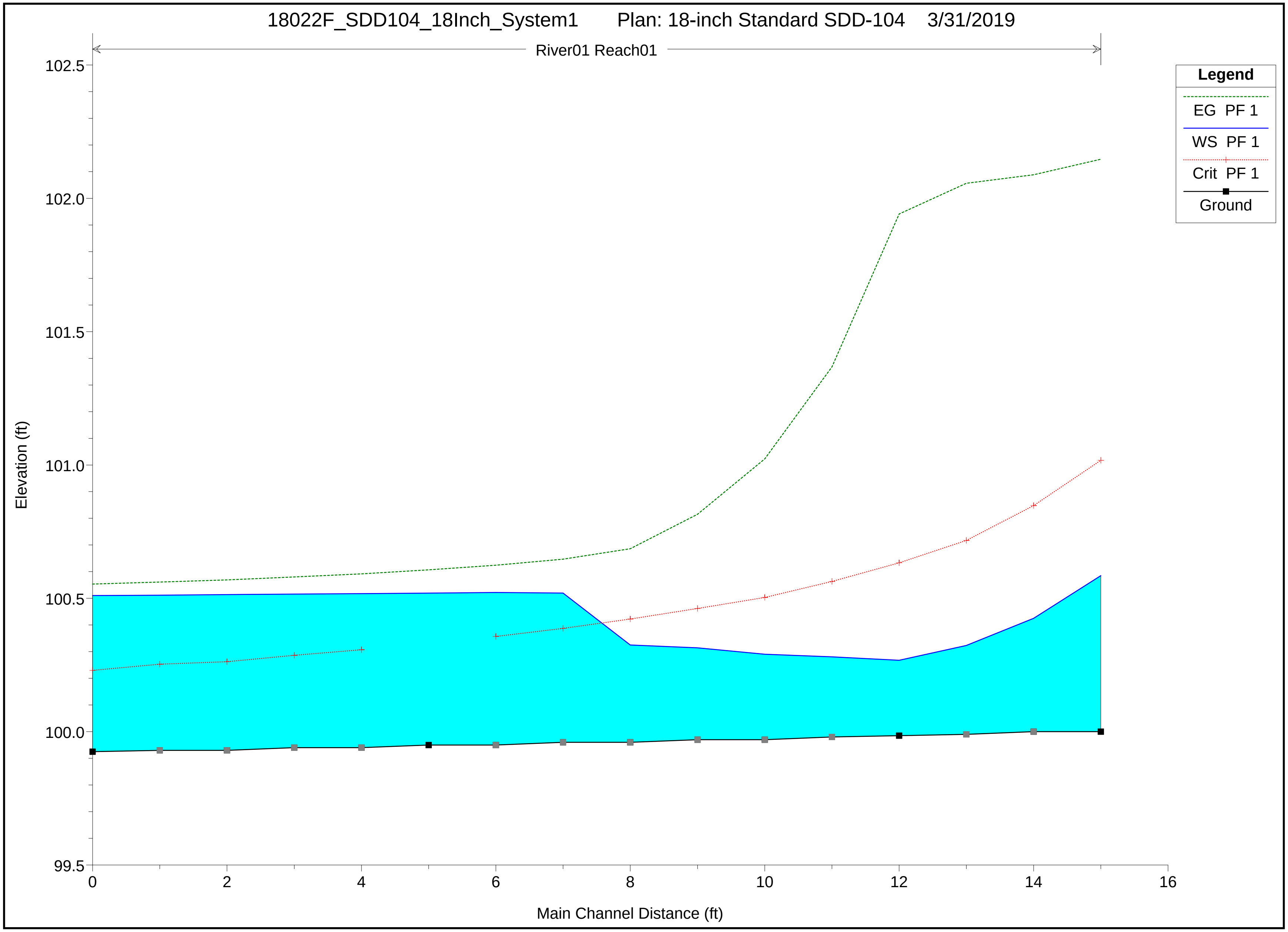
APPENDIX E

Energy Dissipater Design

RIP RAP PAD AT NODE 145
SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104 River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	8.80	100.00	100.59	101.02	102.15	0.107622	10.03	0.88	6.51	2.31	
Reach01	99.*	PF 1	8.80	100.00	100.43	100.85	102.09	0.025645	10.35	0.85	6.05	2.80	
Reach01	98.*	PF 1	8.80	99.99	100.32	100.72	102.06	0.036989	10.57	0.83	6.00	3.23	
Reach01	97	PF 1	8.80	99.99	100.27	100.63	101.94	0.509679	10.38	0.85	6.20	3.44	End of Wing Wall
Reach01	96.*	PF 1	8.80	99.98	100.28	100.56	101.37	0.305081	8.37	1.05	6.93	2.69	Start of 1/4 Ton
Reach01	95.*	PF 1	8.80	99.97	100.29	100.50	101.02	0.188718	6.87	1.28	7.66	2.14	
Reach01	94.*	PF 1	8.80	99.97	100.31	100.46	100.82	0.117142	5.68	1.55	8.38	1.71	
Reach01	93.*	PF 1	8.80	99.96	100.33	100.42	100.69	0.078038	4.82	1.83	9.07	1.41	
Reach01	92.*	PF 1	8.80	99.96	100.52	100.39	100.65	0.015531	2.86	3.08	10.32	0.67	Hydraulic Jump
Reach01	91.*	PF 1	8.80	99.95	100.52	100.36	100.62	0.012151	2.56	3.43	10.85	0.60	
Reach01	90	PF 1	8.80	99.95	100.52		100.61	0.010521	2.38	3.70	11.33	0.56	
Reach01	89.*	PF 1	8.80	99.94	100.52	100.31	100.59	0.008612	2.17	4.05	11.35	0.50	
Reach01	88.*	PF 1	8.80	99.94	100.52	100.29	100.58	0.007613	2.04	4.32	11.34	0.47	
Reach01	87.*	PF 1	8.80	99.93	100.51	100.26	100.57	0.006371	1.88	4.67	11.36	0.43	End of 1/4 Ton
Reach01	86.*	PF 1	8.80	99.93	100.51	100.25	100.56	0.005716	1.78	4.95	11.36	0.41	
Reach01	85	PF 1	8.80	99.93	100.51	100.23	100.55	0.005001	1.67	5.27	11.37	0.38	


18022F_SDD104_18Inch_System1 Plan: 18-inch Standard SDD-104 3/31/2019
River01 Reach01
Elevation (ft)
102.5
102.0
101.5
101.0
100.5
100.0
99.5
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                          *
 * SYSTEM 1 - MAINLINE VELOCITY RUN FROM NODES 145 TO 115                    *
 * TAILWATER ASSUMED TO BE FLOWLINE OF THE PIPE                              *
  **************************************************************************

   FILE NAME: 145_V.PIP
   TIME/DATE OF STUDY: 20:39 03/26/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                   DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   145.00-             1.15 Dc          150.14       0.88*             165.07
         } FRICTION
   140.00-             1.15 Dc          150.14       0.82*             174.11
         } JUNCTION
   140.00-             1.79             199.06       0.40*             404.13
         } FRICTION
   135.00-             1.15*Dc          150.14       1.15*Dc           150.14
         } JUNCTION
   135.00-             1.81*            149.52       0.78               82.53
         } FRICTION
   115.00-             1.55*            121.33       0.90 Dc            79.82
         } CATCH BASIN
   115.00-             1.73*            108.06       0.90 Dc            27.15
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   145.00            FLOWLINE ELEVATION =   101.16
  PIPE FLOW =       8.80 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   101.160 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  1.15 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE   145.00 : HGL = <  102.038>;EGL= <  103.080>;FLOWLINE= <  101.160>

******************************************************************************
  FLOW PROCESS FROM NODE   145.00 TO NODE   140.00 IS CODE =  1
```

```
  UPSTREAM NODE   140.00     ELEVATION =   101.32  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       8.80 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.05           CRITICAL DEPTH(FT) =      1.15
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.82
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.816      8.951          2.061            174.11
         2.348          0.826      8.826          2.036            172.54
         4.725          0.835      8.704          2.012            171.05
         7.133          0.844      8.585          1.990            169.62
         9.576          0.854      8.470          1.968            168.26
        12.058          0.863      8.358          1.948            166.96
        14.581          0.872      8.249          1.930            165.72
        16.000          0.878      8.191          1.920            165.07
------------------------------------------------------------------------------
  NODE   140.00 : HGL = <  102.136>;EGL= <  103.381>;FLOWLINE= <  101.320>

******************************************************************************
  FLOW PROCESS FROM NODE   140.00 TO NODE   140.00 IS CODE =  5
  UPSTREAM NODE   140.00     ELEVATION =   101.32  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       8.80    18.00     60.00    101.32      1.15       23.474
    DOWNSTREAM      8.80    18.00       -      101.32      1.15        8.954
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.29736
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02118
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.15927
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.637 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 6.892)+( 0.000) =   6.892
------------------------------------------------------------------------------
  NODE   140.00 : HGL = <  101.717>;EGL= <  110.274>;FLOWLINE= <  101.320>

******************************************************************************
  FLOW PROCESS FROM NODE   140.00 TO NODE   135.00 IS CODE =  1
  UPSTREAM NODE   135.00     ELEVATION =   184.15  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       8.80 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     201.42 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.37           CRITICAL DEPTH(FT) =      1.15
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.15
==============================================================================
```

```
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.148     6.061         1.719           150.14
         0.005          1.117     6.235         1.721           150.30
         0.019          1.086     6.423         1.727           150.81
         0.045          1.054     6.629         1.737           151.68
         0.084          1.023     6.852         1.753           152.94
         0.137          0.992     7.096         1.774           154.63
         0.209          0.960     7.361         1.802           156.79
         0.300          0.929     7.652         1.839           159.45
         0.415          0.898     7.969         1.885           162.66
         0.559          0.867     8.317         1.941           166.49
         0.737          0.835     8.699         2.011           170.99
         0.956          0.804     9.120         2.096           176.25
         1.224          0.773     9.586         2.201           182.35
         1.554          0.741    10.102         2.327           189.42
         1.961          0.710    10.677         2.482           197.57
         2.464          0.679    11.320         2.670           206.98
         3.091          0.648    12.042         2.901           217.82
         3.881          0.616    12.858         3.185           230.35
         4.889          0.585    13.784         3.537           244.86
         6.199          0.554    14.843         3.977           261.73
         7.942          0.523    16.063         4.531           281.42
        10.345          0.491    17.479         5.238           304.56
        13.837          0.460    19.139         6.152           331.94
        19.390          0.429    21.107         7.350           364.64
        30.145          0.397    23.466         8.953           404.12
       201.420          0.397    23.466         8.954           404.13
------------------------------------------------------------------------------
  NODE   135.00 : HGL = <  185.298>;EGL= <  185.869>;FLOWLINE= <  184.150>

******************************************************************************
  FLOW PROCESS FROM NODE   135.00 TO NODE   135.00 IS CODE =  5
  UPSTREAM NODE   135.00     ELEVATION =   184.48  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.50    18.00     57.30    184.48      0.90        3.112
    DOWNSTREAM      8.80    18.00       -      184.15      1.15        6.063
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           3.30===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00274
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00806
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00540
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.022 FEET         ENTRANCE LOSSES =  0.114 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.452)+( 0.114) =   0.567
------------------------------------------------------------------------------
  NODE   135.00 : HGL = <  186.285>;EGL= <  186.436>;FLOWLINE= <  184.480>

******************************************************************************
  FLOW PROCESS FROM NODE   135.00 TO NODE   115.00 IS CODE =  1
  UPSTREAM NODE   115.00     ELEVATION =   184.83  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
```

```
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.50 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      34.41 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((      5.50)/(   105.046))**2 = 0.00274
  HF=L*SF = (     34.41)*(0.00274) =      0.094
------------------------------------------------------------------------------
  NODE   115.00 : HGL = <  186.379>;EGL= <  186.530>;FLOWLINE= <  184.830>

******************************************************************************
  FLOW PROCESS FROM NODE   115.00 TO NODE   115.00 IS CODE =  8
  UPSTREAM NODE   115.00     ELEVATION =   184.83  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       5.50 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.11 FEET/SEC.    VELOCITY HEAD =  0.150 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.150) =  0.030
------------------------------------------------------------------------------
  NODE   115.00 : HGL = <  186.560>;EGL= <  186.560>;FLOWLINE= <  184.830>

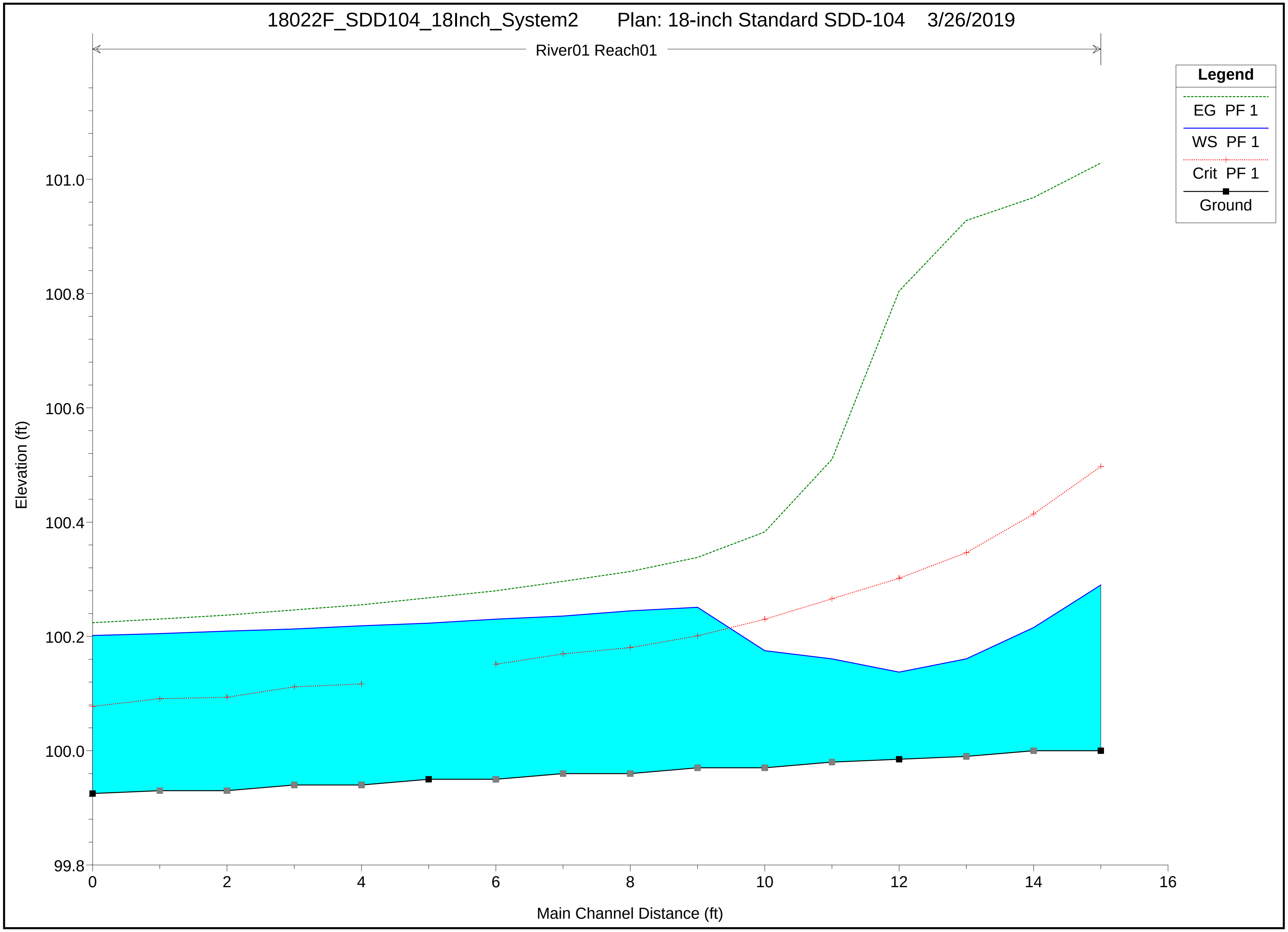
******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   115.00            FLOWLINE ELEVATION =   184.83
  ASSUMED UPSTREAM CONTROL HGL =    185.73 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

RIP RAP PAD AT NODE 225
SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104 River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	3.00	100.00	100.29	100.50	101.03	0.129727	6.90	0.44	4.74	2.26	
Reach01	99.*	PF 1	3.00	100.00	100.22	100.41	100.97	0.028720	6.96	0.43	4.79	2.64	
Reach01	98.*	PF 1	3.00	99.99	100.16	100.35	100.93	0.039929	7.03	0.43	5.02	3.00	End of Wing Wall
Reach01	97	PF 1	3.00	99.99	100.14	100.30	100.80	0.326543	6.55	0.46	5.42	2.96	Start of No.2 Backing
Reach01	96.*	PF 1	3.00	99.98	100.16	100.27	100.51	0.136286	4.74	0.63	6.27	1.96	
Reach01	95.*	PF 1	3.00	99.97	100.18	100.23	100.38	0.068698	3.66	0.82	7.09	1.42	
Reach01	94.*	PF 1	3.00	99.97	100.25	100.20	100.34	0.018969	2.37	1.26	8.10	0.79	Hydraulic Jump
Reach01	93.*	PF 1	3.00	99.96	100.24	100.18	100.31	0.014707	2.11	1.42	8.75	0.70	
Reach01	92.*	PF 1	3.00	99.96	100.24	100.17	100.30	0.013553	1.98	1.52	9.35	0.66	
Reach01	91.*	PF 1	3.00	99.95	100.23	100.15	100.28	0.010753	1.78	1.68	10.02	0.59	
Reach01	90	PF 1	3.00	99.95	100.22		100.27	0.009985	1.69	1.78	10.64	0.57	
Reach01	89.*	PF 1	3.00	99.94	100.22	100.12	100.26	0.008062	1.54	1.95	10.65	0.51	
Reach01	88.*	PF 1	3.00	99.94	100.21	100.11	100.25	0.007510	1.46	2.05	10.64	0.49	
Reach01	87.*	PF 1	3.00	99.93	100.21	100.09	100.24	0.006126	1.34	2.23	10.65	0.45	End of No.2 Backing
Reach01	86.*	PF 1	3.00	99.93	100.20	100.09	100.23	0.005718	1.28	2.34	10.64	0.43	
Reach01	85	PF 1	3.00	99.93	100.20	100.08	100.22	0.005001	1.21	2.49	10.65	0.40	


18022F_SDD104_18Inch_System2 Plan: 18-inch Standard SDD-104 3/26/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
101.0
100.8
100.6
100.4
100.2
100.0
99.8
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
*******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************* DESCRIPTION OF STUDY *************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                         *
 * SYSTEM 2 - VELOCITY RUN FROM NODES 225 TO 210                            *
 * TAILWATER ASSUMED TO BE FLOWLINE OF THE PIPE                             *
  **************************************************************************

   FILE NAME: 225_V.PIP
   TIME/DATE OF STUDY: 21:55 03/26/2019

*******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   225.00-             0.66 Dc          36.26        0.49*              41.07
         } FRICTION
   220.00-             0.66 Dc          36.26        0.44*              45.00
         } JUNCTION
   220.00-             0.66 Dc          36.26        0.22*             109.76
         } FRICTION
   215.00-             0.66 Dc          36.26        0.25*              93.80
         } JUNCTION
   215.00-             0.66 Dc          36.26        0.22*             112.18
         } FRICTION
   210.00-             0.66*Dc          36.26        0.66*Dc            36.26
         } CATCH BASIN
   210.00-             0.96*            19.47        0.66 Dc            12.89
-------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
*******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   225.00            FLOWLINE ELEVATION =   126.02
  PIPE FLOW =       3.00 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   126.020 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.66 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
-------------------------------------------------------------------------------
  NODE   225.00 : HGL = <  126.511>;EGL= <  127.064>;FLOWLINE= <  126.020>

*******************************************************************************
  FLOW PROCESS FROM NODE   225.00 TO NODE   220.00 IS CODE =  1
```

```
  UPSTREAM NODE   220.00     ELEVATION =   126.18  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       3.00 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.55          CRITICAL DEPTH(FT) =      0.66
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.44
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.443      6.884          1.179           45.00
          1.224          0.447      6.794          1.164           44.58
          2.473          0.451      6.705          1.150           44.19
          3.750          0.455      6.619          1.136           43.80
          5.057          0.460      6.534          1.123           43.43
          6.397          0.464      6.452          1.110           43.07
          7.774          0.468      6.371          1.099           42.73
          9.191          0.472      6.292          1.087           42.39
         10.653          0.476      6.215          1.077           42.07
         12.167          0.481      6.139          1.066           41.76
         13.738          0.485      6.065          1.057           41.46
         15.374          0.489      5.993          1.047           41.17
         16.000          0.491      5.967          1.044           41.07
------------------------------------------------------------------------------
  NODE   220.00 : HGL = <  126.623>;EGL= <  127.359>;FLOWLINE= <  126.180>

******************************************************************************
  FLOW PROCESS FROM NODE   220.00 TO NODE   220.00 IS CODE =  5
  UPSTREAM NODE   220.00     ELEVATION =   126.51  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       3.00    18.00     60.00    126.51      0.66       18.726
    DOWNSTREAM      3.00    18.00       -      126.18      0.66        6.887
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.38345
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02270
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.20307
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.812 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 4.816)+( 0.000) =   4.816
------------------------------------------------------------------------------
  NODE   220.00 : HGL = <  126.729>;EGL= <  132.174>;FLOWLINE= <  126.510>

******************************************************************************
  FLOW PROCESS FROM NODE   220.00 TO NODE   215.00 IS CODE =  1
  UPSTREAM NODE   215.00     ELEVATION =   156.94  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       3.00 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      78.00 FEET          MANNING'S N  =  0.01300
```

```
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.22           CRITICAL DEPTH(FT) =      0.66
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.25
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.245     15.929          4.188            93.80
         0.337          0.244     16.030          4.237            94.38
         0.691          0.243     16.132          4.287            94.96
         1.063          0.242     16.236          4.338            95.55
         1.456          0.241     16.340          4.390            96.15
         1.870          0.240     16.446          4.442            96.75
         2.309          0.239     16.553          4.496            97.36
         2.774          0.238     16.661          4.551            97.98
         3.270          0.237     16.770          4.606            98.60
         3.799          0.236     16.881          4.663            99.23
         4.366          0.235     16.993          4.721            99.87
         4.977          0.233     17.106          4.780           100.51
         5.638          0.232     17.220          4.840           101.17
         6.356          0.231     17.336          4.901           101.83
         7.143          0.230     17.453          4.963           102.50
         8.010          0.229     17.571          5.026           103.17
         8.976          0.228     17.691          5.091           103.86
        10.062          0.227     17.812          5.157           104.55
        11.303          0.226     17.935          5.224           105.26
        12.745          0.225     18.059          5.292           105.97
        14.463          0.224     18.184          5.362           106.69
        16.580          0.223     18.312          5.433           107.41
        19.328          0.222     18.440          5.505           108.15
        23.229          0.221     18.570          5.579           108.90
        29.956          0.220     18.702          5.654           109.65
        78.000          0.219     18.720          5.664           109.76
------------------------------------------------------------------------------
  NODE   215.00 : HGL = <  157.185>;EGL= <  161.128>;FLOWLINE= <  156.940>

******************************************************************************
  FLOW PROCESS FROM NODE   215.00 TO NODE   215.00 IS CODE =  5
  UPSTREAM NODE   215.00     ELEVATION =   157.27  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       3.00    18.00       0.00    157.27       0.66      19.149
    DOWNSTREAM      3.00    18.00        -      156.94       0.66      15.934
    LATERAL #1      0.00     0.00       0.00      0.00       0.00       0.000
    LATERAL #2      0.00     0.00       0.00      0.00       0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.40867
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.24216
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.32542
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.302 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.053)+( 0.000) =   2.053
------------------------------------------------------------------------------
  NODE   215.00 : HGL = <  157.486>;EGL= <  163.180>;FLOWLINE= <  157.270>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE   215.00 TO NODE   210.00 IS CODE =  1
  UPSTREAM NODE   210.00     ELEVATION =   205.79  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       3.00 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      82.03 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.20          CRITICAL DEPTH(FT) =      0.66
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.66
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.658       4.017          0.909            36.26
        0.002          0.640       4.170          0.910            36.30
        0.007          0.622       4.335          0.914            36.45
        0.018          0.603       4.512          0.919            36.70
        0.033          0.585       4.703          0.928            37.06
        0.054          0.566       4.910          0.941            37.55
        0.083          0.548       5.135          0.958            38.17
        0.120          0.529       5.379          0.979            38.93
        0.167          0.511       5.646          1.006            39.86
        0.226          0.493       5.938          1.040            40.96
        0.299          0.474       6.258          1.083            42.25
        0.390          0.456       6.611          1.135            43.77
        0.503          0.437       7.001          1.199            45.53
        0.642          0.419       7.434          1.278            47.57
        0.815          0.400       7.918          1.374            49.93
        1.031          0.382       8.460          1.494            52.67
        1.302          0.363       9.072          1.642            55.83
        1.646          0.345       9.765          1.827            59.50
        2.089          0.327      10.558          2.059            63.76
        2.669          0.308      11.470          2.352            68.76
        3.449          0.290      12.529          2.729            74.62
        4.533          0.271      13.769          3.217            81.57
        6.125          0.253      15.238          3.861            89.88
        8.681          0.234      17.000          4.725            99.91
       13.679          0.216      19.143          5.910           112.18
       82.030          0.216      19.143          5.910           112.18
------------------------------------------------------------------------------
  NODE   210.00 : HGL = <  206.448>;EGL= <  206.699>;FLOWLINE= <  205.790>

******************************************************************************
  FLOW PROCESS FROM NODE   210.00 TO NODE   210.00 IS CODE =  8
  UPSTREAM NODE   210.00     ELEVATION =   205.79  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       3.00 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.02 FEET/SEC.    VELOCITY HEAD =  0.251 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.251) =  0.050
------------------------------------------------------------------------------
  NODE   210.00 : HGL = <  206.749>;EGL= <  206.749>;FLOWLINE= <  205.790>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   210.00            FLOWLINE ELEVATION =   205.79
  ASSUMED UPSTREAM CONTROL HGL =    206.45 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
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 END OF GRADUALLY VARIED FLOW ANALYSIS
♀
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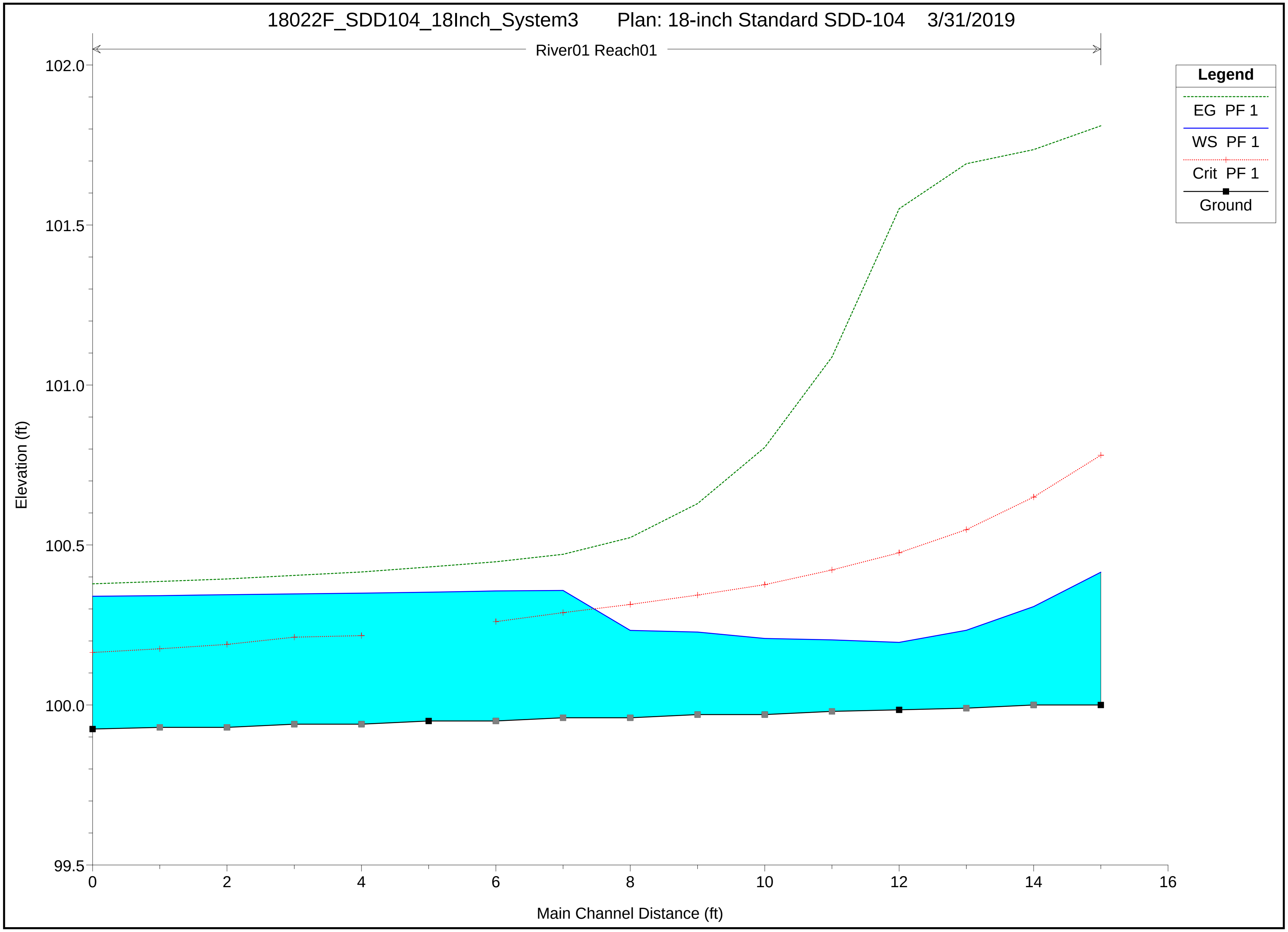
RIP RAP PAD AT NODE 335
SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104   River: River01   Reach: Reach01   Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	5.90	100.00	100.42	100.78	101.81	0.151935	9.48	0.62	5.49	2.59	
Reach01	99.*	PF 1	5.90	100.00	100.31	100.65	101.74	0.033898	9.59	0.62	5.35	3.05	
Reach01	98.*	PF 1	5.90	99.99	100.23	100.55	101.69	0.047246	9.69	0.61	5.46	3.46	
Reach01	97	PF 1	5.90	99.99	100.20	100.48	101.55	0.432094	9.34	0.63	5.76	3.59	End of Wing Wall
Reach01	96.*	PF 1	5.90	99.98	100.20	100.42	101.09	0.260393	7.55	0.78	6.50	2.81	Start of Facing Class
Reach01	95.*	PF 1	5.90	99.97	100.21	100.38	100.81	0.161794	6.20	0.95	7.26	2.24	
Reach01	94.*	PF 1	5.90	99.97	100.23	100.34	100.63	0.097794	5.09	1.16	8.00	1.77	
Reach01	93.*	PF 1	5.90	99.96	100.23	100.31	100.52	0.065413	4.32	1.36	8.71	1.46	
Reach01	92.*	PF 1	5.90	99.96	100.36	100.29	100.47	0.015380	2.70	2.19	9.77	0.75	Hydraulic Jump
Reach01	91.*	PF 1	5.90	99.95	100.36	100.26	100.45	0.012039	2.42	2.44	10.38	0.67	
Reach01	90	PF 1	5.90	99.95	100.35		100.43	0.010640	2.26	2.61	10.94	0.63	
Reach01	89.*	PF 1	5.90	99.94	100.35	100.22	100.42	0.008586	2.05	2.87	10.96	0.57	
Reach01	88.*	PF 1	5.90	99.94	100.35	100.21	100.40	0.007699	1.93	3.05	10.95	0.53	
Reach01	87.*	PF 1	5.90	99.93	100.34	100.19	100.39	0.006342	1.78	3.32	10.97	0.49	End of Facing Class
Reach01	86.*	PF 1	5.90	99.93	100.34	100.18	100.39	0.005750	1.69	3.50	10.96	0.46	
Reach01	85	PF 1	5.90	99.93	100.34	100.16	100.38	0.005007	1.58	3.73	10.97	0.43	


18022F_SDD104_18Inch_System3 Plan: 18-inch Standard SDD-104 3/31/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
102.0
101.5
101.0
100.5
100.0
99.5
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                                *
 * SYSTEM 3 -  VELOCITY RUN FROM NODES 335 TO 315                            *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                  *
  **************************************************************************

   FILE NAME: 335_V.PIP
   TIME/DATE OF STUDY: 11:28 04/02/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE     PRESSURE+         FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   335.00-             0.94 Dc            87.58       0.74*            95.02
         } FRICTION
   330.00-             0.94 Dc            87.58       0.59*           113.57
         } JUNCTION
   330.00-             1.07               89.90       0.31*           254.25
         } FRICTION
   320.00-             0.94 Dc            87.58       0.32*           246.31
         } JUNCTION
   320.00-             0.94 Dc            87.58       0.29*           281.65
         } FRICTION
   315.00-             0.94*Dc            87.58       0.94*Dc          87.58
         } CATCH BASIN
   315.00-             1.42*              49.55       0.94 Dc          29.54
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   335.00            FLOWLINE ELEVATION =   170.72
  PIPE FLOW =       5.90 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   170.720 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.94 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE   335.00 : HGL = <  171.456>;EGL= <  172.183>;FLOWLINE= <  170.720>

******************************************************************************
  FLOW PROCESS FROM NODE   335.00 TO NODE   330.00 IS CODE =  1
```

```
  UPSTREAM NODE   330.00     ELEVATION =   171.16  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.90 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      44.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.80           CRITICAL DEPTH(FT) =      0.94
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.59
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.595     9.046          1.866          113.57
         2.129          0.603     8.878          1.828          111.99
         4.289          0.611     8.717          1.792          110.49
         6.483          0.620     8.560          1.758          109.06
         8.716          0.628     8.409          1.727          107.69
        10.990          0.636     8.263          1.697          106.39
        13.311          0.645     8.121          1.670          105.15
        15.684          0.653     7.984          1.644          103.96
        18.115          0.662     7.851          1.619          102.84
        20.611          0.670     7.723          1.597          101.76
        23.182          0.678     7.599          1.575          100.74
        25.837          0.687     7.478          1.556           99.77
        28.591          0.695     7.361          1.537           98.85
        31.458          0.703     7.247          1.520           97.98
        34.459          0.712     7.137          1.503           97.15
        37.620          0.720     7.030          1.488           96.36
        40.977          0.729     6.927          1.474           95.61
        44.000          0.736     6.842          1.463           95.02
------------------------------------------------------------------------------
  NODE   330.00 : HGL = <  171.755>;EGL= <  173.026>;FLOWLINE= <  171.160>

******************************************************************************
  FLOW PROCESS FROM NODE   330.00 TO NODE   330.00 IS CODE =  5
  UPSTREAM NODE   330.00     ELEVATION =   171.49  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      5.90    18.00     60.00    171.49      0.94       22.050
    DOWNSTREAM     5.90    18.00       -      171.16      0.94        9.049
    LATERAL #1     0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34569
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02874
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.18721
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.749 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 6.327)+( 0.000) =   6.327
------------------------------------------------------------------------------
  NODE   330.00 : HGL = <  171.803>;EGL= <  179.353>;FLOWLINE= <  171.490>

******************************************************************************
  FLOW PROCESS FROM NODE   330.00 TO NODE   320.00 IS CODE =  1
```

```
  UPSTREAM NODE   320.00     ELEVATION =   209.64  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.90 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     110.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.31           CRITICAL DEPTH(FT) =      0.94
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.32
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.320     21.339          7.396          246.31
         0.601          0.320     21.368          7.414          246.63
         1.228          0.320     21.396          7.433          246.96
         1.884          0.320     21.425          7.452          247.28
         2.571          0.319     21.453          7.470          247.60
         3.293          0.319     21.482          7.489          247.92
         4.053          0.319     21.511          7.508          248.25
         4.855          0.318     21.540          7.527          248.57
         5.704          0.318     21.568          7.546          248.90
         6.606          0.318     21.597          7.565          249.22
         7.567          0.317     21.626          7.584          249.55
         8.597          0.317     21.655          7.604          249.88
         9.703          0.317     21.685          7.623          250.20
        10.901          0.317     21.714          7.642          250.53
        12.204          0.316     21.743          7.662          250.86
        13.633          0.316     21.773          7.681          251.19
        15.215          0.316     21.802          7.701          251.53
        16.986          0.315     21.832          7.721          251.86
        18.997          0.315     21.861          7.741          252.19
        21.321          0.315     21.891          7.760          252.53
        24.074          0.314     21.920          7.780          252.86
        27.448          0.314     21.950          7.800          253.20
        31.803          0.314     21.980          7.820          253.53
        37.951          0.314     22.010          7.841          253.87
        48.493          0.313     22.040          7.861          254.21
       110.000          0.313     22.043          7.863          254.25
------------------------------------------------------------------------------
  NODE   320.00 : HGL = <  209.960>;EGL= <  217.036>;FLOWLINE= <  209.640>

******************************************************************************
  FLOW PROCESS FROM NODE   320.00 TO NODE   320.00 IS CODE =  5
  UPSTREAM NODE   320.00     ELEVATION =   209.97  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.90    18.00      0.00    209.97      0.94      24.477
    DOWNSTREAM      5.90    18.00       -      209.64      0.94      21.346
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.46457
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.31537
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.38997
  JUNCTION LENGTH =   4.00 FEET
```

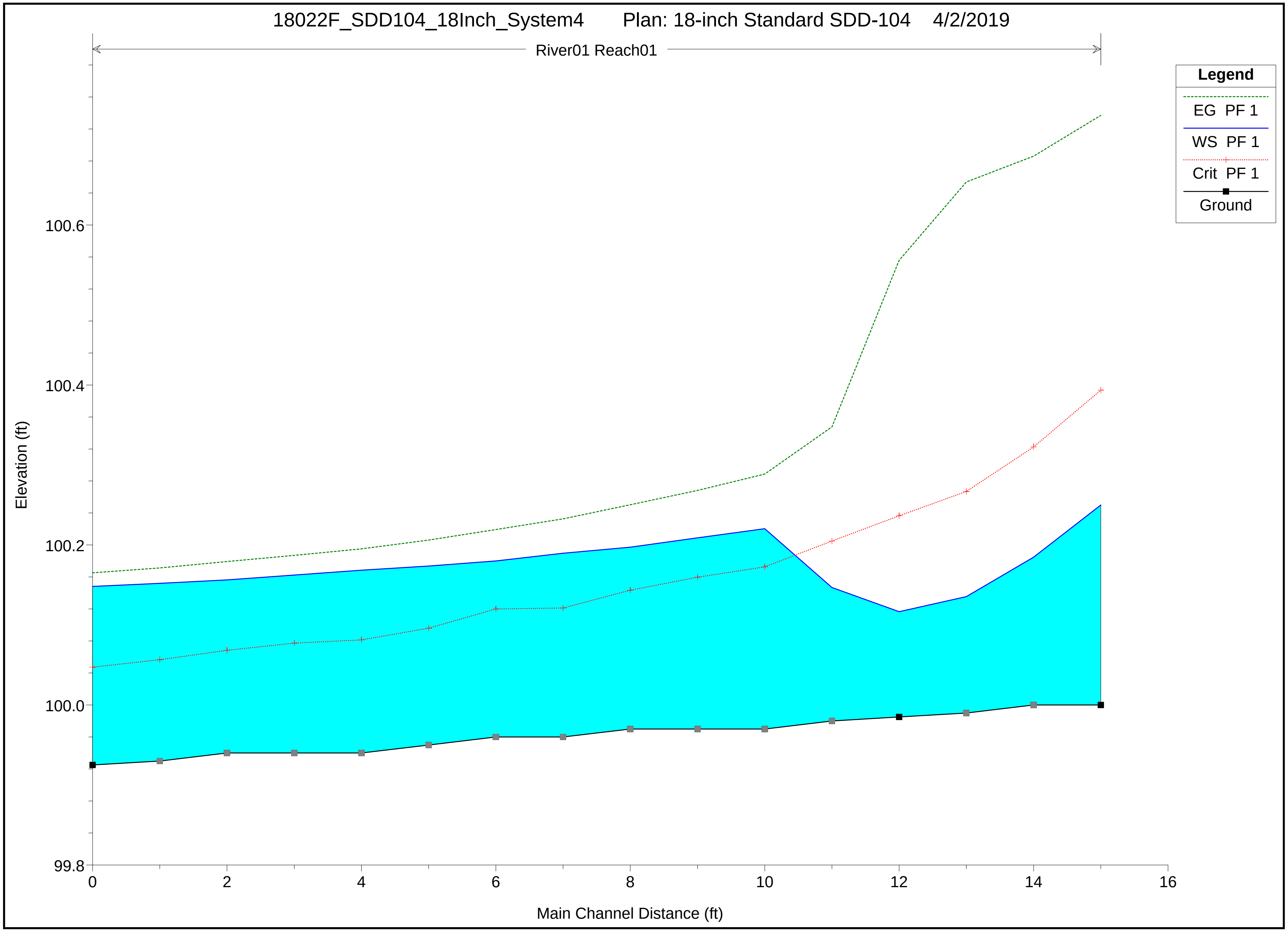
```
  FRICTION LOSSES =  1.560 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.529)+( 0.000) =   2.529
----------------------------------------------------------------------------
  NODE   320.00 : HGL = <  210.261>;EGL= <  219.565>;FLOWLINE= <  209.970>

****************************************************************************
  FLOW PROCESS FROM NODE   320.00 TO NODE   315.00 IS CODE =  1
  UPSTREAM NODE   315.00     ELEVATION =   262.11  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.90 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      80.00 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.27          CRITICAL DEPTH(FT) =      0.94
============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.94
============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
----------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.938      5.075          1.338             87.58
         0.002          0.911      5.251          1.339             87.69
         0.010          0.884      5.442          1.344             88.03
         0.024          0.857      5.649          1.353             88.62
         0.045          0.831      5.873          1.367             89.47
         0.074          0.804      6.117          1.385             90.61
         0.112          0.777      6.383          1.410             92.07
         0.162          0.750      6.673          1.442             93.88
         0.226          0.723      6.991          1.483             96.07
         0.306          0.697      7.340          1.534             98.69
         0.406          0.670      7.725          1.597            101.78
         0.530          0.643      8.151          1.675            105.40
         0.683          0.616      8.623          1.772            109.63
         0.873          0.589      9.150          1.890            114.55
         1.110          0.563      9.741          2.037            120.26
         1.406          0.536     10.407          2.219            126.90
         1.780          0.509     11.161          2.444            134.61
         2.256          0.482     12.021          2.727            143.59
         2.871          0.455     13.008          3.085            154.10
         3.681          0.429     14.152          3.541            166.45
         4.775          0.402     15.489          4.129            181.07
         6.306          0.375     17.067          4.901            198.51
         8.568          0.348     18.952          5.929            219.53
        12.227          0.321     21.236          7.329            245.16
        19.445          0.295     24.047          9.280            276.87
        80.000          0.291     24.470          9.595            281.65
----------------------------------------------------------------------------
  NODE   315.00 : HGL = <  263.048>;EGL= <  263.448>;FLOWLINE= <  262.110>

****************************************************************************
  FLOW PROCESS FROM NODE   315.00 TO NODE   315.00 IS CODE =  8
  UPSTREAM NODE   315.00     ELEVATION =   262.11  (FLOW IS SUBCRITICAL)
----------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       5.90 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   5.08 FEET/SEC.    VELOCITY HEAD =  0.400 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.400) =  0.080
----------------------------------------------------------------------------
  NODE   315.00 : HGL = <  263.528>;EGL= <  263.528>;FLOWLINE= <  262.110>

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

```
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   315.00            FLOWLINE ELEVATION =   262.11
  ASSUMED UPSTREAM CONTROL HGL =    263.05 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

RIP RAP PAD AT NODE 430
SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104 River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	2.10	100.00	100.25	100.39	100.74	0.104253	5.60	0.38	4.50	1.97	
Reach01	99.*	PF 1	2.10	100.00	100.18	100.32	100.69	0.023478	5.68	0.37	4.61	2.33	
Reach01	98.*	PF 1	2.10	99.99	100.14	100.27	100.65	0.033417	5.78	0.36	4.87	2.67	
Reach01	97	PF 1	2.10	99.99	100.12	100.24	100.56	0.261976	5.32	0.39	5.29	2.58	End of Wing Wall
Reach01	96.*	PF 1	2.10	99.98	100.15	100.21	100.35	0.087228	3.60	0.58	5.98	1.55	Start of No.2 Backing
Reach01	95.*	PF 1	2.10	99.97	100.22	100.17	100.29	0.017295	2.10	1.00	6.91	0.74	Hydraulic Jump
Reach01	94.*	PF 1	2.10	99.97	100.21	100.16	100.27	0.015957	1.95	1.08	7.30	0.70	
Reach01	93.*	PF 1	2.10	99.97	100.20	100.14	100.25	0.015289	1.85	1.14	7.70	0.68	
Reach01	92.*	PF 1	2.10	99.96	100.19	100.12	100.23	0.012183	1.66	1.26	8.17	0.61	
Reach01	91.*	PF 1	2.10	99.96	100.18	100.12	100.22	0.011806	1.59	1.32	8.58	0.60	
Reach01	90.*	PF 1	2.10	99.95	100.17	100.10	100.21	0.009526	1.44	1.45	9.07	0.54	
Reach01	89.*	PF 1	2.10	99.94	100.17	100.08	100.20	0.007657	1.31	1.60	9.54	0.48	
Reach01	88.*	PF 1	2.10	99.94	100.16	100.08	100.19	0.007298	1.26	1.67	9.98	0.47	
Reach01	87.*	PF 1	2.10	99.94	100.16	100.07	100.18	0.007021	1.21	1.73	10.44	0.46	End of No.2 Backing
Reach01	86.*	PF 1	2.10	99.93	100.15	100.06	100.17	0.005704	1.11	1.89	10.91	0.42	
Reach01	85	PF 1	2.10	99.93	100.15	100.05	100.17	0.005001	1.05	2.01	11.37	0.39	


18022F_SDD104_18Inch_System4 Plan: 18-inch Standard SDD-104 4/2/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
100.6
100.4
100.2
100.0
99.8
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                         *
 * SYSTEM 4 - MAINLINE RUN FROM NODES 430 TO 410                            *
 * TAILWATER ASSUMED TO BE FLOWLINE OF THE PIPE                             *
  **************************************************************************

   FILE NAME: 430_V.PIP
   TIME/DATE OF STUDY: 14:47 03/25/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   430.00-             0.55 Dc           22.94        0.45*             24.32
         } FRICTION
   425.00-             0.55 Dc           22.94        0.40*             26.51
         } JUNCTION
   425.00-             0.55 Dc           22.94        0.19*             65.98
         } FRICTION
   420.00-             0.55 Dc           22.94        0.20*             60.21
         } JUNCTION
   420.00-             0.55 Dc           22.94        0.17*             76.04
         } FRICTION
   415.00-             0.55 Dc           22.94        0.19*             66.49
         } JUNCTION
   415.00-             0.55 Dc           22.94        0.15*             95.12
         } FRICTION
   410.00-             0.55*Dc           22.94        0.55*Dc           22.94
         } CATCH BASIN
   410.00-             0.79*             12.23        0.55 Dc            8.27
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   430.00            FLOWLINE ELEVATION =   195.37
  PIPE FLOW =       2.10 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   195.370 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.55 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
```

```
  NODE   430.00 : HGL = <  195.820>;EGL= <  196.164>;FLOWLINE= <  195.370>

******************************************************************************
  FLOW PROCESS FROM NODE   430.00 TO NODE   425.00 IS CODE =  1
  UPSTREAM NODE   425.00     ELEVATION =   195.75  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      38.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.45          CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.40
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.399       5.562         0.880            26.51
          0.808          0.402       5.519         0.875            26.38
          1.637          0.404       5.477         0.870            26.26
          2.488          0.406       5.435         0.865            26.15
          3.365          0.408       5.393         0.860            26.03
          4.269          0.410       5.353         0.856            25.92
          5.204          0.413       5.312         0.851            25.81
          6.172          0.415       5.273         0.847            25.70
          7.178          0.417       5.233         0.843            25.60
          8.226          0.419       5.195         0.839            25.50
          9.322          0.422       5.157         0.835            25.40
         10.471          0.424       5.119         0.831            25.30
         11.683          0.426       5.082         0.827            25.21
         12.968          0.428       5.045         0.824            25.12
         14.337          0.430       5.009         0.820            25.03
         15.807          0.433       4.973         0.817            24.94
         17.400          0.435       4.938         0.814            24.85
         19.144          0.437       4.903         0.811            24.77
         21.080          0.439       4.869         0.808            24.69
         23.268          0.442       4.835         0.805            24.61
         25.800          0.444       4.801         0.802            24.54
         28.831          0.446       4.768         0.799            24.46
         32.649          0.448       4.735         0.797            24.39
         37.907          0.450       4.703         0.794            24.32
         38.000          0.450       4.702         0.794            24.32
------------------------------------------------------------------------------
  NODE   425.00 : HGL = <  196.149>;EGL= <  196.630>;FLOWLINE= <  195.750>

******************************************************************************
  FLOW PROCESS FROM NODE   425.00 TO NODE   425.00 IS CODE =  5
  UPSTREAM NODE   425.00     ELEVATION =   196.08  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      2.10    18.00     60.00    196.08      0.55      16.057
    DOWNSTREAM     2.10    18.00       -      195.75      0.55       5.564
    LATERAL #1     0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00       0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.33515
```

```
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01662
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.17588
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.704 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.644)+( 0.000) =   3.644
------------------------------------------------------------------------------
  NODE   425.00 : HGL = <  196.271>;EGL= <  200.274>;FLOWLINE= <  196.080>

******************************************************************************
  FLOW PROCESS FROM NODE   425.00 TO NODE   420.00 IS CODE =  1
  UPSTREAM NODE   420.00     ELEVATION =   205.91  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      29.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.19          CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.20
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.204     14.609          3.520             60.21
         0.304          0.203     14.664          3.544             60.43
         0.622          0.202     14.720          3.569             60.65
         0.956          0.202     14.777          3.595             60.88
         1.307          0.201     14.834          3.620             61.11
         1.676          0.201     14.891          3.646             61.33
         2.066          0.200     14.948          3.672             61.56
         2.478          0.200     15.006          3.699             61.79
         2.916          0.199     15.064          3.725             62.03
         3.382          0.199     15.123          3.752             62.26
         3.881          0.198     15.182          3.780             62.50
         4.416          0.198     15.241          3.807             62.73
         4.992          0.197     15.301          3.835             62.97
         5.618          0.197     15.362          3.863             63.21
         6.300          0.196     15.422          3.892             63.46
         7.051          0.196     15.483          3.920             63.70
         7.884          0.195     15.545          3.950             63.95
         8.818          0.195     15.607          3.979             64.19
         9.882          0.194     15.669          4.009             64.44
        11.116          0.193     15.732          4.039             64.69
        12.580          0.193     15.795          4.069             64.95
        14.379          0.192     15.858          4.100             65.20
        16.709          0.192     15.922          4.131             65.46
        20.005          0.191     15.987          4.162             65.71
        25.673          0.191     16.052          4.194             65.97
        29.000          0.191     16.052          4.194             65.98
------------------------------------------------------------------------------
  NODE   420.00 : HGL = <  206.114>;EGL= <  209.430>;FLOWLINE= <  205.910>

******************************************************************************
  FLOW PROCESS FROM NODE   420.00 TO NODE   420.00 IS CODE =  5
  UPSTREAM NODE   420.00     ELEVATION =   206.24  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       2.10    18.00      0.00    206.24       0.55      18.563
    DOWNSTREAM      2.10    18.00       -      205.91       0.55      14.613
```

```
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.50718
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.25613
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.38166
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.527 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.334)+( 0.000) =   2.334
------------------------------------------------------------------------------
  NODE   420.00 : HGL = <  206.413>;EGL= <  211.764>;FLOWLINE= <  206.240>

******************************************************************************
  FLOW PROCESS FROM NODE   420.00 TO NODE   415.00 IS CODE =  1
  UPSTREAM NODE   415.00     ELEVATION =   234.55  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      55.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.17           CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.19
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.190    16.180          4.258           66.49
         0.258          0.189    16.268          4.301           66.84
         0.529          0.188    16.357          4.346           67.20
         0.813          0.188    16.447          4.391           67.56
         1.112          0.187    16.538          4.436           67.92
         1.428          0.186    16.629          4.483           68.29
         1.762          0.186    16.721          4.530           68.66
         2.115          0.185    16.814          4.578           69.03
         2.491          0.184    16.908          4.626           69.41
         2.893          0.183    17.003          4.676           69.79
         3.322          0.183    17.099          4.726           70.17
         3.784          0.182    17.196          4.776           70.56
         4.283          0.181    17.294          4.828           70.95
         4.825          0.181    17.392          4.881           71.35
         5.418          0.180    17.492          4.934           71.75
         6.070          0.179    17.592          4.988           72.16
         6.796          0.178    17.694          5.043           72.56
         7.612          0.178    17.797          5.099           72.98
         8.542          0.177    17.900          5.156           73.39
         9.623          0.176    18.005          5.213           73.81
        10.907          0.176    18.111          5.272           74.24
        12.489          0.175    18.217          5.331           74.67
        14.540          0.174    18.325          5.392           75.10
        17.447          0.174    18.434          5.453           75.54
        22.455          0.173    18.544          5.516           75.98
        55.000          0.173    18.558          5.524           76.04
------------------------------------------------------------------------------
  NODE   415.00 : HGL = <  234.740>;EGL= <  238.808>;FLOWLINE= <  234.550>

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

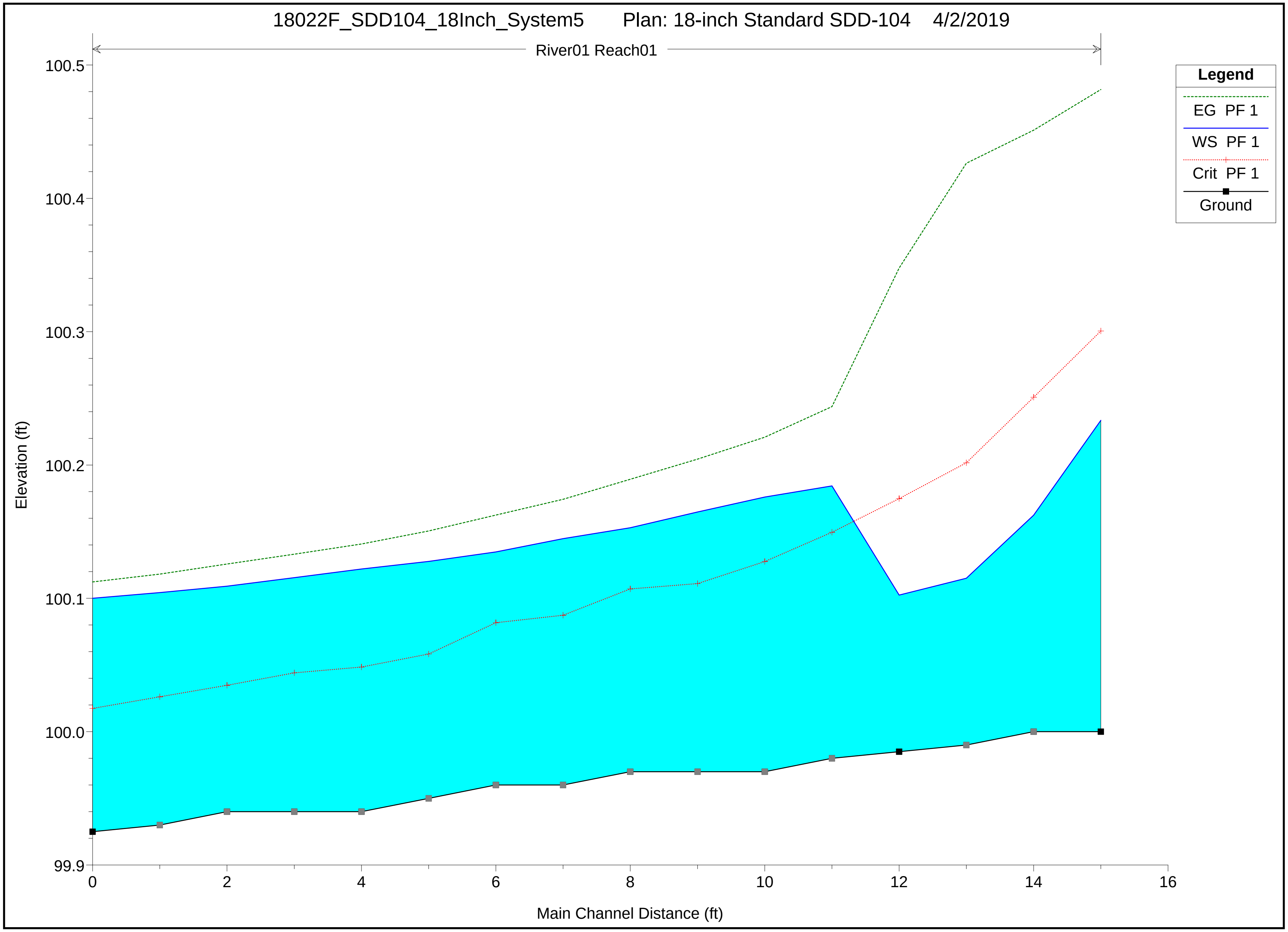
```
  FLOW PROCESS FROM NODE   415.00 TO NODE   415.00 IS CODE =  5
  UPSTREAM NODE   415.00     ELEVATION =   234.88  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       2.10    18.00     20.00    234.88      0.55       23.290
    DOWNSTREAM      2.10    18.00       -      234.55      0.55       16.185
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.97050
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34285
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.65667
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  2.627 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 4.643)+( 0.000) =   4.643
------------------------------------------------------------------------------
  NODE   415.00 : HGL = <  235.028>;EGL= <  243.451>;FLOWLINE= <  234.880>

******************************************************************************
  FLOW PROCESS FROM NODE   415.00 TO NODE   410.00 IS CODE =  1
  UPSTREAM NODE   410.00     ELEVATION =   259.36  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       2.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      25.23 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.15           CRITICAL DEPTH(FT) =      0.55
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.55
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.547     3.603          0.749            22.94
          0.001          0.531     3.751          0.750            22.97
          0.004          0.515     3.911          0.753            23.07
          0.010          0.499     4.083          0.758            23.25
          0.018          0.483     4.269          0.766            23.51
          0.030          0.467     4.472          0.778            23.86
          0.046          0.451     4.692          0.793            24.30
          0.067          0.435     4.933          0.813            24.84
          0.094          0.419     5.197          0.839            25.50
          0.128          0.403     5.487          0.871            26.29
          0.170          0.387     5.807          0.911            27.22
          0.222          0.371     6.161          0.961            28.32
          0.288          0.355     6.556          1.023            29.59
          0.370          0.339     6.997          1.100            31.08
          0.472          0.323     7.493          1.196            32.81
          0.601          0.308     8.053          1.315            34.82
          0.764          0.292     8.691          1.465            37.17
          0.974          0.276     9.422          1.655            39.92
          1.247          0.260    10.266          1.897            43.14
          1.610          0.244    11.250          2.210            46.95
          2.105          0.228    12.409          2.620            51.49
          2.803          0.212    13.788          3.166            56.94
```

```
        3.844          0.196     15.452          3.906            63.58
        5.544          0.180     17.492          4.934            71.75
        8.931          0.164     20.037          6.402            82.00
       25.230          0.148     23.283          8.571            95.12
------------------------------------------------------------------------------
  NODE   410.00 : HGL = <  259.907>;EGL= <  260.109>;FLOWLINE= <  259.360>

******************************************************************************
  FLOW PROCESS FROM NODE   410.00 TO NODE   410.00 IS CODE =  8
  UPSTREAM NODE   410.00     ELEVATION =   259.36  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       2.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.60 FEET/SEC.    VELOCITY HEAD =  0.202 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.202) =  0.040
------------------------------------------------------------------------------
  NODE   410.00 : HGL = <  260.149>;EGL= <  260.149>;FLOWLINE= <  259.360>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   410.00           FLOWLINE ELEVATION =   259.36
  ASSUMED UPSTREAM CONTROL HGL =    259.91 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

RIP RAP PAD AT NODE 525
SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104 River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	1.40	100.00	100.23	100.30	100.48	0.058179	4.00	0.35	4.40	1.46	
Reach01	99.*	PF 1	1.40	100.00	100.16	100.25	100.45	0.016075	4.31	0.32	4.47	1.89	End of Wing Wall
Reach01	98.*	PF 1	1.40	99.99	100.12	100.20	100.43	0.024520	4.48	0.31	4.75	2.23	Start of No.2 Backing
Reach01	97	PF 1	1.40	99.99	100.10	100.17	100.35	0.170420	3.97	0.35	5.20	2.04	
Reach01	96.*	PF 1	1.40	99.98	100.18	100.15	100.24	0.019766	1.96	0.71	6.19	0.76	Hydraulic Jump
Reach01	95.*	PF 1	1.40	99.97	100.18	100.13	100.22	0.014715	1.70	0.82	6.68	0.66	
Reach01	94.*	PF 1	1.40	99.97	100.16	100.11	100.20	0.014016	1.60	0.88	7.09	0.64	
Reach01	93.*	PF 1	1.40	99.97	100.15	100.11	100.19	0.013993	1.53	0.91	7.50	0.63	
Reach01	92.*	PF 1	1.40	99.96	100.14	100.09	100.17	0.011180	1.38	1.02	7.98	0.56	
Reach01	91.*	PF 1	1.40	99.96	100.13	100.08	100.16	0.011311	1.34	1.05	8.41	0.56	
Reach01	90.*	PF 1	1.40	99.95	100.13	100.06	100.15	0.009122	1.21	1.15	8.91	0.51	
Reach01	89.*	PF 1	1.40	99.94	100.12	100.05	100.14	0.007266	1.10	1.27	9.40	0.45	
Reach01	88.*	PF 1	1.40	99.94	100.12	100.04	100.13	0.007134	1.06	1.32	9.85	0.45	
Reach01	87.*	PF 1	1.40	99.94	100.11	100.03	100.13	0.007104	1.03	1.35	10.32	0.44	End of No.2 Backing
Reach01	86.*	PF 1	1.40	99.93	100.10	100.03	100.12	0.005687	0.94	1.48	10.81	0.40	
Reach01	85	PF 1	1.40	99.93	100.10	100.02	100.11	0.005001	0.89	1.58	11.29	0.37	


18022F_SDD104_18Inch_System5 Plan: 18-inch Standard SDD-104 4/2/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
100.5
100.4
100.3
100.2
100.1
100.0
99.9
Main Channel Distance (ft)
0
2
4
6
8
10
12
14
16

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON STORM RESTORATION PHASE 1                          *
 * SYSTEM 5 - MAINLINE RUN FROM NODES 525 TO 510                             *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                  *
  ***************************************************************************

   FILE NAME: 525_V.PIP
   TIME/DATE OF STUDY: 14:59 03/25/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   525.00-             0.44 Dc           13.68        0.38*             14.24
         } FRICTION
   520.00-             0.44*Dc           13.68        0.44*Dc           13.68
         } JUNCTION
   520.00-             0.44 Dc           13.68        0.15*             42.25
         } FRICTION
   515.00-             0.44 Dc           13.68        0.31*             16.37
         } JUNCTION
   515.00-             0.44 Dc           13.68        0.37*             14.32
         } FRICTION
   510.00-             0.44*Dc           13.68        0.44*Dc           13.68
         } CATCH BASIN
   510.00-             0.63*              7.26        0.44 Dc            4.98
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   525.00            FLOWLINE ELEVATION =   213.03
  PIPE FLOW =       1.40 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   213.030 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.44 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE   525.00 : HGL = <  213.408>;EGL= <  213.657>;FLOWLINE= <  213.030>

******************************************************************************
  FLOW PROCESS FROM NODE   525.00 TO NODE   520.00 IS CODE =  1
```

```
  UPSTREAM NODE   520.00     ELEVATION =   213.15  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.40 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      12.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.37           CRITICAL DEPTH(FT) =      0.44
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.44
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.442      3.217          0.603           13.68
         0.014          0.439      3.246          0.603           13.68
         0.044          0.436      3.276          0.603           13.68
         0.092          0.433      3.307          0.603           13.69
         0.159          0.431      3.338          0.604           13.70
         0.247          0.428      3.369          0.604           13.71
         0.359          0.425      3.401          0.605           13.72
         0.497          0.422      3.434          0.605           13.73
         0.664          0.419      3.467          0.606           13.75
         0.864          0.416      3.501          0.607           13.77
         1.100          0.413      3.535          0.607           13.79
         1.379          0.410      3.570          0.608           13.82
         1.706          0.407      3.605          0.609           13.84
         2.089          0.405      3.642          0.611           13.87
         2.538          0.402      3.678          0.612           13.90
         3.066          0.399      3.716          0.613           13.93
         3.690          0.396      3.754          0.615           13.97
         4.431          0.393      3.793          0.616           14.01
         5.322          0.390      3.832          0.618           14.05
         6.410          0.387      3.873          0.620           14.09
         7.765          0.384      3.914          0.622           14.14
         9.510          0.381      3.955          0.625           14.19
        11.869          0.379      3.998          0.627           14.24
        12.000          0.378      4.000          0.627           14.24
------------------------------------------------------------------------------
  NODE   520.00 : HGL = <  213.592>;EGL= <  213.753>;FLOWLINE= <  213.150>

******************************************************************************
  FLOW PROCESS FROM NODE   520.00 TO NODE   520.00 IS CODE =  5
  UPSTREAM NODE   520.00     ELEVATION =   213.48  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.40    18.00     60.00    213.48       0.44      15.449
    DOWNSTREAM      1.40    18.00       -      213.15       0.44       3.205
    LATERAL #1      0.00     0.00      0.00      0.00       0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00       0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.42521
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00491
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.21506
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.860 FEET         ENTRANCE LOSSES =  0.000 FEET
```

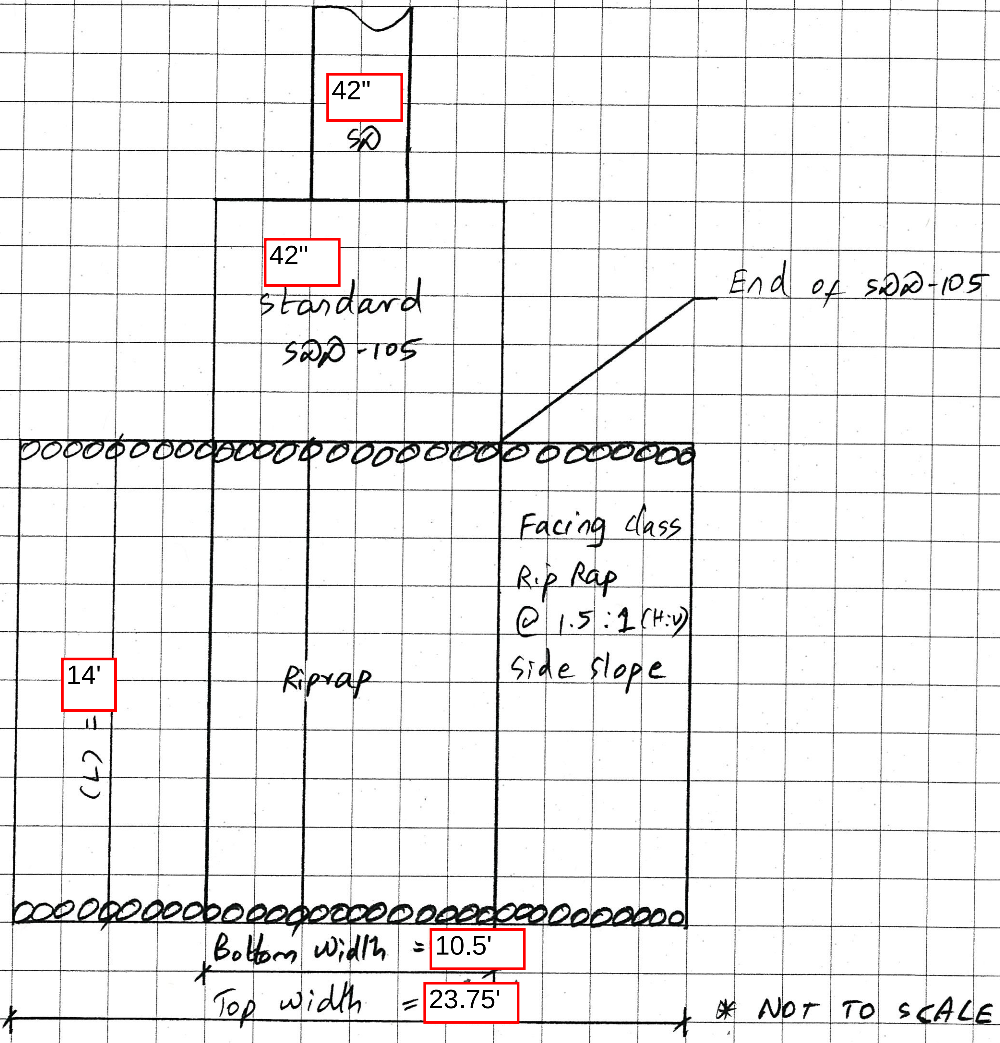
```
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.582)+( 0.000) =   3.582
------------------------------------------------------------------------------
  NODE   520.00 : HGL = <  213.628>;EGL= <  217.335>;FLOWLINE= <  213.480>

******************************************************************************
  FLOW PROCESS FROM NODE   520.00 TO NODE   515.00 IS CODE =  1
  UPSTREAM NODE   515.00     ELEVATION =   261.27  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.40 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     100.75 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.14          CRITICAL DEPTH(FT) =      0.44
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.31
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.312     5.250          0.741             16.37
         0.046          0.306     5.416          0.761             16.71
         0.097          0.299     5.590          0.785             17.08
         0.154          0.292     5.775          0.810             17.47
         0.219          0.286     5.971          0.839             17.90
         0.292          0.279     6.178          0.872             18.37
         0.374          0.272     6.398          0.908             18.87
         0.467          0.265     6.632          0.949             19.42
         0.572          0.259     6.881          0.994             20.01
         0.691          0.252     7.147          1.046             20.65
         0.827          0.245     7.431          1.103             21.34
         0.982          0.239     7.735          1.168             22.08
         1.160          0.232     8.060          1.241             22.89
         1.366          0.225     8.411          1.324             23.77
         1.604          0.218     8.788          1.418             24.73
         1.883          0.212     9.195          1.526             25.77
         2.213          0.205     9.636          1.648             26.90
         2.606          0.198    10.114          1.788             28.14
         3.083          0.192    10.634          1.949             29.50
         3.670          0.185    11.201          2.134             30.98
         4.412          0.178    11.822          2.350             32.62
         5.382          0.172    12.505          2.601             34.42
         6.718          0.165    13.257          2.895             36.42
         8.728          0.158    14.089          3.242             38.63
        12.410          0.151    15.014          3.654             41.10
       100.750          0.148    15.444          3.855             42.25
------------------------------------------------------------------------------
  NODE   515.00 : HGL = <  261.582>;EGL= <  262.011>;FLOWLINE= <  261.270>

******************************************************************************
  FLOW PROCESS FROM NODE   515.00 TO NODE   515.00 IS CODE =  5
  UPSTREAM NODE   515.00     ELEVATION =   261.60  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      1.40    18.00     35.00    261.60      0.44       4.063
    DOWNSTREAM     1.40    18.00       -      261.27      0.44       5.252
    LATERAL #1     0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2     0.00     0.00      0.00      0.00      0.00       0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===
```

```
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00954
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01967
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01460
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.058 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.220)+( 0.000) =   0.220
------------------------------------------------------------------------------
  NODE   515.00 : HGL = <  261.974>;EGL= <  262.231>;FLOWLINE= <  261.600>

******************************************************************************
  FLOW PROCESS FROM NODE   515.00 TO NODE   510.00 IS CODE =  1
  UPSTREAM NODE   510.00     ELEVATION =   261.97  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.40 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      37.69 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.37           CRITICAL DEPTH(FT) =      0.44
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.44
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.443      3.204          0.603            13.68
         0.008          0.440      3.233          0.603            13.68
         0.031          0.438      3.263          0.603            13.68
         0.072          0.435      3.293          0.603            13.69
         0.132          0.432      3.324          0.604            13.69
         0.213          0.429      3.355          0.604            13.70
         0.317          0.426      3.386          0.604            13.71
         0.447          0.423      3.418          0.605            13.73
         0.606          0.420      3.451          0.605            13.74
         0.797          0.418      3.484          0.606            13.76
         1.025          0.415      3.518          0.607            13.78
         1.294          0.412      3.552          0.608            13.80
         1.610          0.409      3.587          0.609            13.83
         1.983          0.406      3.623          0.610            13.85
         2.420          0.403      3.659          0.611            13.88
         2.936          0.400      3.696          0.613            13.92
         3.545          0.397      3.733          0.614            13.95
         4.271          0.395      3.772          0.616            13.99
         5.145          0.392      3.810          0.617            14.03
         6.213          0.389      3.850          0.619            14.07
         7.546          0.386      3.890          0.621            14.11
         9.263          0.383      3.931          0.623            14.16
        11.587          0.380      3.973          0.625            14.21
        15.021          0.377      4.016          0.628            14.26
        21.174          0.374      4.060          0.631            14.32
        37.690          0.374      4.062          0.631            14.32
------------------------------------------------------------------------------
  NODE   510.00 : HGL = <  262.413>;EGL= <  262.573>;FLOWLINE= <  261.970>

******************************************************************************
  FLOW PROCESS FROM NODE   510.00 TO NODE   510.00 IS CODE =  8
  UPSTREAM NODE   510.00     ELEVATION =   261.97  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
```

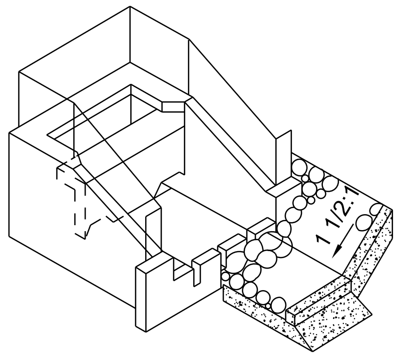
```
  PIPE FLOW =       1.40 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.20 FEET/SEC.    VELOCITY HEAD =  0.159 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.159) =  0.032
------------------------------------------------------------------------------
  NODE   510.00 : HGL = <  262.605>;EGL= <  262.605>;FLOWLINE= <  261.970>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   510.00            FLOWLINE ELEVATION =   261.97
  ASSUMED UPSTREAM CONTROL HGL =    262.41 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

Date 04/02/2019
Job No. 18022-F
Page
Done By
Checked By

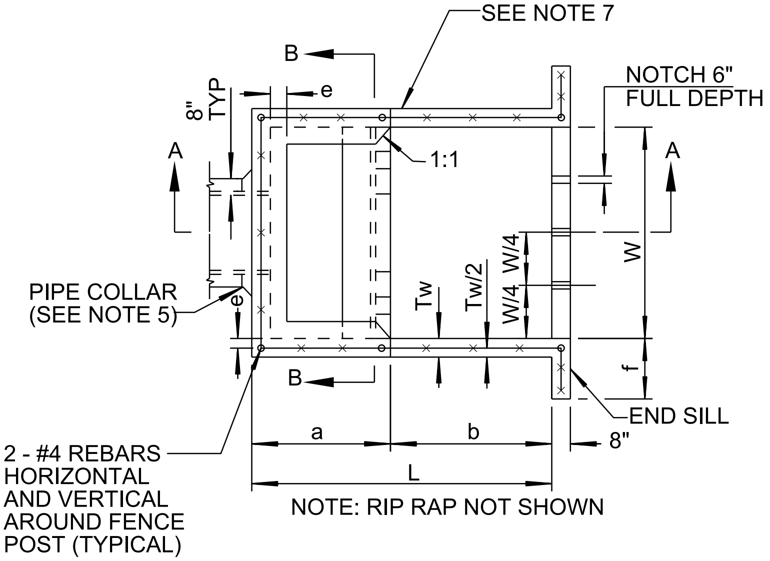
Energy Dissipater @ Node 695 System 6



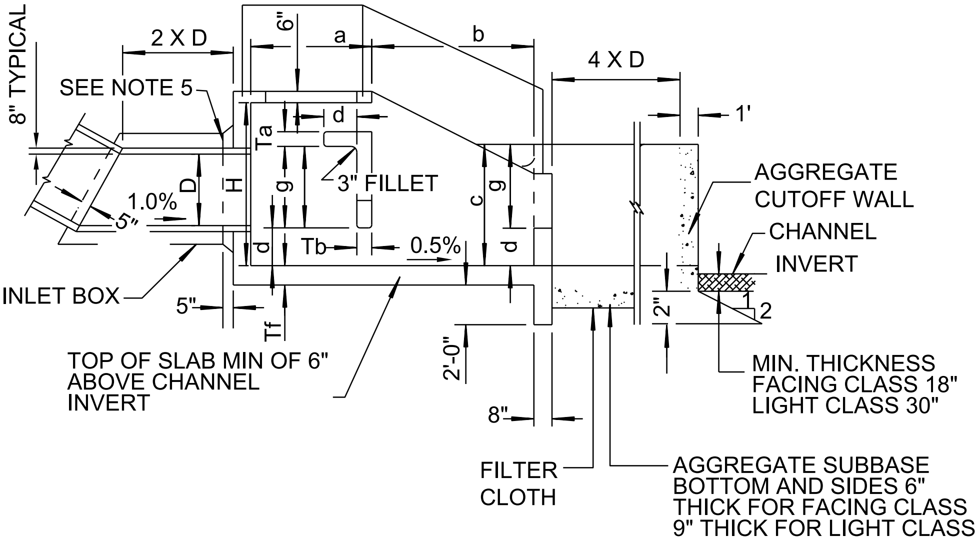
∴ Install Facing Class, 23.75' (W) × 14' (L) × 1.4' (T) with filter blanket material per geotechnical engineer's recommendation.



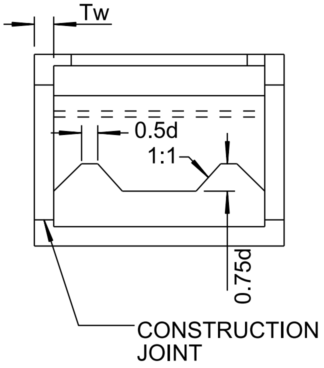
PICTORIAL VIEW



PLAN



SECTION A-A



SECTION B-B

NOTES

SEE TABLE ON SHEET 2 FOR DIMENSIONS, SEE NOTES ON SHEET 2.

SHEET 1 OF 2

REVISION	BY	APPROVED	DATE
ORIGINAL*	KA	J. NAGELVOORT	01/12
UPDATED	BD	J. NAGELVOORT	08/15
UPDATED	AB	J. NAGELVOORT	02/16
REDRAFTED	CD	J. NAGELVOORT	09/18

CITY OF SAN DIEGO – STANDARD DRAWING

CONCRETE ENERGY DISSIPATOR

RECOMMENDED BY THE CITY
OF SAN DIEGO STANDARDS COMMITTEE

9/10/18
COORDINATOR R.C.E. 56523 DATE

DRAWING NUMBER **SDD-105**

CONCRETE ENERGY DISSIPATOR DIMENSIONS

Pipe Dia, Inch (D)	18	24	30	36	42	48	54	60	72
Area (sq ft)	1.77	3.14	4.91	7.07	9.62	12.57	15.90	19.63	28.27
Max Q (cfs)	21	38	59	85	115	151	191	236	339
W	5'-6"	6'-9"	8'-0"	9'-3"	10'-6"	11'-9"	13'-0"	14'-3"	16'-6"
H	4'-3"	5'-3"	6'-3"	7'-3"	8'-0"	9'-0"	9'-9"	10'-9"	12'-3"
L	7'-4"	9'-0"	10'-8"	12'-4"	14'-0"	15'-8"	17'-4"	19'-0"	22'-0"
a	3'-3"	3'-11"	4'-7"	5'-3"	6'-0"	6'-9"	7'-4"	8'-0"	9'-3"
b	4'-1"	5'-1"	6'-1"	7'-1"	8'-0"	8'-11"	10'-0"	11'-0"	12'-9"
c	2'-4"	2'-10"	3"-4"	3'-10"	4'-5"	4'-11"	5'-5"	5'-11"	6'-11"
d	0'-11"	1'-2"	1'-4"	1'-7"	1'-9"	2'-0"	2'-2"	2'-5"	2'-9"
e	0'-6"	0'-6"	0'-8"	0'-8"	0'-10"	0'-10"	1'-0"	1'-0"	1'-3"
f	1'-6"	2'-0"	2'-6"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"
g	2'-1"	2'-6"	3'-0"	3'-6"	3'-11"	4'-5"	4'-11"	5'-4"	6'-2"
Tf	8"			10"		12"			
Tb	7"			9 1/2"		10 1/2"			
Tw	7"			9 1/2"		10 1/2"			
Ta	7"			8"					

NOTES

1. DESIGN EQUIVALENT FLUID PRESSURE (EARTH LOADING) = 60 pcf MAXIMUM OUTLET VELOCITY = 35 ft / s
2. CONCRETE SHALL BE 560-C-3250
3. REINFORCING SHALL CONFORM TO ASTM DESIGNATION A615 AND MAY BE GRADE 40 OR 60. REINFORCING SHALL BE PLACED WITH 2" CLEAR CONCRETE COVER UNLESS NOTED OTHERWISE. SPLICES SHALL NOT BE PERMITTED EXCEPT AS INDICATED ON THE PLANS.
4. FOR PIPE GRADES NOT EXCEEDING 20%, INLET BOX MAY BE OMITTED.
5. IF INLET BOX IS OMITTED, CONSTRUCT PIPE COLLAR AS SHOWN.
6. UNLESS NOTED OTHERWISE, ALL REINFORCING BAR BENDS SHALL BE FABRICATED WITH STANDARD HOOKS. FOR STRUCTURAL DETAILS, **SEE D-42** FOR PIPELINE SIZES FROM 18" TO 30" AND **SEE D-43** FOR PIPELINE SIZES FROM 36" TO 72".
7. 5' HIGH CHAIN LINK FENCING, EMBED POST 18" DEEP IN WALLS AND ENCASE WITH CLASS B MORTAR.
8. IN SANDY AND SILTY SOIL:

   A) RIP RAP AND AGGREGATE BASE CUTOFF WALL REQUIRED AT THE END OF ROCK APRON.

   B) FILTER CLOTH (POLYFILTER X OR EQUIVALENT) SHALL BE INSTALLED ON NATIVE SOIL BASE, MINIMUM OF 1' OVERLAPS AT JOINTS
9. RIP RAP AND SUBBASE CLASSIFICATION SHALL BE **AS SHOWN ON PLANS**.
10. FOR RIP RAP SELECTION SEE TABLE 200-1.7 OF THE WHITEBOOK.

SHEET 2 OF 2

REVISION	BY	APPROVED	DATE
ORIGINAL*	KA	J. NAGELVOORT	01/12
UPDATED	BD	J. NAGELVOORT	08/15
UPDATED	AB	J. NAGELVOORT	02/16
REDRAFTED	CD	J. NAGELVOORT	09/18

CITY OF SAN DIEGO – STANDARD DRAWING

CONCRETE ENERGY DISSIPATOR

RECOMMENDED BY THE CITY
OF SAN DIEGO STANDARDS COMMITTEE

9/10/18

COORDINATOR R.C.E. 56523 DATE

DRAWING NUMBER **SDD-105**

SDD-105 Rip-Rap Sizing

Outfall Location: 695

Proposed pipe size: 42 inches

STEP 1

Velocity off of proposed pipe: 36.8 feet/second

From AES Pipeflow output for SITE 1 storm drain system.

Please refer to Appendix D - Node 695

Therefore, Design Velocity: 36.8 ft/sec.

Design Velocity exceeds 35 ft/sec

STEP 2

Max Discharge from storm drain pipe,	115	cfs	From SDD-105 Standard Detail
Design Discharge, Q_{design}	54.7	cfs	From AES Pipeflow Run

OK Design Discharge < Max Discharge

Therefore, assuming the flow off of SDD-105 is subcritical and weirs on to the rip-rap

STEP 3

Weir Equation $Q = CLH^{3/2}$

Q_{design}	54.7	cfs	
C	3		
L	14	feet	From SDD-105 standard detail
Solving for H, depth of weir flow			
H depth of weir flow	1.19	feet	
Area, A = Length * Height	16.7	square-feet	
Velocity, V	3.3	feet/second	

OK Velocity < 5 ft/sec. Hence, non-erosive

STEP 4

Check for depth of weir flow, H < d+ (g/2)

From SDD-105 standard detail

d	1.8	feet
g	3.9	feet
d + (g/2)	3.7	feet

Depth of weir flow off of SDD-105 is less than d+ (g/2)

Since, V = **3.3 feet/sec** (< 5 feet/sec), install Facing class riprap, based on Table 200-1.7 off the Whitebook.
Please refer to the end of this Appendix for rip-rap details.

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                                 *
 * SYSTEM 6 -  VELOCITY RUN FROM NODES 695 TO 665                             *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                   *
  **************************************************************************

   FILE NAME: 695_V.PIP
   TIME/DATE OF STUDY: 11:03 04/02/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                 DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   695.00-             2.31 Dc         1285.72       0.78*          3628.24
         } FRICTION
   690.00-             2.31 Dc         1285.72       0.74*          3933.09
         } JUNCTION
   690.00-             2.32 Dc         1285.72       0.72*          4106.40
         } FRICTION
   685.00-             2.31*Dc         1285.72       2.31*Dc        1285.72
         } JUNCTION
   685.00-             3.11*           1139.11       1.74            910.27
         } FRICTION
   680.00-             2.73*            991.82       2.05 Dc         877.18
         } JUNCTION
   680.00-             3.44*           1249.45       1.67            870.12
         } FRICTION
   675.00-             2.92*           1021.30       2.00 Dc         829.90
         } JUNCTION
   675.00-             3.56*            978.26       1.06            274.77
         } FRICTION
   665.00-             3.33*            874.31       1.26 Dc         262.39
         } CATCH BASIN
   665.00-             3.42*            847.28       1.26 Dc          93.64
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   695.00            FLOWLINE ELEVATION =   224.31
  PIPE FLOW =      54.70 CFS        PIPE DIAMETER =  42.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   224.310 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
```

```
         IS LESS THAN CRITICAL DEPTH(  2.31 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE   695.00 : HGL = <  225.095>;EGL= <  242.964>;FLOWLINE= <  224.310>

******************************************************************************
  FLOW PROCESS FROM NODE   695.00 TO NODE   690.00 IS CODE =  1
  UPSTREAM NODE   690.00     ELEVATION =   224.43  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      54.70 CFS     PIPE DIAMETER =  42.00 INCHES
  PIPE LENGTH =      12.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.84           CRITICAL DEPTH(FT) =      2.31
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.74
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.741     36.828        21.814          3933.09
         11.941          0.785     33.926        18.668          3629.61
         12.000          0.785     33.913        18.654          3628.24
------------------------------------------------------------------------------
  NODE   690.00 : HGL = <  225.171>;EGL= <  246.244>;FLOWLINE= <  224.430>

******************************************************************************
  FLOW PROCESS FROM NODE   690.00 TO NODE   690.00 IS CODE =  5
  UPSTREAM NODE   690.00     ELEVATION =   224.76  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      54.70    42.00      0.00    224.76      2.31       38.494
    DOWNSTREAM     54.70    42.00       -      224.43      2.31       36.839
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34747
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.30688
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.32718
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.309 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.243)+( 0.000) =   2.243
------------------------------------------------------------------------------
  NODE   690.00 : HGL = <  225.478>;EGL= <  248.487>;FLOWLINE= <  224.760>

******************************************************************************
  FLOW PROCESS FROM NODE   690.00 TO NODE   685.00 IS CODE =  1
  UPSTREAM NODE   685.00     ELEVATION =   264.86  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      54.70 CFS     PIPE DIAMETER =  42.00 INCHES
  PIPE LENGTH =      77.80 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.65           CRITICAL DEPTH(FT) =      2.31
```

```
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.31
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          2.315     8.099          3.334          1285.72
         0.008          2.248     8.374          3.338          1287.32
         0.032          2.182     8.672          3.350          1292.28
         0.076          2.115     8.995          3.372          1300.86
         0.142          2.049     9.347          3.406          1313.37
         0.234          1.982     9.729          3.453          1330.14
         0.357          1.916    10.147          3.515          1351.57
         0.517          1.849    10.604          3.596          1378.11
         0.720          1.783    11.105          3.698          1410.31
         0.975          1.716    11.656          3.827          1448.78
         1.292          1.649    12.264          3.986          1494.27
         1.687          1.583    12.937          4.184          1547.66
         2.176          1.516    13.686          4.427          1610.00
         2.783          1.450    14.522          4.727          1682.57
         3.539          1.383    15.461          5.097          1766.92
         4.485          1.317    16.519          5.557          1864.95
         5.680          1.250    17.721          6.129          1979.05
         7.204          1.184    19.093          6.848          2112.18
         9.176          1.117    20.671          7.756          2268.13
        11.777          1.051    22.502          8.918          2451.78
        15.296          0.984    24.647         10.423          2669.51
        20.232          0.918    27.184         12.400          2929.82
        27.537          0.851    30.225         15.045          3244.26
        39.384          0.785    33.918         18.660          3628.83
        62.808          0.718    38.482         23.727          4106.40
        77.800          0.718    38.482         23.727          4106.40
------------------------------------------------------------------------------
  NODE   685.00 : HGL = <  267.175>;EGL= <  268.194>;FLOWLINE= <  264.860>

******************************************************************************
  FLOW PROCESS FROM NODE   685.00 TO NODE   685.00 IS CODE =  5
  UPSTREAM NODE   685.00     ELEVATION =   265.36  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      39.50    36.00     19.65    265.36      2.05       5.588
    DOWNSTREAM     54.70    42.00       -      264.86      2.31       8.101
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5          15.20===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00351
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00492
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00421
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.017 FEET         ENTRANCE LOSSES =  0.204 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.560)+( 0.204) =   0.764
------------------------------------------------------------------------------
  NODE   685.00 : HGL = <  268.473>;EGL= <  268.958>;FLOWLINE= <  265.360>

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

```
 FLOW PROCESS FROM NODE   685.00 TO NODE   680.00 IS CODE =  1
 UPSTREAM NODE   680.00     ELEVATION =   265.86  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =      39.50 CFS     PIPE DIAMETER =  36.00 INCHES
 PIPE LENGTH =      49.95 FEET          MANNING'S N  =  0.01300
==============================================================================
 DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     3.11
==============================================================================
 PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
 DISTANCE FROM       PRESSURE   VELOCITY     SPECIFIC       PRESSURE+
  CONTROL(FT)        HEAD(FT)   (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          3.113      5.588          3.598          1139.11
       17.340          3.000      5.588          3.485          1089.37
------------------------------------------------------------------------------
 NORMAL DEPTH(FT) =      1.66          CRITICAL DEPTH(FT) =      2.05
==============================================================================
 ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     3.00
==============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
 DISTANCE FROM      FLOW DEPTH  VELOCITY     SPECIFIC       PRESSURE+
  CONTROL(FT)          (FT)     (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
       17.340          3.000      5.586          3.485          1089.37
       22.698          2.962      5.600          3.449          1073.59
       27.630          2.924      5.625          3.415          1058.74
       32.321          2.886      5.657          3.383          1044.54
       36.827          2.847      5.696          3.351          1030.92
       41.176          2.809      5.740          3.321          1017.84
       45.385          2.771      5.789          3.292          1005.29
       49.466          2.733      5.843          3.263           993.25
       49.950          2.728      5.850          3.260           991.82
------------------------------------------------------------------------------
 NODE   680.00 : HGL = <  268.588>;EGL= <  269.120>;FLOWLINE= <  265.860>

******************************************************************************
 FLOW PROCESS FROM NODE   680.00 TO NODE   680.00 IS CODE =  5
 UPSTREAM NODE   680.00     ELEVATION =   266.19  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM      37.90    36.00     82.70    266.19      2.00        5.362
   DOWNSTREAM     39.50    36.00       -      265.86      2.05        5.851
   LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
   LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
      Q5           1.60===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00323
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00306
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00315
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.013 FEET         ENTRANCE LOSSES =  0.106 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.850)+( 0.106) =   0.956
------------------------------------------------------------------------------
 NODE   680.00 : HGL = <  269.630>;EGL= <  270.076>;FLOWLINE= <  266.190>

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

```
  FLOW PROCESS FROM NODE   680.00 TO NODE   675.00 IS CODE =  1
  UPSTREAM NODE   675.00     ELEVATION =   266.95  (FLOW SEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      37.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      76.00 FEET          MANNING'S N  =  0.01300
==============================================================================
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) =     3.44
==============================================================================
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       PRESSURE   VELOCITY     SPECIFIC       PRESSURE+
   CONTROL(FT)        HEAD(FT)   (FT/SEC)    ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          3.440      5.362          3.886         1249.45
        64.967          3.000      5.362          3.446         1055.42
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.62          CRITICAL DEPTH(FT) =      2.00
==============================================================================
  ASSUMED DOWNSTREAM PRESSURE HEAD(FT) =     3.00
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY     SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        64.967          3.000      5.360          3.446         1055.42
        70.380          2.960      5.374          3.409         1038.87
        75.392          2.920      5.400          3.373         1023.24
        76.000          2.915      5.403          3.369         1021.30
------------------------------------------------------------------------------
  NODE   675.00 : HGL = <  269.865>;EGL= <  270.319>;FLOWLINE= <  266.950>

******************************************************************************
  FLOW PROCESS FROM NODE   675.00 TO NODE   675.00 IS CODE =  5
  UPSTREAM NODE   675.00     ELEVATION =   267.28  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      15.70    36.00    81.90    267.28      1.26        2.221
    DOWNSTREAM     37.90    36.00      -      266.95      2.00        5.405
    LATERAL #1      0.00     0.00     0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00     0.00      0.00      0.00        0.000
       Q5          22.20===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00055
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00285
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00170
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.007 FEET         ENTRANCE LOSSES =  0.091 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.512)+( 0.091) =   0.602
------------------------------------------------------------------------------
  NODE   675.00 : HGL = <  270.845>;EGL= <  270.921>;FLOWLINE= <  267.280>

******************************************************************************
  FLOW PROCESS FROM NODE   675.00 TO NODE   665.00 IS CODE =  1
  UPSTREAM NODE   665.00     ELEVATION =   267.53  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      15.70 CFS     PIPE DIAMETER =  36.00 INCHES
```

```
  PIPE LENGTH =      25.85 FEET          MANNING'S N  =  0.01300
  SF=(Q/K)**2 = ((     15.70)/(   666.509))**2 = 0.00055
  HF=L*SF = (     25.85)*(0.00055) =      0.014
------------------------------------------------------------------------------
  NODE   665.00 : HGL = <  270.859>;EGL= <  270.936>;FLOWLINE= <  267.530>

******************************************************************************
  FLOW PROCESS FROM NODE   665.00 TO NODE   665.00 IS CODE =  8
  UPSTREAM NODE   665.00     ELEVATION =   267.53  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      15.70 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =   2.22 FEET/SEC.    VELOCITY HEAD =  0.077 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.077) =  0.015
------------------------------------------------------------------------------
  NODE   665.00 : HGL = <  270.951>;EGL= <  270.951>;FLOWLINE= <  267.530>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   665.00            FLOWLINE ELEVATION =   267.53
  ASSUMED UPSTREAM CONTROL HGL =    268.79 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

RIP RAP PAD AT NODE 755
SYSTEM 7 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104 River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	5.70	100.00	100.17	100.76	107.93	2.777926	22.35	0.25	4.02	9.55	
Reach01	99.*	PF 1	5.70	100.00	100.14	100.63	106.64	0.444287	20.47	0.28	4.34	9.67	
Reach01	98.*	PF 1	5.70	99.99	100.11	100.54	105.98	0.504799	19.45	0.29	4.70	10.01	
Reach01	97	PF 1	5.70	99.99	100.10	100.47	104.39	4.359633	16.61	0.34	5.19	8.66	End of Wing Wall
Reach01	96.*	PF 1	5.70	99.98	100.14	100.42	101.73	1.021041	10.11	0.56	6.16	4.44	Start of 1/4 Ton
Reach01	95.*	PF 1	5.70	99.97	100.18	100.37	100.92	0.347085	6.93	0.82	7.10	2.69	
Reach01	94.*	PF 1	5.70	99.97	100.22	100.34	100.61	0.136956	5.00	1.14	7.98	1.75	
Reach01	93.*	PF 1	5.70	99.96	100.41	100.30	100.51	0.016583	2.55	2.24	9.39	0.67	Hydraulic Jump
Reach01	92.*	PF 1	5.70	99.96	100.40	100.28	100.49	0.014393	2.35	2.43	9.91	0.62	
Reach01	91.*	PF 1	5.70	99.95	100.40	100.26	100.47	0.011511	2.12	2.69	10.50	0.56	
Reach01	90	PF 1	5.70	99.95	100.39		100.45	0.010204	1.98	2.88	11.03	0.52	
Reach01	89.*	PF 1	5.70	99.94	100.39	100.21	100.44	0.008368	1.81	3.15	11.05	0.48	
Reach01	88.*	PF 1	5.70	99.94	100.39	100.20	100.43	0.007525	1.71	3.34	11.04	0.45	
Reach01	87.*	PF 1	5.70	99.93	100.38	100.18	100.42	0.006278	1.58	3.62	11.05	0.41	End of 1/4 Ton
Reach01	86.*	PF 1	5.70	99.93	100.38	100.17	100.41	0.005705	1.49	3.81	11.05	0.39	
Reach01	85	PF 1	5.70	99.93	100.38	100.15	100.41	0.005003	1.40	4.06	11.05	0.37	

Decimal Slope of EGL = (107.93-104.39)/3 = 1.2 ft/ft
(Used for tractive force calculations)

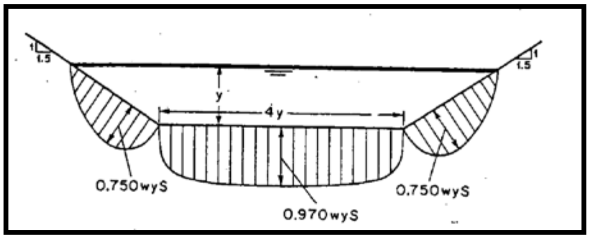
RICK™
ENGINEERING COMPANY

Tractive Force Calculations

Job Name: Maple Canyon Restoration Phase 1
Job Number: 18022 F
Date: 4/1/2019

Cross Section Number: **X-sec 97 - D40 HEC-RAS**

Flow Depth: **0.11** feet (including S.Elev)
Flow Velocity: **16.61** fps
bottom width: **4.5** feet
z: **3** :1
S_{EGL}= **1.18** *Decimal Slope of EGL*



Required Riprap Size from Greenbook: **No. 3 Backing - D_{50}=0.4 feet (or larger)**

Tractive Force Calculations

Channel Bottom:

b/y = 40.909
X_{bottom}= **1** from figure 1

$T_{bottom} = X_{bottom} (\gamma_W) D S_{EGL}$

T_{bottom} = 8.0995 lb/ft^3

$T_{permissible}= 0.04 (\gamma_S-\gamma_W) D_{50}$

$T_{permissible} = 0.04 (165 - 62.4 \text{ lb/ft}^3) D_{50}$

$T_{bottom} = T_{permissible} = 4.1 D_{50}$

D_{50} = 1.975 feet

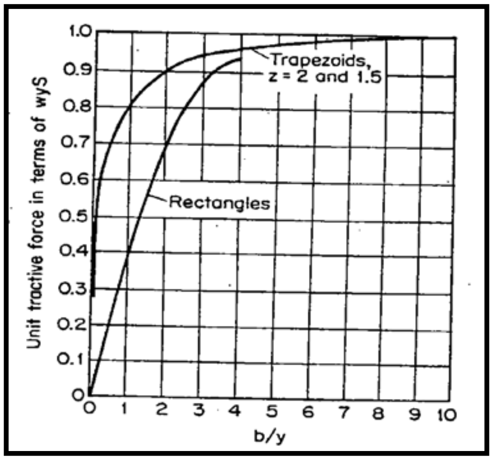


Figure 1: On bottom of Channels

Channel Sides:

b/y = 40.909
X_{side}= **0.78** from figure 2

$T_{side} = X_{side} (\gamma_W) D S_{EGL}$

T_{side} = 6.3176 lb/ft^3

$T_{perm\text{-}side} = T_{side} [(1-(\sin^2 \Phi/\sin^2 \theta))^{0.5}] = 4.1 D_{50}$

Φ = 18.43 degrees
θ = 40 degrees *(angle of repose of rock)*

$T_{perm\text{-}side}$ = **7.2565 lb/ft^3**

$T_{side} = T_{perm\text{-}side} = 4.1 D_{50}$

D_{50} = 1.770 feet

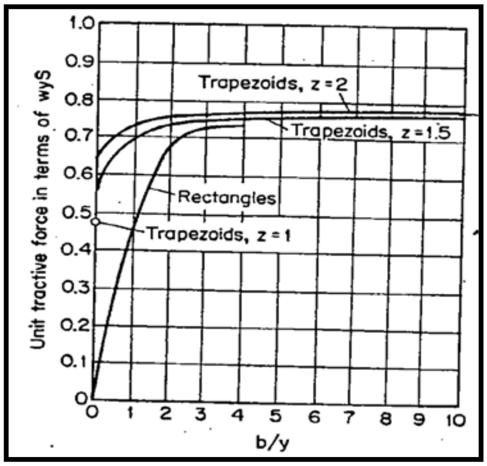
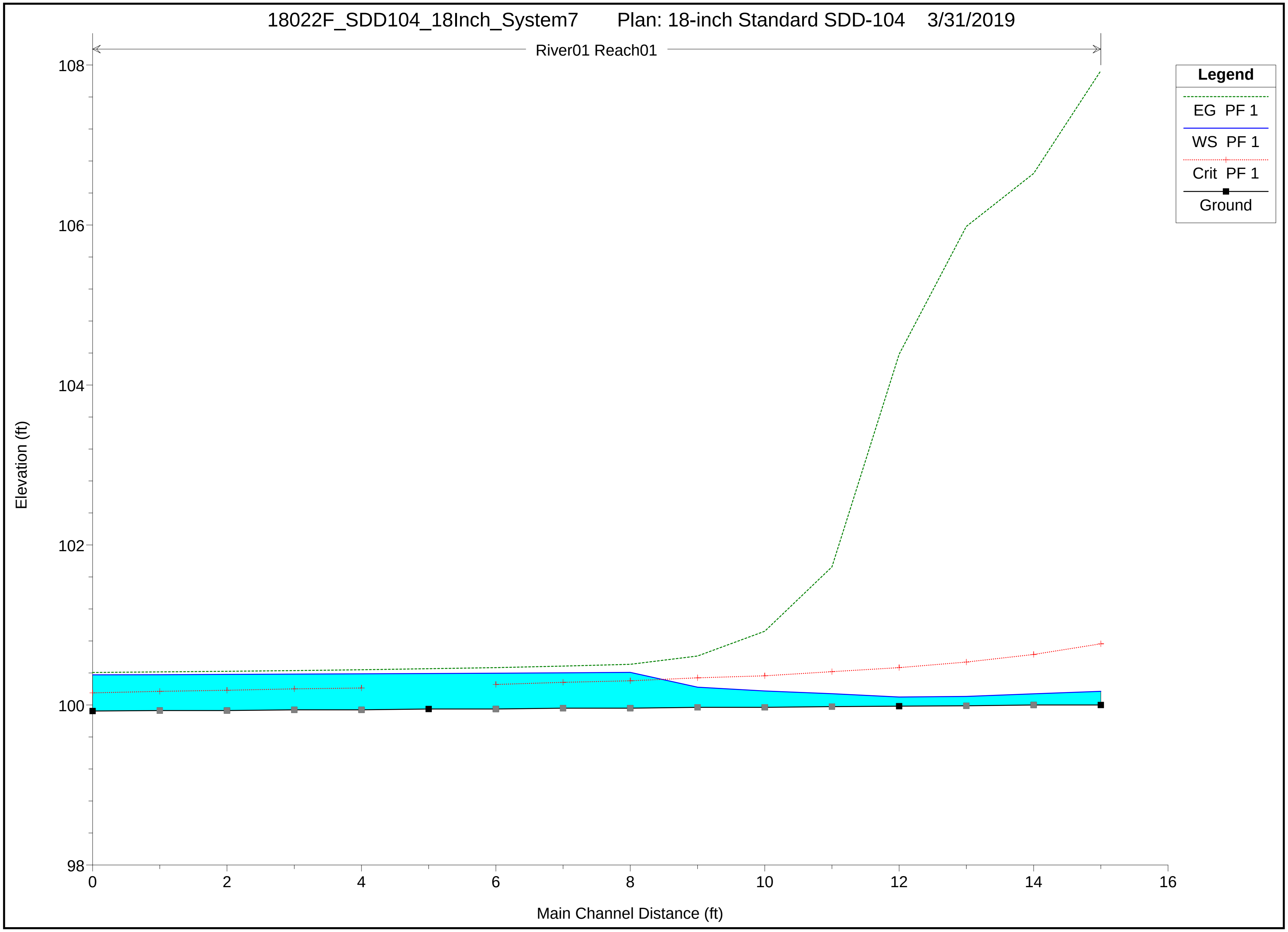


Figure 2: On sides of Channels

Design Specifications:

Required Rock Size	**1/4 Ton - D_{50}=1.8 feet (or larger)**
Minimum Rock Thickness:	**0.6 Feet (or 1.5 x D_{50})**
Filter Material:	**Per Geotechnical Engineers Specifications**


18022F_SDD104_18Inch_System7 Plan: 18-inch Standard SDD-104 3/31/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
108
106
104
102
100
98
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION - PHASE 1                              *
 * VELOCITY RUN FOR MAINLINE FROM NODES 755 TO 710                           *
 * TAILWATER ASSUMED TO BE THE FLOWLINE OF PIPE                              *
  **************************************************************************

   FILE NAME: 755_V.PIP
   TIME/DATE OF STUDY: 20:14 03/25/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   755.00-             0.92 Dc           83.68        0.42*            158.25
         } FRICTION
   750.00-             0.92 Dc           83.68        0.30*            248.21
         } JUNCTION
   750.00-             0.92 Dc           83.68        0.27*            287.40
         } FRICTION
   745.00-             0.92 Dc           83.68        0.59*            107.64
         } JUNCTION
   745.00-             1.09              78.43        0.45*            119.54
         } FRICTION
   730.00-             0.87 Dc           72.26        0.83*             72.52
         } JUNCTION
   730.00-             0.78 Dc           54.33        0.67*             56.15
         } FRICTION
   710.00-             0.78*Dc           54.33        0.78*Dc           54.33
         } CATCH BASIN
   710.00-             1.14*             29.55        0.78 Dc           18.98
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   755.00            FLOWLINE ELEVATION =   201.97
  PIPE FLOW =       5.70 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   201.970 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.92 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
```

```
  NODE   755.00 : HGL = <  202.393>;EGL= <  205.404>;FLOWLINE= <  201.970>

******************************************************************************
  FLOW PROCESS FROM NODE   755.00 TO NODE   750.00 IS CODE =  1
  UPSTREAM NODE   750.00     ELEVATION =   202.21  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.70 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      24.89 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.80           CRITICAL DEPTH(FT) =      0.92
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.30
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.303     22.285          8.020           248.21
          3.982          0.323     20.371          6.771           227.39
          8.009          0.343     18.726          5.791           209.57
         12.080          0.363     17.300          5.013           194.21
         16.195          0.382     16.055          4.387           180.87
         20.353          0.402     14.960          3.879           169.22
         24.558          0.422     13.991          3.463           159.00
         24.890          0.423     13.920          3.434           158.25
------------------------------------------------------------------------------
  NODE   750.00 : HGL = <  202.513>;EGL= <  210.230>;FLOWLINE= <  202.210>

******************************************************************************
  FLOW PROCESS FROM NODE   750.00 TO NODE   750.00 IS CODE =  5
  UPSTREAM NODE   750.00     ELEVATION =   202.54  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.70    18.00      0.00    202.54      0.92      25.880
    DOWNSTREAM      5.70    18.00       -      202.21      0.92      22.292
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.55997
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.36687
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.46342
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.854 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.984)+( 0.000) =   2.984
------------------------------------------------------------------------------
  NODE   750.00 : HGL = <  202.813>;EGL= <  213.214>;FLOWLINE= <  202.540>

******************************************************************************
  FLOW PROCESS FROM NODE   750.00 TO NODE   745.00 IS CODE =  1
  UPSTREAM NODE   745.00     ELEVATION =   266.28  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.70 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      96.27 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
```

```
  NORMAL DEPTH(FT) =      0.26          CRITICAL DEPTH(FT) =      0.92
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.59
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000         0.589      8.847          1.805            107.64
        0.099         0.576      9.117          1.868            110.11
        0.208         0.563      9.403          1.937            112.77
        0.331         0.550      9.707          2.014            115.63
        0.468         0.537     10.028          2.099            118.72
        0.622         0.524     10.371          2.195            122.04
        0.794         0.511     10.735          2.301            125.62
        0.988         0.498     11.123          2.420            129.49
        1.207         0.485     11.537          2.553            133.65
        1.454         0.472     11.980          2.701            138.15
        1.736         0.458     12.455          2.869            143.02
        2.057         0.445     12.964          3.057            148.29
        2.425         0.432     13.513          3.269            153.99
        2.849         0.419     14.104          3.510            160.19
        3.342         0.406     14.743          3.783            166.93
        3.919         0.393     15.435          4.095            174.27
        4.601         0.380     16.187          4.451            182.28
        5.416         0.367     17.006          4.860            191.05
        6.405         0.354     17.901          5.333            200.67
        7.626         0.341     18.882          5.880            211.25
        9.172         0.328     19.961          6.518            222.94
       11.198         0.315     21.152          7.267            235.88
       13.997         0.302     22.474          8.149            250.27
       18.227         0.289     23.945          9.198            266.33
       25.999         0.275     25.593         10.453            284.34
       96.270         0.273     25.872         10.674            287.40
------------------------------------------------------------------------------
  NODE   745.00 : HGL = <  266.869>;EGL= <  268.085>;FLOWLINE= <  266.280>

******************************************************************************
  FLOW PROCESS FROM NODE   745.00 TO NODE   745.00 IS CODE =  5
  UPSTREAM NODE   745.00     ELEVATION =   266.61  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.10    18.00       0.00    266.61       0.87      11.584
    DOWNSTREAM      5.70    18.00      -        266.28       0.92       8.849
    LATERAL #1      0.00     0.00       0.00      0.00       0.00       0.000
    LATERAL #2      0.00     0.00       0.00      0.00       0.00       0.000
       Q5           0.60===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.06368
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.02773
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04571
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.183 FEET         ENTRANCE LOSSES =  0.243 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.811)+( 0.243) =   1.054
------------------------------------------------------------------------------
  NODE   745.00 : HGL = <  267.056>;EGL= <  269.139>;FLOWLINE= <  266.610>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE   745.00 TO NODE   730.00 IS CODE =  1
  UPSTREAM NODE   730.00     ELEVATION =   269.83  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      43.90 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.43           CRITICAL DEPTH(FT) =      0.87
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.83
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.828      5.093          1.232            72.52
         0.059          0.812      5.217          1.235            72.76
         0.143          0.797      5.348          1.241            73.09
         0.253          0.781      5.485          1.248            73.51
         0.392          0.765      5.630          1.257            74.03
         0.566          0.749      5.783          1.268            74.65
         0.777          0.733      5.944          1.282            75.38
         1.032          0.717      6.114          1.298            76.22
         1.335          0.701      6.294          1.316            77.18
         1.696          0.685      6.485          1.338            78.28
         2.121          0.669      6.688          1.364            79.51
         2.623          0.653      6.902          1.393            80.89
         3.214          0.637      7.131          1.427            82.42
         3.910          0.621      7.374          1.466            84.13
         4.734          0.605      7.634          1.511            86.02
         5.711          0.589      7.911          1.562            88.11
         6.878          0.573      8.208          1.620            90.41
         8.285          0.557      8.526          1.687            92.95
         9.999          0.542      8.867          1.763            95.74
        12.123          0.526      9.235          1.851            98.82
        14.814          0.510      9.632          1.951           102.20
        18.337          0.494     10.060          2.066           105.92
        23.189          0.478     10.525          2.199           110.02
        30.486          0.462     11.030          2.352           114.54
        43.817          0.446     11.580          2.529           119.54
        43.900          0.446     11.580          2.529           119.54
------------------------------------------------------------------------------
  NODE   730.00 : HGL = <  270.658>;EGL= <  271.061>;FLOWLINE= <  269.830>

******************************************************************************
  FLOW PROCESS FROM NODE   730.00 TO NODE   730.00 IS CODE =  5
  UPSTREAM NODE   730.00     ELEVATION =   270.16  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM       4.10    18.00      0.00    270.16      0.78        5.386
   DOWNSTREAM      5.10    18.00       -      269.83      0.87        5.095
   LATERAL #1      1.00    18.00     66.80    270.12      0.37        1.440
   LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00910
  DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00678
```

```
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00794
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.032 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.217)+( 0.000) =   0.217
------------------------------------------------------------------------------
  NODE   730.00 : HGL = <  270.828>;EGL= <  271.279>;FLOWLINE= <  270.160>

******************************************************************************
  FLOW PROCESS FROM NODE   730.00 TO NODE   710.00 IS CODE =  1
  UPSTREAM NODE   710.00     ELEVATION =   270.35  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      18.98 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.65          CRITICAL DEPTH(FT) =      0.78
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.78
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.775      4.448          1.083            54.33
         0.014          0.770      4.484          1.083            54.33
         0.057          0.765      4.521          1.083            54.34
         0.132          0.760      4.559          1.083            54.36
         0.242          0.755      4.597          1.084            54.38
         0.391          0.750      4.636          1.084            54.42
         0.582          0.745      4.675          1.085            54.46
         0.820          0.740      4.716          1.086            54.50
         1.111          0.735      4.757          1.087            54.56
         1.461          0.730      4.798          1.088            54.62
         1.879          0.725      4.841          1.090            54.70
         2.373          0.720      4.884          1.091            54.78
         2.954          0.715      4.928          1.093            54.87
         3.638          0.710      4.973          1.095            54.96
         4.442          0.705      5.018          1.097            55.07
         5.389          0.700      5.064          1.099            55.18
         6.510          0.695      5.112          1.101            55.31
         7.845          0.690      5.160          1.104            55.44
         9.453          0.685      5.208          1.107            55.58
        11.419          0.681      5.258          1.110            55.74
        13.872          0.676      5.309          1.113            55.90
        17.034          0.671      5.361          1.117            56.07
        18.980          0.668      5.385          1.119            56.15
------------------------------------------------------------------------------
  NODE   710.00 : HGL = <  271.125>;EGL= <  271.433>;FLOWLINE= <  270.350>

******************************************************************************
  FLOW PROCESS FROM NODE   710.00 TO NODE   710.00 IS CODE =  8
  UPSTREAM NODE   710.00     ELEVATION =   270.35  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       4.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.45 FEET/SEC.    VELOCITY HEAD =  0.307 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.307) =  0.061
------------------------------------------------------------------------------
  NODE   710.00 : HGL = <  271.494>;EGL= <  271.494>;FLOWLINE= <  270.350>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
```

```
  NODE NUMBER =   710.00            FLOWLINE ELEVATION =   270.35
  ASSUMED UPSTREAM CONTROL HGL =    271.13 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

Hydraulic Analysis Report

Project Data

Project Title: System8

Designer:

Project Date: Tuesday, April 02, 2019

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Rectangular

Channel Width: 5.5000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0150

Flow: 12.9000 cfs

Result Parameters

Depth: 0.5586 ft

Area of Flow: 3.0725 ft^2

Wetted Perimeter: 6.6173 ft

Hydraulic Radius: 0.4643 ft

Average Velocity: 4.1985 ft/s

Top Width: 5.5000 ft

Froude Number: 0.9899

Critical Depth: 0.5549 ft

Critical Velocity: 4.2270 ft/s

Critical Slope: 0.0051 ft/ft

Critical Top Width: 5.50 ft

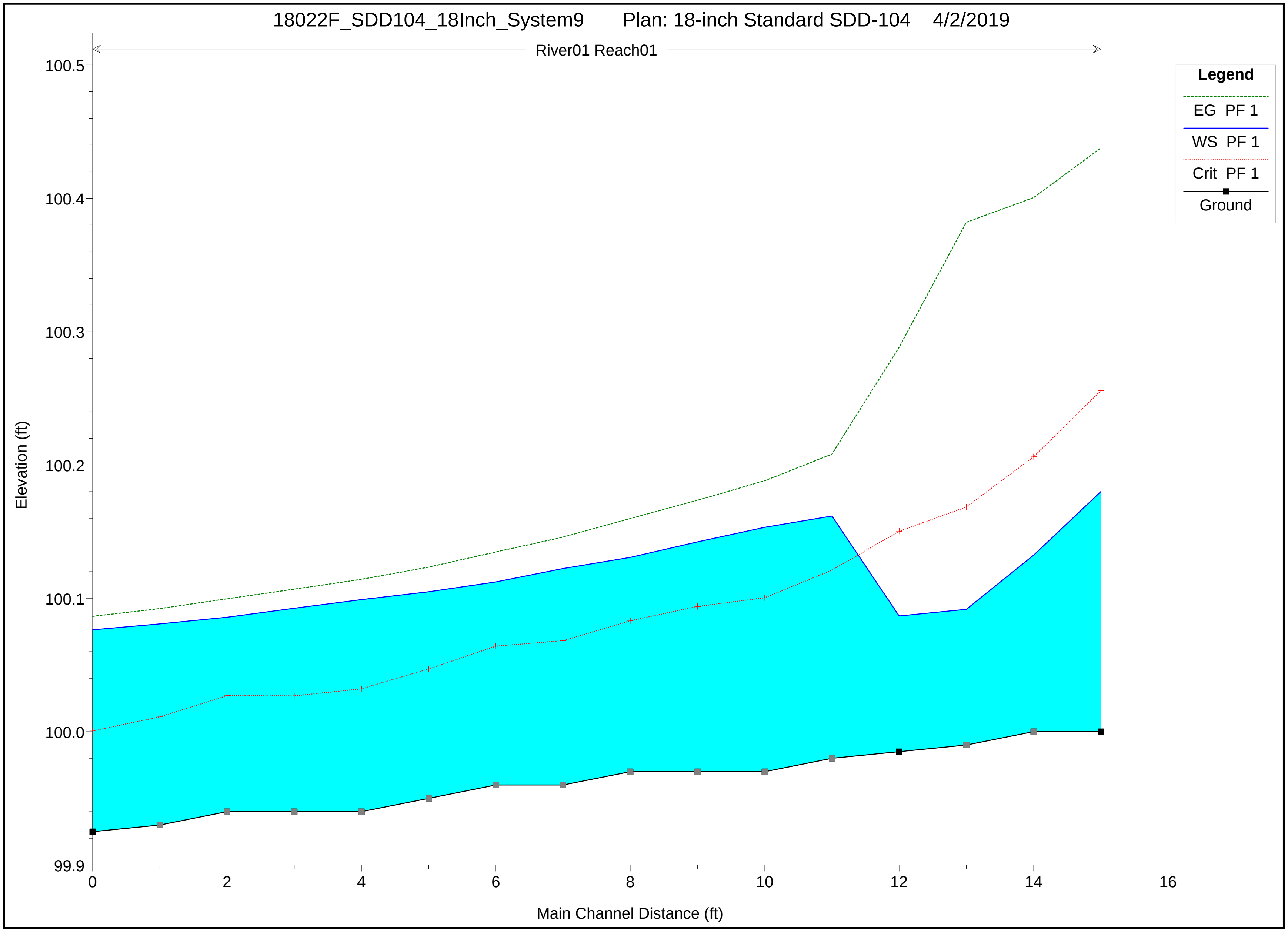
Calculated Max Shear Stress: 0.1743 lb/ft^2

Calculated Avg Shear Stress: 0.1449 lb/ft^2

RIP RAP PAD AT NODE 925
SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104   River: River01   Reach: Reach01   Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	1.10	100.00	100.18	100.26	100.44	0.085505	4.07	0.27	4.08	1.69	
Reach01	99.*	PF 1	1.10	100.00	100.13	100.21	100.40	0.019596	4.16	0.26	4.29	2.01	
Reach01	98.*	PF 1	1.10	99.99	100.09	100.17	100.38	0.030121	4.32	0.25	4.61	2.39	End of Wing Wall
Reach01	97	PF 1	1.10	99.99	100.09	100.15	100.29	0.169442	3.60	0.31	5.11	1.99	Start of No.2 Backing
Reach01	96.*	PF 1	1.10	99.98	100.16	100.12	100.21	0.018020	1.73	0.64	6.06	0.71	Hydraulic Jump
Reach01	95.*	PF 1	1.10	99.97	100.15	100.10	100.19	0.013410	1.50	0.73	6.56	0.62	
Reach01	94.*	PF 1	1.10	99.97	100.14	100.09	100.17	0.013002	1.42	0.78	6.98	0.60	
Reach01	93.*	PF 1	1.10	99.97	100.13	100.08	100.16	0.013312	1.37	0.80	7.40	0.60	
Reach01	92.*	PF 1	1.10	99.96	100.12	100.07	100.15	0.010624	1.23	0.89	7.89	0.54	
Reach01	91.*	PF 1	1.10	99.96	100.11	100.06	100.13	0.011051	1.20	0.91	8.32	0.54	
Reach01	90.*	PF 1	1.10	99.95	100.10	100.05	100.12	0.008893	1.09	1.01	8.83	0.49	
Reach01	89.*	PF 1	1.10	99.94	100.10	100.03	100.11	0.007024	0.99	1.11	9.33	0.44	
Reach01	88.*	PF 1	1.10	99.94	100.09	100.03	100.11	0.007033	0.96	1.14	9.79	0.43	
Reach01	87.*	PF 1	1.10	99.94	100.09	100.03	100.10	0.007179	0.94	1.17	10.27	0.44	End of No.2 Backing
Reach01	86.*	PF 1	1.10	99.93	100.08	100.01	100.09	0.005684	0.86	1.28	10.77	0.39	
Reach01	85	PF 1	1.10	99.93	100.08	100.00	100.09	0.005009	0.81	1.36	11.25	0.37	


18022F_SDD104_18Inch_System9 Plan: 18-inch Standard SDD-104 4/2/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
100.5
100.4
100.3
100.2
100.1
100.0
99.9
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                               *
 * SYSTEM 9 -  VELOCITY RUN FROM NODES 925 TO 910                           *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                 *
  **************************************************************************

   FILE NAME: 925_V.PIP
   TIME/DATE OF STUDY: 19:02 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE     PRESSURE+        FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
   925.00-             0.39 Dc           10.07       0.33*             10.55
         } FRICTION
   920.00-             0.39*Dc           10.07       0.39*Dc           10.07
         } JUNCTION
   920.00-             0.39 Dc           10.07       0.13*             31.24
         } FRICTION
   915.00-             0.39 Dc           10.07       0.16*             24.01
         } JUNCTION
   915.00-             0.39 Dc           10.07       0.13*             33.30
         } FRICTION
   910.00-             0.39*Dc           10.07       0.39*Dc           10.07
         } CATCH BASIN
   910.00-             0.56*              5.33       0.39 Dc            3.68
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   925.00            FLOWLINE ELEVATION =   172.93
  PIPE FLOW =       1.10 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   172.930 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.39 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE   925.00 : HGL = <  173.261>;EGL= <  173.486>;FLOWLINE= <  172.930>

******************************************************************************
  FLOW PROCESS FROM NODE   925.00 TO NODE   920.00 IS CODE =  1
```

```
  UPSTREAM NODE   920.00     ELEVATION =   173.11  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      18.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.33           CRITICAL DEPTH(FT) =      0.39
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.39
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.392      2.995           0.531            10.07
         0.007          0.389      3.022           0.531            10.07
         0.027          0.387      3.050           0.531            10.07
         0.063          0.384      3.079           0.531            10.08
         0.115          0.381      3.108           0.531            10.08
         0.185          0.379      3.138           0.532            10.09
         0.276          0.376      3.168           0.532            10.10
         0.388          0.374      3.198           0.533            10.11
         0.526          0.371      3.229           0.533            10.12
         0.692          0.369      3.261           0.534            10.13
         0.889          0.366      3.293           0.535            10.15
         1.123          0.364      3.326           0.535            10.16
         1.398          0.361      3.359           0.536            10.18
         1.721          0.358      3.393           0.537            10.20
         2.101          0.356      3.427           0.538            10.23
         2.548          0.353      3.462           0.540            10.25
         3.077          0.351      3.498           0.541            10.28
         3.707          0.348      3.535           0.542            10.30
         4.466          0.346      3.572           0.544            10.33
         5.392          0.343      3.609           0.546            10.36
         6.548          0.341      3.648           0.547            10.40
         8.038          0.338      3.687           0.549            10.43
        10.054          0.335      3.727           0.551            10.47
        13.033          0.333      3.768           0.553            10.51
        18.000          0.331      3.806           0.556            10.55
------------------------------------------------------------------------------
  NODE   920.00 : HGL = <  173.502>;EGL= <  173.641>;FLOWLINE= <  173.110>

******************************************************************************
  FLOW PROCESS FROM NODE   920.00 TO NODE   920.00 IS CODE =  5
  UPSTREAM NODE   920.00     ELEVATION =   173.44  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.10    18.00     60.00    173.44      0.39       14.538
    DOWNSTREAM      1.10    18.00       -      173.11      0.39        2.996
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.44006
  DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00492
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.22249
  JUNCTION LENGTH =   4.00 FEET
```

```
  FRICTION LOSSES =  0.890 FEET          ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.212)+( 0.000) =   3.212
------------------------------------------------------------------------------
  NODE   920.00 : HGL = <  173.571>;EGL= <  176.853>;FLOWLINE= <  173.440>

******************************************************************************
  FLOW PROCESS FROM NODE   920.00 TO NODE   915.00 IS CODE =  1
  UPSTREAM NODE   915.00     ELEVATION =   226.08  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     117.89 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.13           CRITICAL DEPTH(FT) =      0.39
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.16
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.158     11.076          2.064            24.01
        0.157          0.157     11.188          2.102            24.25
        0.322          0.156     11.302          2.141            24.48
        0.497          0.155     11.419          2.181            24.72
        0.682          0.154     11.537          2.222            24.97
        0.878          0.153     11.658          2.264            25.22
        1.087          0.152     11.781          2.308            25.48
        1.309          0.150     11.906          2.353            25.74
        1.548          0.149     12.033          2.399            26.00
        1.803          0.148     12.163          2.447            26.27
        2.079          0.147     12.295          2.496            26.55
        2.377          0.146     12.429          2.546            26.83
        2.700          0.145     12.566          2.598            27.11
        3.054          0.144     12.706          2.652            27.41
        3.443          0.143     12.848          2.708            27.70
        3.874          0.142     12.993          2.765            28.01
        4.357          0.141     13.140          2.824            28.32
        4.902          0.140     13.291          2.884            28.63
        5.528          0.138     13.444          2.947            28.95
        6.259          0.137     13.601          3.012            29.28
        7.133          0.136     13.760          3.078            29.62
        8.216          0.135     13.923          3.147            29.96
        9.629          0.134     14.089          3.219            30.31
       11.644          0.133     14.259          3.292            30.66
       15.135          0.132     14.432          3.368            31.03
      117.890          0.131     14.533          3.413            31.24
------------------------------------------------------------------------------
  NODE   915.00 : HGL = <  226.238>;EGL= <  228.144>;FLOWLINE= <  226.080>

******************************************************************************
  FLOW PROCESS FROM NODE   915.00 TO NODE   915.00 IS CODE =  5
  UPSTREAM NODE   915.00     ELEVATION =   226.41  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.10    18.00       0.00    226.41      0.39      15.518
    DOWNSTREAM      1.10    18.00        -      226.08      0.39      11.079
    LATERAL #1      0.00     0.00       0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00       0.00      0.00      0.00       0.000
      Q5            0.00===Q5 EQUALS BASIN INPUT===
```

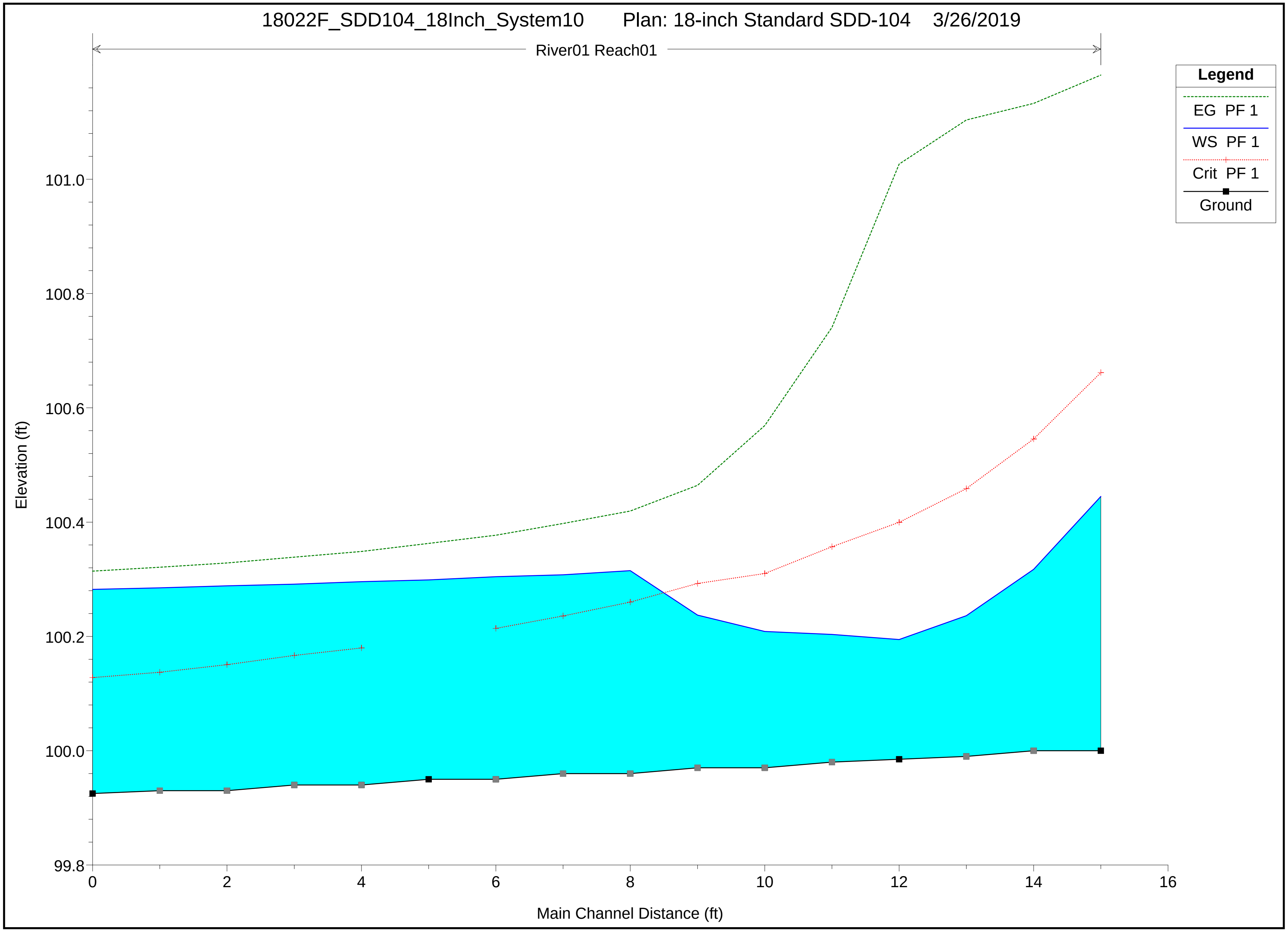
```
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.53056
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.20211
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.36634
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.465 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.131)+( 0.000) =   2.131
------------------------------------------------------------------------------
  NODE   915.00 : HGL = <  226.536>;EGL= <  230.275>;FLOWLINE= <  226.410>

******************************************************************************
  FLOW PROCESS FROM NODE   915.00 TO NODE   910.00 IS CODE =  1
  UPSTREAM NODE   910.00     ELEVATION =   258.07  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.10 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      44.61 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.12          CRITICAL DEPTH(FT) =      0.39
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.39
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.392      2.995          0.531            10.07
          0.001          0.381      3.117          0.532            10.08
          0.004          0.370      3.248          0.534            10.13
          0.009          0.359      3.389          0.537            10.20
          0.017          0.348      3.542          0.543            10.31
          0.027          0.337      3.707          0.550            10.45
          0.042          0.326      3.886          0.560            10.64
          0.061          0.315      4.080          0.573            10.86
          0.084          0.304      4.292          0.590            11.13
          0.114          0.293      4.524          0.611            11.46
          0.152          0.282      4.779          0.637            11.84
          0.198          0.271      5.059          0.669            12.28
          0.255          0.260      5.370          0.708            12.80
          0.326          0.249      5.714          0.756            13.40
          0.415          0.238      6.099          0.816            14.09
          0.525          0.227      6.530          0.890            14.89
          0.663          0.216      7.017          0.981            15.82
          0.839          0.205      7.569          1.095            16.89
          1.066          0.194      8.200          1.239            18.14
          1.364          0.183      8.927          1.421            19.60
          1.765          0.172      9.770          1.655            21.32
          2.322          0.161     10.759          1.960            23.36
          3.141          0.150     11.931          2.362            25.79
          4.456          0.139     13.338          2.903            28.73
          7.029          0.128     15.050          3.648            32.33
         44.610          0.126     15.513          3.865            33.30
------------------------------------------------------------------------------
  NODE   910.00 : HGL = <  258.462>;EGL= <  258.601>;FLOWLINE= <  258.070>

******************************************************************************
  FLOW PROCESS FROM NODE   910.00 TO NODE   910.00 IS CODE =  8
  UPSTREAM NODE   910.00     ELEVATION =   258.07  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
```

```
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.10 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.00 FEET/SEC.    VELOCITY HEAD =  0.139 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.139) =  0.028
------------------------------------------------------------------------------
  NODE   910.00 : HGL = <  258.629>;EGL= <  258.629>;FLOWLINE= <  258.070>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =   910.00            FLOWLINE ELEVATION =   258.07
  ASSUMED UPSTREAM CONTROL HGL =    258.46 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

RIP RAP PAD AT NODE 1045
SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104   River: River01   Reach: Reach01   Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	4.60	100.00	100.45	100.66	101.18	0.073187	6.89	0.67	5.67	1.82	
Reach01	99.*	PF 1	4.60	100.00	100.32	100.55	101.13	0.018568	7.25	0.63	5.40	2.27	
Reach01	98.*	PF 1	4.60	99.99	100.24	100.46	101.10	0.027720	7.47	0.62	5.48	2.65	End of Wing Wall
Reach01	97	PF 1	4.60	99.99	100.19	100.40	101.03	0.267084	7.32	0.63	5.76	2.82	Start of No.2 Backing
Reach01	96.*	PF 1	4.60	99.98	100.20	100.36	100.74	0.158267	5.88	0.78	6.50	2.19	
Reach01	95.*	PF 1	4.60	99.97	100.21	100.31	100.57	0.097140	4.82	0.95	7.26	1.74	
Reach01	94.*	PF 1	4.60	99.97	100.24	100.29	100.46	0.052656	3.82	1.20	8.04	1.30	
Reach01	93.*	PF 1	4.60	99.96	100.32	100.26	100.42	0.016552	2.59	1.78	9.03	0.77	Hydraulic Jump
Reach01	92.*	PF 1	4.60	99.96	100.31	100.24	100.40	0.014665	2.41	1.91	9.60	0.72	
Reach01	91.*	PF 1	4.60	99.95	100.30	100.21	100.38	0.011550	2.16	2.13	10.23	0.64	
Reach01	90	PF 1	4.60	99.95	100.30		100.36	0.010387	2.03	2.27	10.81	0.61	
Reach01	89.*	PF 1	4.60	99.94	100.30	100.18	100.35	0.008391	1.85	2.49	10.83	0.55	
Reach01	88.*	PF 1	4.60	99.94	100.29	100.17	100.34	0.007623	1.75	2.63	10.82	0.52	
Reach01	87.*	PF 1	4.60	99.93	100.29	100.15	100.33	0.006263	1.60	2.87	10.84	0.47	End of No.2 Backing
Reach01	86.*	PF 1	4.60	99.93	100.29	100.14	100.32	0.005733	1.52	3.02	10.83	0.45	
Reach01	85	PF 1	4.60	99.93	100.28	100.13	100.31	0.005000	1.43	3.22	10.83	0.42	

18022F_SDD104_18Inch_System10 Plan: 18-inch Standard SDD-104 3/26/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
101.0
100.8
100.6
100.4
100.2
100.0
99.8
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
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                         San Diego, California 92110
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  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                               *
 * SYSTEM 10 -  VELOCITY RUN FROM NODES 1045 TO 1010                        *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                 *
  **************************************************************************

   FILE NAME: 1045_V.PIP
   TIME/DATE OF STUDY: 18:42 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1045.00-             0.82 Dc           63.12        0.66*             68.00
         } FRICTION
  1040.00-             0.82 Dc           63.12        0.61*             71.29
         } JUNCTION
  1040.00-             0.87              63.48        0.33*            146.60
         } FRICTION
  1035.00-             0.82 Dc           63.12        0.31*            156.94
         } JUNCTION
  1035.00-             0.82 Dc           63.12        0.28*            182.92
         } FRICTION
  1030.00-             0.82 Dc           63.12        0.29*            174.25
         } JUNCTION
  1030.00-             0.82 Dc           63.12        0.26*            202.64
         } FRICTION
  1025.00-             0.82 Dc           63.12        0.75*             63.91
         } JUNCTION
  1025.00-             0.82 Dc           63.12        0.70*             65.44
         } FRICTION
  1020.00-             0.82*Dc           63.12        0.82*Dc           63.12
         } JUNCTION
  1020.00-             0.88              63.55        0.68*             66.46
         } FRICTION
  1015.00-             0.82 Dc           63.12        0.61*             71.51
         } JUNCTION
  1015.00-             0.82 Dc           63.12        0.72*             64.93
         } FRICTION
  1010.00-             0.82*Dc           63.12        0.82*Dc           63.12
         } CATCH BASIN
  1010.00-             1.22*             34.60        0.82 Dc           21.85
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
```

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  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1045.00            FLOWLINE ELEVATION =   166.71
  PIPE FLOW =       4.60 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   166.710 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.82 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE  1045.00 : HGL = <  167.366>;EGL= <  167.962>;FLOWLINE= <  166.710>

******************************************************************************
  FLOW PROCESS FROM NODE  1045.00 TO NODE  1040.00 IS CODE =  1
  UPSTREAM NODE  1040.00     ELEVATION =   166.91  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      20.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.69           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.61
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.612      6.778          1.326             71.29
         1.233          0.616      6.730          1.320             71.00
         2.496          0.619      6.683          1.313             70.72
         3.794          0.622      6.636          1.307             70.45
         5.129          0.626      6.590          1.300             70.18
         6.505          0.629      6.544          1.294             69.91
         7.926          0.632      6.499          1.289             69.66
         9.397          0.635      6.455          1.283             69.41
        10.924          0.639      6.411          1.277             69.16
        12.513          0.642      6.368          1.272             68.92
        14.174          0.645      6.325          1.267             68.69
        15.915          0.649      6.283          1.262             68.47
        17.748          0.652      6.242          1.257             68.25
        19.689          0.655      6.201          1.253             68.03
        20.000          0.656      6.194          1.252             68.00
------------------------------------------------------------------------------
  NODE  1040.00 : HGL = <  167.522>;EGL= <  168.236>;FLOWLINE= <  166.910>

******************************************************************************
  FLOW PROCESS FROM NODE  1040.00 TO NODE  1040.00 IS CODE =  5
  UPSTREAM NODE  1040.00     ELEVATION =   167.24  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM       4.60    18.00     60.00    167.24      0.82       16.180
   DOWNSTREAM      4.60    18.00       -      166.91      0.82        6.780
   LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
   LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5          0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
```

```
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.17704
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01567
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.09635
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.385 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.396)+( 0.000) =   3.396
------------------------------------------------------------------------------
  NODE  1040.00 : HGL = <  167.567>;EGL= <  171.632>;FLOWLINE= <  167.240>

******************************************************************************
  FLOW PROCESS FROM NODE  1040.00 TO NODE  1035.00 IS CODE =  1
  UPSTREAM NODE  1035.00     ELEVATION =   178.83  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      66.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.33           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.31
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.311     17.365          4.996           156.94
         0.695          0.312     17.312          4.968           156.48
         1.417          0.312     17.260          4.941           156.03
         2.170          0.313     17.208          4.914           155.57
         2.955          0.314     17.156          4.887           155.12
         3.775          0.314     17.105          4.860           154.68
         4.636          0.315     17.054          4.834           154.23
         5.540          0.316     17.003          4.807           153.79
         6.493          0.316     16.952          4.781           153.35
         7.502          0.317     16.902          4.755           152.91
         8.572          0.318     16.851          4.730           152.47
         9.712          0.318     16.802          4.704           152.04
        10.933          0.319     16.752          4.679           151.61
        12.249          0.320     16.703          4.654           151.18
        13.675          0.320     16.654          4.629           150.75
        15.232          0.321     16.605          4.605           150.33
        16.948          0.322     16.556          4.580           149.91
        18.861          0.322     16.508          4.556           149.49
        21.023          0.323     16.460          4.532           149.07
        23.512          0.323     16.412          4.508           148.65
        26.446          0.324     16.364          4.485           148.24
        30.028          0.325     16.317          4.461           147.83
        34.632          0.325     16.270          4.438           147.42
        41.102          0.326     16.223          4.415           147.02
        52.148          0.327     16.176          4.392           146.61
        66.000          0.327     16.175          4.392           146.60
------------------------------------------------------------------------------
  NODE  1035.00 : HGL = <  179.141>;EGL= <  183.826>;FLOWLINE= <  178.830>

******************************************************************************
  FLOW PROCESS FROM NODE  1035.00 TO NODE  1035.00 IS CODE =  5
  UPSTREAM NODE  1035.00     ELEVATION =   179.16  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
```

```
    UPSTREAM       4.60    18.00     12.00    179.16      0.82        20.340
   DOWNSTREAM      4.60    18.00       -      178.83      0.82        17.370
   LATERAL #1      0.00     0.00     0.00       0.00      0.00         0.000
   LATERAL #2      0.00     0.00     0.00       0.00      0.00         0.000
      Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.33831
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.21636
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.27733
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.109 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.036)+( 0.000) =   2.036
------------------------------------------------------------------------------
  NODE  1035.00 : HGL = <  179.439>;EGL= <  185.863>;FLOWLINE= <  179.160>

******************************************************************************
  FLOW PROCESS FROM NODE  1035.00 TO NODE  1030.00 IS CODE =  1
  UPSTREAM NODE  1030.00     ELEVATION =   215.88  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     108.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.28           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.29
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.288     19.346         6.104           174.25
         0.511          0.288     19.386         6.127           174.60
         1.045          0.288     19.425         6.150           174.94
         1.604          0.287     19.464         6.174           175.29
         2.190          0.287     19.504         6.197           175.64
         2.806          0.286     19.544         6.221           175.99
         3.455          0.286     19.584         6.245           176.34
         4.141          0.285     19.624         6.269           176.69
         4.867          0.285     19.664         6.293           177.04
         5.639          0.285     19.705         6.317           177.39
         6.462          0.284     19.745         6.342           177.75
         7.344          0.284     19.786         6.366           178.11
         8.294          0.283     19.827         6.391           178.47
         9.321          0.283     19.867         6.416           178.82
        10.440          0.283     19.909         6.441           179.18
        11.669          0.282     19.950         6.466           179.55
        13.030          0.282     19.991         6.491           179.91
        14.555          0.281     20.033         6.517           180.27
        16.287          0.281     20.074         6.542           180.64
        18.290          0.281     20.116         6.568           181.01
        20.665          0.280     20.158         6.594           181.38
        23.577          0.280     20.200         6.620           181.75
        27.340          0.279     20.243         6.646           182.12
        32.656          0.279     20.285         6.673           182.49
        41.778          0.279     20.328         6.699           182.87
       108.000          0.278     20.334         6.703           182.92
------------------------------------------------------------------------------
  NODE  1030.00 : HGL = <  216.168>;EGL= <  221.984>;FLOWLINE= <  215.880>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE  1030.00 TO NODE  1030.00 IS CODE =  5
  UPSTREAM NODE  1030.00     ELEVATION =   216.21  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00      0.00    216.21      0.82       22.582
    DOWNSTREAM      4.60    18.00       -      215.88      0.82       19.352
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.45519
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.29379
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.37449
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.498 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.404)+( 0.000) =   2.404
------------------------------------------------------------------------------
  NODE  1030.00 : HGL = <  216.469>;EGL= <  224.387>;FLOWLINE= <  216.210>

******************************************************************************
  FLOW PROCESS FROM NODE  1030.00 TO NODE  1025.00 IS CODE =  1
  UPSTREAM NODE  1025.00     ELEVATION =   260.03  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      72.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.24          CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.75
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.752      5.187          1.170            63.91
         0.017          0.732      5.373          1.180            64.46
         0.039          0.711      5.572          1.194            65.17
         0.068          0.691      5.787          1.211            66.04
         0.105          0.670      6.018          1.233            67.11
         0.151          0.650      6.267          1.260            68.38
         0.206          0.629      6.537          1.293            69.87
         0.275          0.609      6.830          1.334            71.61
         0.357          0.589      7.149          1.383            73.61
         0.457          0.568      7.496          1.441            75.91
         0.577          0.548      7.877          1.512            78.54
         0.722          0.527      8.294          1.596            81.53
         0.897          0.507      8.754          1.698            84.95
         1.109          0.486      9.263          1.819            88.83
         1.368          0.466      9.827          1.966            93.25
         1.685          0.446     10.457          2.145            98.29
         2.078          0.425     11.163          2.361           104.04
         2.570          0.405     11.959          2.627           110.63
         3.195          0.384     12.861          2.954           118.20
         4.003          0.364     13.891          3.362           126.95
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          5.074          0.343     15.075          3.875           137.10
          6.546          0.323     16.449          4.527           148.98
          8.679          0.303     18.057          5.369           162.97
         12.061          0.282     19.959          6.472           179.63
         18.592          0.262     22.238          7.945           199.67
         72.000          0.259     22.575          8.177           202.64
------------------------------------------------------------------------------
  NODE  1025.00 : HGL = <  260.782>;EGL= <  261.200>;FLOWLINE= <  260.030>

******************************************************************************
  FLOW PROCESS FROM NODE  1025.00 TO NODE  1025.00 IS CODE =  5
  UPSTREAM NODE  1025.00     ELEVATION =   260.36  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     47.00    260.36      0.82       5.643
    DOWNSTREAM      4.60    18.00       -      260.03      0.82       5.189
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00952
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00760
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00856
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.034 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.359)+( 0.000) =   0.359
------------------------------------------------------------------------------
  NODE  1025.00 : HGL = <  261.064>;EGL= <  261.559>;FLOWLINE= <  260.360>

******************************************************************************
  FLOW PROCESS FROM NODE  1025.00 TO NODE  1020.00 IS CODE =  1
  UPSTREAM NODE  1020.00     ELEVATION =   260.68  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      32.17 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.70          CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.82
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)         (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.823      4.628          1.156            63.12
          0.014          0.818      4.664          1.156            63.13
          0.059          0.813      4.700          1.157            63.14
          0.138          0.808      4.737          1.157            63.16
          0.253          0.803      4.775          1.157            63.18
          0.408          0.798      4.813          1.158            63.22
          0.608          0.793      4.852          1.159            63.26
          0.857          0.788      4.892          1.159            63.31
          1.161          0.783      4.932          1.161            63.37
          1.526          0.777      4.973          1.162            63.44
          1.962          0.772      5.015          1.163            63.52
          2.478          0.767      5.057          1.165            63.60
```

```
         3.085          0.762      5.100          1.166            63.70
         3.799          0.757      5.144          1.168            63.80
         4.638          0.752      5.188          1.170            63.92
         5.626          0.747      5.234          1.172            64.04
         6.796          0.742      5.280          1.175            64.17
         8.189          0.736      5.327          1.177            64.31
         9.867          0.731      5.375          1.180            64.46
        11.918          0.726      5.423          1.183            64.63
        14.477          0.721      5.473          1.186            64.80
        17.776          0.716      5.523          1.190            64.98
        22.242          0.711      5.574          1.194            65.17
        28.843          0.706      5.627          1.198            65.38
        32.170          0.704      5.642          1.199            65.44
------------------------------------------------------------------------------
  NODE  1020.00 : HGL = <  261.503>;EGL= <  261.836>;FLOWLINE= <  260.680>

******************************************************************************
  FLOW PROCESS FROM NODE  1020.00 TO NODE  1020.00 IS CODE =  5
  UPSTREAM NODE  1020.00     ELEVATION =   261.01  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     60.50    261.01      0.82       5.882
    DOWNSTREAM      4.60    18.00       -      260.68      0.82       4.629
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01065
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00562
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00814
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.033 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.393)+( 0.000) =   0.393
------------------------------------------------------------------------------
  NODE  1020.00 : HGL = <  261.692>;EGL= <  262.229>;FLOWLINE= <  261.010>

******************************************************************************
  FLOW PROCESS FROM NODE  1020.00 TO NODE  1015.00 IS CODE =  1
  UPSTREAM NODE  1015.00     ELEVATION =   261.51  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      49.42 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.69          CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.61
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.610      6.814          1.331            71.51
         1.238          0.613      6.765          1.324            71.21
         2.508          0.617      6.717          1.318            70.93
         3.812          0.620      6.670          1.311            70.65
```

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        5.153          0.623      6.624          1.305            70.37
        6.536          0.626      6.578          1.299            70.10
        7.964          0.630      6.532          1.293            69.84
        9.443          0.633      6.487          1.287            69.59
       10.979          0.636      6.443          1.281            69.34
       12.578          0.640      6.399          1.276            69.10
       14.248          0.643      6.356          1.271            68.86
       15.999          0.646      6.314          1.266            68.63
       17.845          0.649      6.272          1.261            68.40
       19.799          0.653      6.230          1.256            68.18
       21.880          0.656      6.189          1.251            67.97
       24.114          0.659      6.149          1.247            67.76
       26.533          0.663      6.109          1.242            67.56
       29.179          0.666      6.069          1.238            67.36
       32.114          0.669      6.030          1.234            67.17
       35.429          0.672      5.992          1.230            66.99
       39.260          0.676      5.954          1.227            66.80
       43.843          0.679      5.916          1.223            66.63
       49.420          0.682      5.880          1.219            66.46
------------------------------------------------------------------------------
  NODE  1015.00 : HGL = <  262.120>;EGL= <  262.841>;FLOWLINE= <  261.510>

******************************************************************************
  FLOW PROCESS FROM NODE  1015.00 TO NODE  1015.00 IS CODE =  5
  UPSTREAM NODE  1015.00     ELEVATION =   261.84  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       4.60    18.00     24.30    261.84      0.82       5.512
    DOWNSTREAM      4.60    18.00       -      261.51      0.82       6.816
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00894
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01589
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01242
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.050 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.188)+( 0.000) =   0.188
------------------------------------------------------------------------------
  NODE  1015.00 : HGL = <  262.557>;EGL= <  263.029>;FLOWLINE= <  261.840>

******************************************************************************
  FLOW PROCESS FROM NODE  1015.00 TO NODE  1010.00 IS CODE =  1
  UPSTREAM NODE  1010.00     ELEVATION =   262.02  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       4.60 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      18.33 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.70           CRITICAL DEPTH(FT) =      0.82
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.82
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
```

```
  CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.823      4.628           1.156             63.12
        0.014          0.818      4.663           1.156             63.13
        0.059          0.813      4.699           1.157             63.14
        0.136          0.808      4.735           1.157             63.16
        0.250          0.803      4.772           1.157             63.18
        0.404          0.798      4.810           1.158             63.22
        0.601          0.793      4.848           1.159             63.26
        0.847          0.788      4.886           1.159             63.31
        1.148          0.783      4.926           1.160             63.36
        1.510          0.778      4.966           1.161             63.43
        1.941          0.773      5.006           1.163             63.50
        2.450          0.768      5.048           1.164             63.59
        3.051          0.763      5.090           1.166             63.68
        3.757          0.758      5.132           1.168             63.78
        4.586          0.753      5.176           1.170             63.88
        5.563          0.748      5.220           1.172             64.00
        6.719          0.743      5.265           1.174             64.13
        8.097          0.738      5.311           1.176             64.26
        9.755          0.733      5.357           1.179             64.41
       11.782          0.728      5.404           1.182             64.56
       14.312          0.723      5.453           1.185             64.73
       17.572          0.718      5.502           1.188             64.90
       18.330          0.717      5.510           1.189             64.93
------------------------------------------------------------------------------
  NODE  1010.00 : HGL = <  262.843>;EGL= <  263.176>;FLOWLINE= <  262.020>

******************************************************************************
  FLOW PROCESS FROM NODE  1010.00 TO NODE  1010.00 IS CODE =  8
  UPSTREAM NODE  1010.00     ELEVATION =   262.02  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       4.60 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.63 FEET/SEC.    VELOCITY HEAD =  0.333 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.333) =  0.067
------------------------------------------------------------------------------
  NODE  1010.00 : HGL = <  263.243>;EGL= <  263.243>;FLOWLINE= <  262.020>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1010.00            FLOWLINE ELEVATION =   262.02
  ASSUMED UPSTREAM CONTROL HGL =    262.84 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
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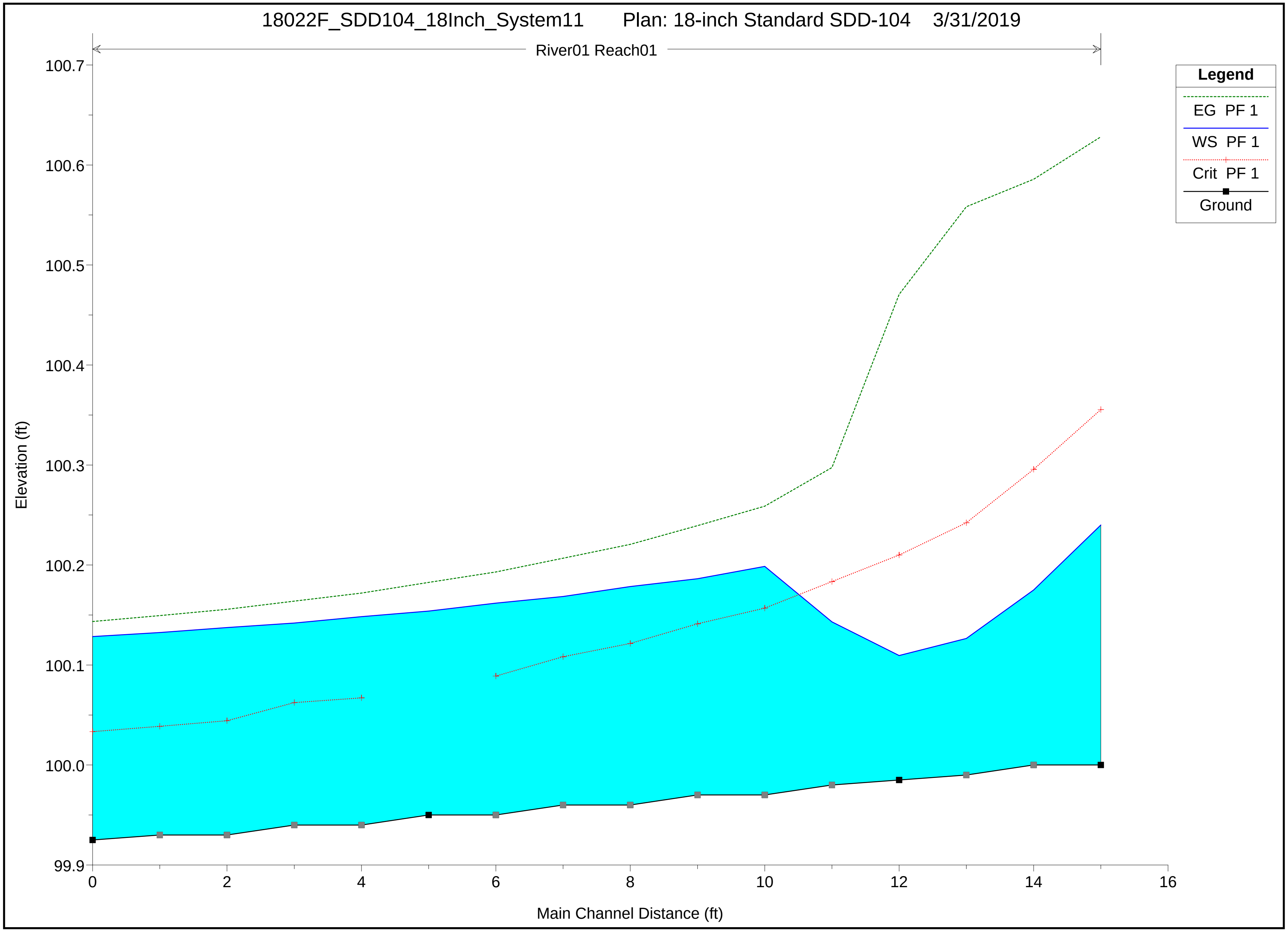
RIP RAP PAD AT NODE 1125
SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104   River: River01   Reach: Reach01   Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	1.80	100.00	100.24	100.36	100.63	0.087762	5.00	0.36	4.44	1.80	
Reach01	99.*	PF 1	1.80	100.00	100.18	100.30	100.59	0.020690	5.14	0.35	4.55	2.17	
Reach01	98.*	PF 1	1.80	99.99	100.13	100.24	100.56	0.030263	5.27	0.34	4.82	2.51	
Reach01	97	PF 1	1.80	99.99	100.11	100.21	100.47	0.232233	4.82	0.37	5.25	2.41	End of Wing Wall
Reach01	96.*	PF 1	1.80	99.98	100.14	100.18	100.30	0.069102	3.15	0.57	6.17	1.38	Start of No.2 Backing
Reach01	95.*	PF 1	1.80	99.97	100.20	100.16	100.26	0.017183	1.97	0.91	7.21	0.73	Hydraulic Jump
Reach01	94.*	PF 1	1.80	99.97	100.19	100.14	100.24	0.016327	1.85	0.97	7.82	0.70	
Reach01	93.*	PF 1	1.80	99.96	100.18	100.12	100.22	0.012793	1.65	1.09	8.49	0.62	
Reach01	92.*	PF 1	1.80	99.96	100.17	100.11	100.21	0.012363	1.57	1.15	9.13	0.61	
Reach01	91.*	PF 1	1.80	99.95	100.16	100.09	100.19	0.009837	1.42	1.27	9.82	0.54	
Reach01	90	PF 1	1.80	99.95	100.15		100.18	0.009530	1.36	1.33	10.48	0.53	
Reach01	89.*	PF 1	1.80	99.94	100.15	100.07	100.17	0.007651	1.23	1.46	10.49	0.48	
Reach01	88.*	PF 1	1.80	99.94	100.14	100.06	100.16	0.007386	1.19	1.51	10.47	0.47	
Reach01	87.*	PF 1	1.80	99.93	100.14	100.04	100.16	0.005942	1.08	1.66	10.48	0.42	End of No.2 Backing
Reach01	86.*	PF 1	1.80	99.93	100.13	100.04	100.15	0.005705	1.05	1.72	10.47	0.41	
Reach01	85	PF 1	1.80	99.93	100.13	100.03	100.14	0.005008	0.98	1.83	10.47	0.38	

18022F_SDD104_18Inch_System11 Plan: 18-inch Standard SDD-104 3/31/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
100.7
100.6
100.5
100.4
100.3
100.2
100.1
100.0
99.9
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
*******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                               *
 * SYSTEM 11 - MAINLINE VELOCITY RUN FROM NODES 1125 TO 1115                *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                 *
  **************************************************************************

   FILE NAME: 1125_V.PIP
   TIME/DATE OF STUDY: 18:17 03/31/2019
*******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                    DOWNSTREAM RUN
    NODE    MODEL   PRESSURE     PRESSURE+        FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1125.00-             0.50 Dc           18.84       0.41*             20.15
         } FRICTION
  1120.00-             0.50 Dc           18.84       0.38*             21.09
         } JUNCTION
  1120.00-             0.51 Dc           18.84       0.18*             51.20
         } FRICTION
  1150.00-             0.50*Dc           18.84       0.50*Dc           18.84
         } CATCH BASIN
  1150.00-             0.73*             10.02       0.50 Dc            6.82
-------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
*******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1125.00            FLOWLINE ELEVATION =   154.55
  PIPE FLOW =       1.80 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   154.550 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.50 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
-------------------------------------------------------------------------------
  NODE  1125.00 : HGL = <  154.960>;EGL= <  155.288>;FLOWLINE= <  154.550>

*******************************************************************************
  FLOW PROCESS FROM NODE  1125.00 TO NODE  1120.00 IS CODE =  1
  UPSTREAM NODE  1120.00     ELEVATION =   154.73  (FLOW IS SUPERCRITICAL)
-------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.80 CFS     PIPE DIAMETER =  18.00 INCHES
```

```
  PIPE LENGTH =      18.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.42           CRITICAL DEPTH(FT) =      0.50
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.38
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.384      5.040          0.779             21.09
         0.654          0.385      5.013          0.776             21.03
         1.327          0.387      4.987          0.773             20.97
         2.021          0.388      4.961          0.771             20.92
         2.738          0.390      4.935          0.768             20.86
         3.480          0.391      4.909          0.766             20.80
         4.250          0.393      4.883          0.763             20.75
         5.051          0.394      4.858          0.761             20.69
         5.886          0.395      4.833          0.758             20.64
         6.759          0.397      4.808          0.756             20.58
         7.677          0.398      4.784          0.754             20.53
         8.643          0.400      4.759          0.752             20.48
         9.667          0.401      4.735          0.750             20.43
        10.756          0.403      4.711          0.748             20.38
        11.923          0.404      4.688          0.746             20.34
        13.183          0.406      4.664          0.744             20.29
        14.554          0.407      4.641          0.742             20.24
        16.064          0.409      4.618          0.740             20.20
        17.749          0.410      4.595          0.738             20.15
        18.000          0.410      4.592          0.738             20.15
------------------------------------------------------------------------------
  NODE  1120.00 : HGL = <  155.114>;EGL= <  155.509>;FLOWLINE= <  154.730>

******************************************************************************
  FLOW PROCESS FROM NODE  1120.00 TO NODE  1120.00 IS CODE =  5
  UPSTREAM NODE  1120.00     ELEVATION =   155.06  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       1.80    18.00     60.00    155.06      0.50      14.513
    DOWNSTREAM      1.80    18.00       -      154.73      0.50       5.041
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.28649
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01427
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.15038
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.602 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.006)+( 0.000) =   3.006
------------------------------------------------------------------------------
  NODE  1120.00 : HGL = <  155.244>;EGL= <  158.515>;FLOWLINE= <  155.060>

******************************************************************************
  FLOW PROCESS FROM NODE  1120.00 TO NODE  1150.00 IS CODE =  1
  UPSTREAM NODE  1150.00     ELEVATION =   202.18  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
```

```
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       1.80 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     140.78 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.18           CRITICAL DEPTH(FT) =      0.50
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.50
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.505      3.444          0.689            18.84
          0.002          0.492      3.570          0.690            18.86
          0.009          0.479      3.706          0.692            18.93
          0.021          0.466      3.850          0.696            19.04
          0.038          0.452      4.006          0.702            19.21
          0.063          0.439      4.173          0.710            19.43
          0.096          0.426      4.352          0.721            19.71
          0.138          0.413      4.546          0.734            20.06
          0.192          0.400      4.756          0.752            20.48
          0.258          0.387      4.984          0.773            20.97
          0.340          0.374      5.232          0.799            21.55
          0.441          0.361      5.502          0.831            22.21
          0.564          0.348      5.798          0.870            22.99
          0.715          0.334      6.124          0.917            23.87
          0.901          0.321      6.482          0.974            24.89
          1.129          0.308      6.879          1.043            26.05
          1.413          0.295      7.320          1.128            27.39
          1.767          0.282      7.812          1.230            28.91
          2.216          0.269      8.365          1.356            30.66
          2.794          0.256      8.989          1.511            32.66
          3.557          0.243      9.698          1.704            34.98
          4.598          0.230     10.508          1.945            37.66
          6.092          0.217     11.443          2.251            40.79
          8.438          0.203     12.530          2.643            44.46
         12.917          0.190     13.806          3.152            48.80
        140.780          0.184     14.508          3.455            51.20
------------------------------------------------------------------------------
  NODE  1150.00 : HGL = <  202.685>;EGL= <  202.869>;FLOWLINE= <  202.180>

******************************************************************************
  FLOW PROCESS FROM NODE  1150.00 TO NODE  1150.00 IS CODE =  8
  UPSTREAM NODE  1150.00     ELEVATION =   202.18  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       1.80 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   3.44 FEET/SEC.    VELOCITY HEAD =  0.184 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.184) =  0.037
------------------------------------------------------------------------------
  NODE  1150.00 : HGL = <  202.906>;EGL= <  202.906>;FLOWLINE= <  202.180>

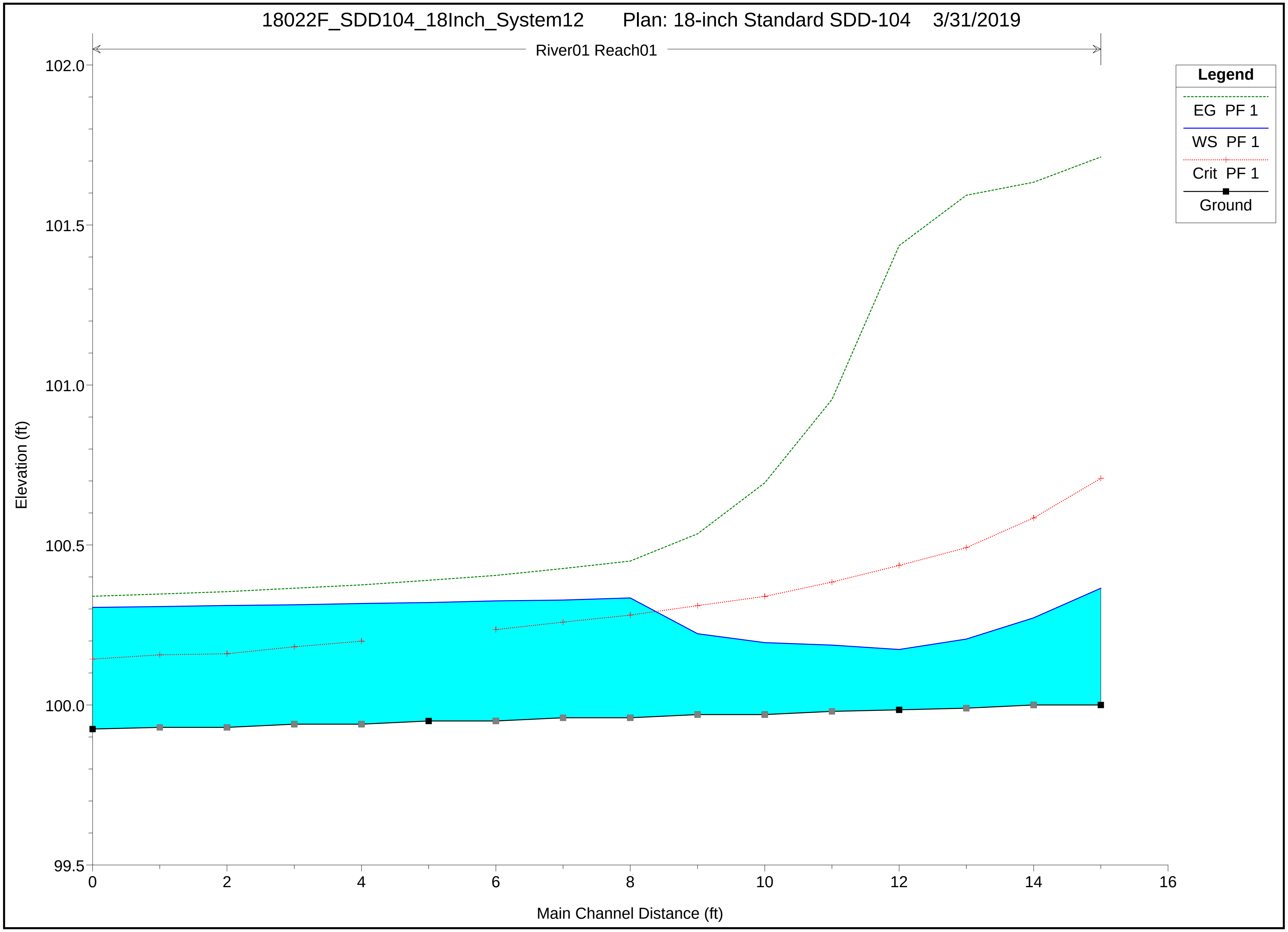
******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1150.00            FLOWLINE ELEVATION =   202.18
  ASSUMED UPSTREAM CONTROL HGL =    202.68 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

RIP RAP PAD AT NODE 1230
SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch_SDD104   River: River01   Reach: Reach01   Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	5.10	100.00	100.37	100.71	101.71	0.174164	9.32	0.55	5.19	2.72	
Reach01	99.*	PF 1	5.10	100.00	100.27	100.58	101.63	0.038011	9.36	0.54	5.13	3.16	
Reach01	98.*	PF 1	5.10	99.99	100.21	100.49	101.59	0.052795	9.45	0.54	5.30	3.58	
Reach01	97	PF 1	5.10	99.99	100.17	100.44	101.44	0.465908	9.01	0.57	5.63	3.66	End of Wing Wall Facing Class
Reach01	96.*	PF 1	5.10	99.98	100.19	100.38	100.95	0.249892	7.03	0.73	6.42	2.72	
Reach01	95.*	PF 1	5.10	99.97	100.19	100.34	100.69	0.145952	5.67	0.90	7.19	2.11	
Reach01	94.*	PF 1	5.10	99.97	100.22	100.31	100.54	0.078093	4.49	1.14	7.98	1.57	
Reach01	93.*	PF 1	5.10	99.96	100.33	100.28	100.45	0.017048	2.72	1.87	9.10	0.78	Hydraulic Jump
Reach01	92.*	PF 1	5.10	99.96	100.33	100.26	100.43	0.014964	2.52	2.02	9.67	0.73	
Reach01	91.*	PF 1	5.10	99.95	100.33	100.24	100.40	0.011758	2.27	2.25	10.29	0.65	
Reach01	90	PF 1	5.10	99.95	100.32		100.39	0.010498	2.12	2.40	10.86	0.61	
Reach01	89.*	PF 1	5.10	99.94	100.32	100.20	100.38	0.008478	1.93	2.64	10.88	0.55	
Reach01	88.*	PF 1	5.10	99.94	100.31	100.18	100.36	0.007660	1.82	2.80	10.87	0.53	
Reach01	87.*	PF 1	5.10	99.93	100.31	100.16	100.35	0.006301	1.67	3.05	10.89	0.48	End of Facing Class
Reach01	86.*	PF 1	5.10	99.93	100.31	100.16	100.35	0.005745	1.59	3.21	10.88	0.46	
Reach01	85	PF 1	5.10	99.93	100.31	100.14	100.34	0.005008	1.49	3.42	10.89	0.43	


18022F_SDD104_18Inch_System12 Plan: 18-inch Standard SDD-104 3/31/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
102.0
101.5
101.0
100.5
100.0
99.5
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
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  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                              *
 * SYSTEM 12 - MAINLINE VELOCITY RUN FROM NODES 1230 TO 1210               *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                *
  **************************************************************************

   FILE NAME: 1230_V.RAT
   TIME/DATE OF STUDY: 17:42 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                 DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1230.00-             0.88 Dc           74.13       0.59*            90.71
         } FRICTION
  1225.00-             0.88 Dc           74.13       0.53*           101.26
         } JUNCTION
  1225.00-             0.97              75.18       0.27*           238.15
         } FRICTION
  1220.00-             0.88 Dc           74.13       0.32*           191.12
         } JUNCTION
  1220.00-             0.88 Dc           74.13       0.29*           225.48
         } FRICTION
  1215.00-             0.88*Dc           74.13       0.88*Dc          74.13
         } JUNCTION
  1215.00-             1.19              85.40       0.36*           163.80
         } FRICTION
  1210.00-             0.88*Dc           74.13       0.88*Dc          74.13
         } CATCH BASIN
  1210.00-             1.31*             41.13       0.88 Dc          25.37
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1230.00            FLOWLINE ELEVATION =   138.54
  PIPE FLOW =       5.20 CFS        PIPE DIAMETER =  18.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   138.540 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  0.88 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
```

```
  NODE  1230.00 : HGL = <  139.133>;EGL= <  140.128>;FLOWLINE= <  138.540>

******************************************************************************
  FLOW PROCESS FROM NODE  1230.00 TO NODE  1225.00 IS CODE =  1
  UPSTREAM NODE  1225.00     ELEVATION =   138.70  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.75           CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.53
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.531      9.280          1.869           101.26
          2.115          0.540      9.080          1.821            99.55
          4.260          0.548      8.888          1.776            97.92
          6.438          0.557      8.704          1.734            96.38
          8.653          0.566      8.526          1.695            94.91
         10.909          0.574      8.355          1.659            93.51
         13.209          0.583      8.190          1.625            92.19
         15.558          0.591      8.031          1.593            90.93
         16.000          0.593      8.003          1.588            90.71
------------------------------------------------------------------------------
  NODE  1225.00 : HGL = <  139.231>;EGL= <  140.569>;FLOWLINE= <  138.700>

******************************************************************************
  FLOW PROCESS FROM NODE  1225.00 TO NODE  1225.00 IS CODE =  5
  UPSTREAM NODE  1225.00     ELEVATION =   139.03  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.20    18.00    60.00    139.03      0.88      23.480
    DOWNSTREAM      5.20    18.00      -      138.70      0.88       9.283
    LATERAL #1      0.00     0.00     0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00     0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.45880
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.03390
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.24635
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.985 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 7.296)+( 0.000) =   7.296
------------------------------------------------------------------------------
  NODE  1225.00 : HGL = <  139.304>;EGL= <  147.865>;FLOWLINE= <  139.030>

******************************************************************************
  FLOW PROCESS FROM NODE  1225.00 TO NODE  1220.00 IS CODE =  1
  UPSTREAM NODE  1220.00     ELEVATION =   204.71  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =     140.00 FEET          MANNING'S N  =  0.01300
```

```
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.27           CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.32
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY       SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)      ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.321     18.735          5.775           191.12
          0.414          0.319     18.896          5.867           192.72
          0.850          0.317     19.061          5.962           194.34
          1.310          0.315     19.228          6.060           195.99
          1.796          0.314     19.397          6.159           197.66
          2.311          0.312     19.569          6.262           199.37
          2.857          0.310     19.744          6.366           201.09
          3.439          0.308     19.921          6.474           202.85
          4.061          0.306     20.101          6.584           204.64
          4.726          0.304     20.284          6.697           206.45
          5.442          0.302     20.470          6.813           208.29
          6.215          0.300     20.659          6.931           210.17
          7.053          0.298     20.851          7.053           212.07
          7.967          0.296     21.046          7.178           214.01
          8.971          0.294     21.244          7.307           215.98
         10.082          0.292     21.446          7.439           217.98
         11.322          0.290     21.651          7.574           220.02
         12.722          0.288     21.859          7.713           222.09
         14.325          0.286     22.071          7.855           224.20
         16.193          0.285     22.287          8.002           226.34
         18.426          0.283     22.506          8.152           228.52
         21.185          0.281     22.728          8.307           230.74
         24.779          0.279     22.955          8.466           233.00
         29.895          0.277     23.186          8.630           235.29
         38.745          0.275     23.420          8.798           237.63
        140.000          0.274     23.473          8.835           238.15
------------------------------------------------------------------------------
  NODE  1220.00 : HGL = <  205.031>;EGL= <  210.485>;FLOWLINE= <  204.710>

******************************************************************************
  FLOW PROCESS FROM NODE  1220.00 TO NODE  1220.00 IS CODE =  5
  UPSTREAM NODE  1220.00     ELEVATION =   205.04  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.20    18.00     15.00    205.04      0.88       22.207
    DOWNSTREAM      5.20    18.00       -      204.71      0.88       18.740
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.39172
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.24231
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.31702
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.268 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.498)+( 0.000) =   2.498
------------------------------------------------------------------------------
  NODE  1220.00 : HGL = <  205.325>;EGL= <  212.983>;FLOWLINE= <  205.040>
```

```
******************************************************************************
  FLOW PROCESS FROM NODE  1220.00 TO NODE  1215.00 IS CODE =  1
  UPSTREAM NODE  1215.00     ELEVATION =   225.16  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =      36.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.26          CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.88
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.878      4.837          1.242            74.13
          0.003          0.853      5.007          1.243            74.22
          0.011          0.829      5.191          1.247            74.51
          0.025          0.804      5.389          1.255            74.99
          0.047          0.779      5.604          1.267            75.70
          0.077          0.755      5.837          1.284            76.65
          0.118          0.730      6.090          1.306            77.85
          0.170          0.705      6.365          1.335            79.34
          0.236          0.681      6.666          1.371            81.15
          0.320          0.656      6.996          1.417            83.30
          0.423          0.631      7.359          1.473            85.84
          0.552          0.607      7.759          1.542            88.82
          0.711          0.582      8.201          1.627            92.28
          0.907          0.557      8.694          1.732            96.30
          1.151          0.533      9.244          1.860           100.95
          1.455          0.508      9.862          2.019           106.33
          1.836          0.483     10.559          2.216           112.58
          2.321          0.459     11.350          2.460           119.82
          2.945          0.434     12.255          2.768           128.27
          3.763          0.409     13.298          3.157           138.15
          4.862          0.385     14.509          3.656           149.79
          6.392          0.360     15.930          4.303           163.58
          8.638          0.335     17.616          5.157           180.09
         12.248          0.311     19.640          6.304           200.07
         19.318          0.286     22.106          7.879           224.55
         36.000          0.285     22.200          7.943           225.48
------------------------------------------------------------------------------
  NODE  1215.00 : HGL = <  226.038>;EGL= <  226.402>;FLOWLINE= <  225.160>

******************************************************************************
  FLOW PROCESS FROM NODE  1215.00 TO NODE  1215.00 IS CODE =  5
  UPSTREAM NODE  1215.00     ELEVATION =   225.49  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM       5.20    18.00     90.00    225.49      0.88       15.958
    DOWNSTREAM      5.20    18.00       -      225.16      0.88        4.839
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
```

```
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.15397
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00586
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.07992
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.320 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 3.402)+( 0.000) =   3.402
------------------------------------------------------------------------------
  NODE  1215.00 : HGL = <  225.850>;EGL= <  229.804>;FLOWLINE= <  225.490>

******************************************************************************
  FLOW PROCESS FROM NODE  1215.00 TO NODE  1210.00 IS CODE =  1
  UPSTREAM NODE  1210.00     ELEVATION =   229.08  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =       5.20 CFS     PIPE DIAMETER =  18.00 INCHES
  PIPE LENGTH =       6.42 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.26           CRITICAL DEPTH(FT) =      0.88
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.88
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.878     4.837          1.242             74.13
         0.003          0.853     5.008          1.243             74.22
         0.011          0.829     5.191          1.247             74.51
         0.025          0.804     5.389          1.255             74.99
         0.047          0.779     5.604          1.267             75.70
         0.077          0.755     5.837          1.284             76.65
         0.117          0.730     6.090          1.306             77.85
         0.170          0.705     6.365          1.335             79.35
         0.236          0.681     6.666          1.371             81.15
         0.320          0.656     6.996          1.417             83.31
         0.423          0.631     7.359          1.473             85.85
         0.552          0.607     7.759          1.542             88.82
         0.710          0.582     8.202          1.627             92.28
         0.907          0.557     8.694          1.732             96.30
         1.150          0.533     9.244          1.861            100.95
         1.454          0.508     9.862          2.019            106.34
         1.836          0.483    10.559          2.216            112.58
         2.320          0.459    11.351          2.461            119.83
         2.944          0.434    12.256          2.768            128.28
         3.762          0.409    13.299          3.157            138.16
         4.860          0.385    14.511          3.656            149.80
         6.390          0.360    15.932          4.304            163.60
         6.420          0.360    15.953          4.314            163.80
------------------------------------------------------------------------------
  NODE  1210.00 : HGL = <  229.958>;EGL= <  230.322>;FLOWLINE= <  229.080>

******************************************************************************
  FLOW PROCESS FROM NODE  1210.00 TO NODE  1210.00 IS CODE =  8
  UPSTREAM NODE  1210.00     ELEVATION =   229.08  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       5.20 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =   4.84 FEET/SEC.    VELOCITY HEAD =  0.364 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.364) =  0.073
------------------------------------------------------------------------------
  NODE  1210.00 : HGL = <  230.394>;EGL= <  230.394>;FLOWLINE= <  229.080>
```

```
******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1210.00            FLOWLINE ELEVATION =   229.08
  ASSUMED UPSTREAM CONTROL HGL =    229.96 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
```

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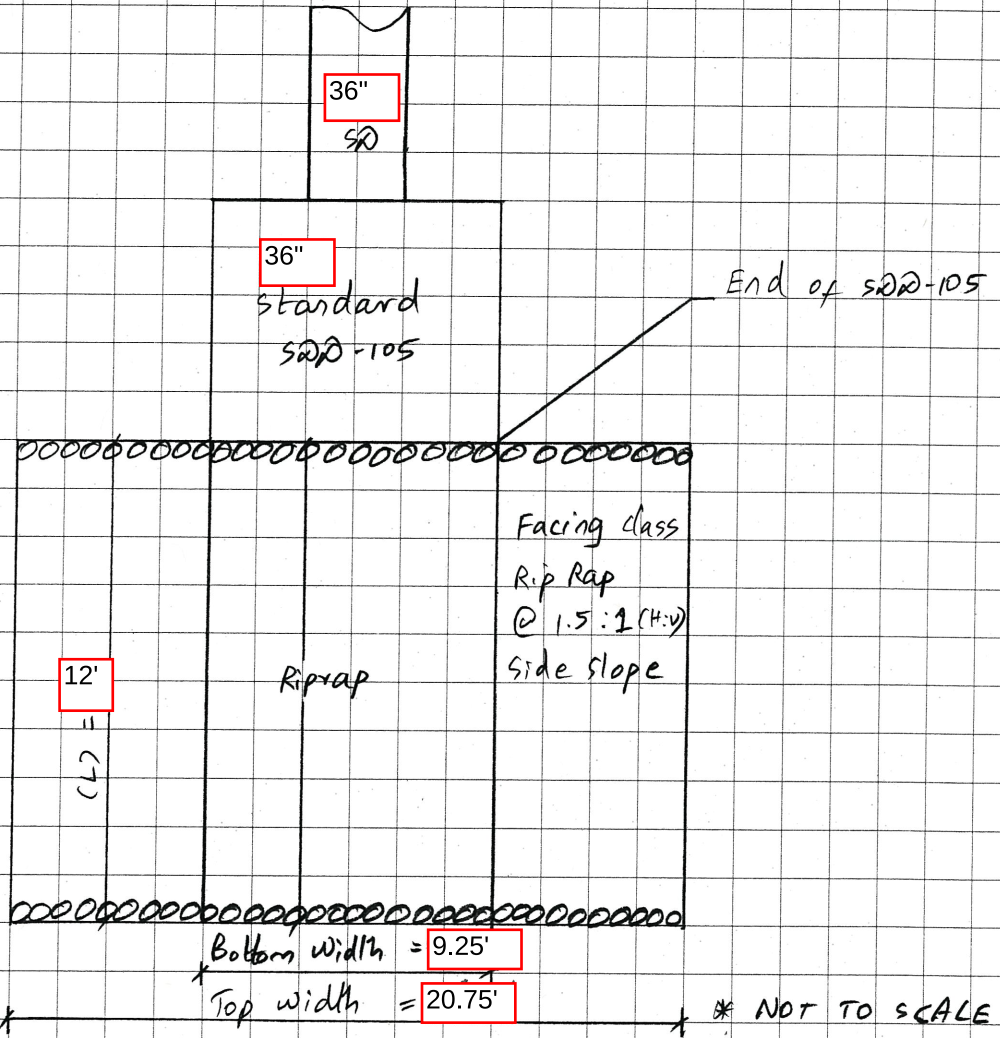
Date 3/312019
Job No. 18022-F
Page
Done By
Checked By

Energy Dissipater @ Node 1350 System 13

[redacted]



∴ Install Facing Class, 20.75' (W) × 12' (L) × 1.4' (T) with filter blanket material per geotechnical engineer's recommendation. For last 5 ft install double Thickness rip-rap – T = 2.8'.

SDD-105 Rip-Rap Sizing

Outfall Location: 1350

Proposed pipe size: 36 inches

STEP 1

Velocity off of proposed pipe: 31.9 feet/second

From AES Pipeflow output for SITE 1 storm drain system.
Please refer to Appendix D - Node 1350

Therefore, Design Velocity: 31.9 ft/sec.
OK Design Velocity < 35 ft/sec

STEP 2

Max Discharge from storm drain pipe,	85	cfs	From SDD-105 Standard Detail
Design Discharge, Q_{design}	41.9	cfs	From AES Pipeflow Run

OK Design Discharge < Max Discharge

Therefore, assuming the flow off of SDD-105 is subcritical and weirs on to the rip-rap

STEP 3

Weir Equation $Q = CLH^{3/2}$

Q_{design}	41.9	cfs	
C	3		
L	12.33	feet	From SDD-105 standard detail
Solving for H, depth of weir flow			
H depth of weir flow	1.09	feet	
Area, A = Length * Height	13.4	square-feet	
Velocity, V	3.1	feet/second	

OK Velocity < 5 ft/sec. Hence, non-erosive

STEP 4

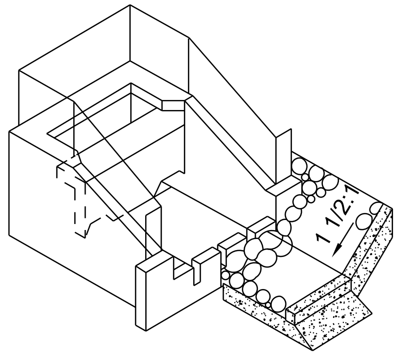
Check for depth of weir flow, H < d+ (g/2)

From SDD-105 standard detail

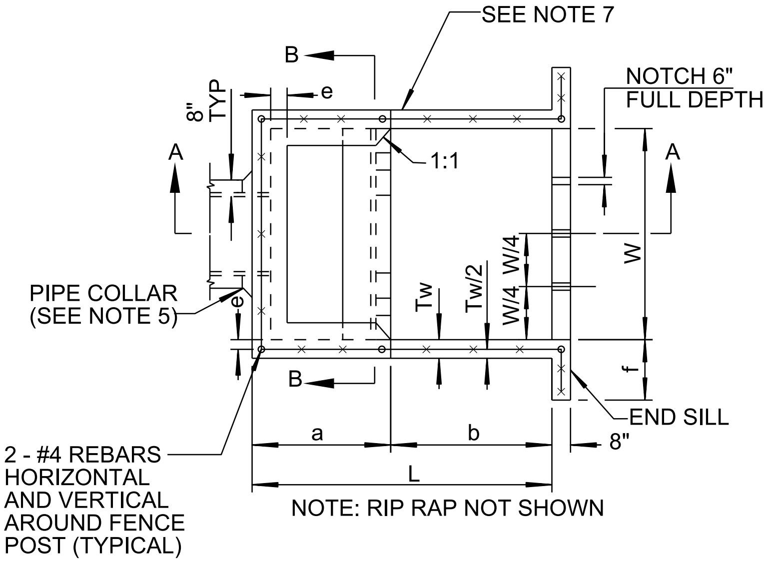
d	1.6	feet
g	3.5	feet
d + (g/2)	3.3	feet

Depth of weir flow off of SDD-105 is less than d+ (g/2)

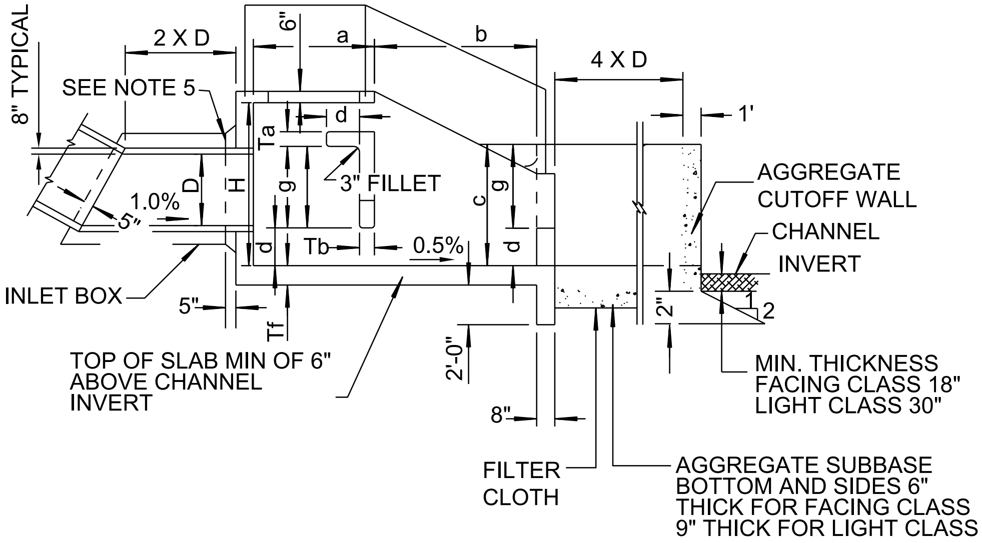
Since, V = **3.1 feet/sec** (< 5 feet/sec), install Facing class riprap, based on Table 200-1.7 off the Whitebook.
Please refer to the end of this Appendix for rip-rap details.

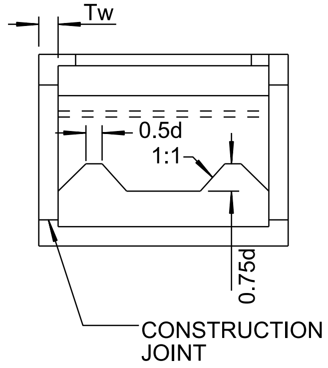


PICTORIAL VIEW



PLAN





SECTION B-B

SECTION A-A

NOTES

SEE TABLE ON SHEET 2 FOR DIMENSIONS, SEE NOTES ON SHEET 2.

SHEET 1 OF 2

REVISION	BY	APPROVED	DATE
ORIGINAL*	KA	J. NAGELVOORT	01/12
UPDATED	BD	J. NAGELVOORT	08/15
UPDATED	AB	J. NAGELVOORT	02/16
REDRAFTED	CD	J. NAGELVOORT	09/18

CITY OF SAN DIEGO – STANDARD DRAWING

CONCRETE ENERGY DISSIPATOR

RECOMMENDED BY THE CITY
OF SAN DIEGO STANDARDS COMMITTEE

CAronga 9/10/18
COORDINATOR R.C.E. 56523 DATE

DRAWING NUMBER **SDD-105**

CONCRETE ENERGY DISSIPATOR DIMENSIONS

Pipe Dia, Inch (D)	18	24	30	36	42	48	54	60	72
Area (sq ft)	1.77	3.14	4.91	7.07	9.62	12.57	15.90	19.63	28.27
Max Q (cfs)	21	38	59	85	115	151	191	236	339
W	5'-6"	6'-9"	8'-0"	9'-3"	10'-6"	11'-9"	13'-0"	14'-3"	16'-6"
H	4'-3"	5'-3"	6'-3"	7'-3"	8'-0"	9'-0"	9'-9"	10'-9"	12'-3"
L	7'-4"	9'-0"	10'-8"	12'-4"	14'-0"	15'-8"	17'-4"	19'-0"	22'-0"
a	3'-3"	3'-11"	4'-7"	5'-3"	6'-0"	6'-9"	7'-4"	8'-0"	9'-3"
b	4'-1"	5'-1"	6'-1"	7'-1"	8'-0"	8'-11"	10'-0"	11'-0"	12'-9"
c	2'-4"	2'-10"	3"-4"	3'-10"	4'-5"	4'-11"	5'-5"	5'-11"	6'-11"
d	0'-11"	1'-2"	1'-4"	1'-7"	1'-9"	2'-0"	2'-2"	2'-5"	2'-9"
e	0'-6"	0'-6"	0'-8"	0'-8"	0'-10"	0'-10"	1'-0"	1'-0"	1'-3"
f	1'-6"	2'-0"	2'-6"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"	3'-0"
g	2'-1"	2'-6"	3'-0"	3'-6"	3'-11"	4'-5"	4'-11"	5'-4"	6'-2"
Tf	8"			10"		12"			
Tb	7"			9 1/2"		10 1/2"			
Tw	7"			9 1/2"		10 1/2"			
Ta	7"			8"					

NOTES

1. DESIGN EQUIVALENT FLUID PRESSURE (EARTH LOADING) = 60 pcf MAXIMUM OUTLET VELOCITY = 35 ft / s
2. CONCRETE SHALL BE 560-C-3250
3. REINFORCING SHALL CONFORM TO ASTM DESIGNATION A615 AND MAY BE GRADE 40 OR 60. REINFORCING SHALL BE PLACED WITH 2" CLEAR CONCRETE COVER UNLESS NOTED OTHERWISE. SPLICES SHALL NOT BE PERMITTED EXCEPT AS INDICATED ON THE PLANS.
4. FOR PIPE GRADES NOT EXCEEDING 20%, INLET BOX MAY BE OMITTED.
5. IF INLET BOX IS OMITTED, CONSTRUCT PIPE COLLAR AS SHOWN.
6. UNLESS NOTED OTHERWISE, ALL REINFORCING BAR BENDS SHALL BE FABRICATED WITH STANDARD HOOKS. FOR STRUCTURAL DETAILS, **SEE D-42** FOR PIPELINE SIZES FROM 18" TO 30" AND **SEE D-43** FOR PIPELINE SIZES FROM 36" TO 72".
7. 5' HIGH CHAIN LINK FENCING, EMBED POST 18" DEEP IN WALLS AND ENCASE WITH CLASS B MORTAR.
8. IN SANDY AND SILTY SOIL:

   A) RIP RAP AND AGGREGATE BASE CUTOFF WALL REQUIRED AT THE END OF ROCK APRON.

   B) FILTER CLOTH (POLYFILTER X OR EQUIVALENT) SHALL BE INSTALLED ON NATIVE SOIL BASE, MINIMUM OF 1' OVERLAPS AT JOINTS
9. RIP RAP AND SUBBASE CLASSIFICATION SHALL BE **AS SHOWN ON PLANS**.
10. FOR RIP RAP SELECTION SEE TABLE 200-1.7 OF THE WHITEBOOK.

SHEET 2 OF 2

REVISION	BY	APPROVED	DATE
ORIGINAL*	KA	J. NAGELVOORT	01/12
UPDATED	BD	J. NAGELVOORT	08/15
UPDATED	AB	J. NAGELVOORT	02/16
REDRAFTED	CD	J. NAGELVOORT	09/18

CITY OF SAN DIEGO – STANDARD DRAWING

CONCRETE ENERGY DISSIPATOR

RECOMMENDED BY THE CITY
OF SAN DIEGO STANDARDS COMMITTEE

9/10/18
COORDINATOR R.C.E. 56523 DATE

DRAWING NUMBER **SDD-105**

```
******************************************************************************
                 PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
           (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                            Analysis prepared by:

                           RICK ENGINEERING COMPANY
                               5620 Friars Road
                         San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY ***************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                                *
 * SYSTEM 13 - MAINLINE VELOCITY RUN FROM NODES 1350 TO 1330                 *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                  *
  ***************************************************************************

   FILE NAME: 1350_V.PIP
   TIME/DATE OF STUDY: 16:26 03/31/2019

******************************************************************************
                GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                          NODAL POINT STATUS TABLE
                 (Note: "*" indicates nodal point data used.)
                       UPSTREAM RUN                  DOWNSTREAM RUN
    NODE    MODEL   PRESSURE      PRESSURE+         FLOW         PRESSURE+
   NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
  1350.00-             2.11 Dc          949.68        0.76*           2437.75
         } FRICTION
  1345.00-             2.11 Dc          949.68        0.72*           2615.56
         } JUNCTION
  1345.00-             2.42             848.63        0.58*           2770.06
         } FRICTION
  1342.50-             1.97 Dc          797.87        0.65*           2352.18
         } JUNCTION
  1342.50-             1.97 Dc          797.87        0.62*           2503.68
         } FRICTION
  1340.00-             1.97 Dc          797.87        1.54*            868.19
         } JUNCTION
  1340.00-             1.97*Dc          797.87        1.97*Dc          797.87
         } FRICTION
  1335.00-             2.03*            798.73        1.97 Dc          797.87
         } JUNCTION
  1335.00-             2.79*            694.33        1.42             382.71
         } FRICTION
  1332.00-             2.24*            505.94        1.47 Dc          381.99
         } JUNCTION
  1332.00-             2.38             496.74        0.74*            621.45
         } FRICTION
  1330.00-             1.49*Dc          359.10        1.49*Dc          359.10
         } CATCH BASIN
  1330.00-             2.24*            200.08        1.49 Dc          122.46
------------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
```

```
  NODE NUMBER =  1350.00            FLOWLINE ELEVATION =   138.67
  PIPE FLOW =      41.90 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =   138.670 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  2.11 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE  1350.00 : HGL = <  139.431>;EGL= <  153.113>;FLOWLINE= <  138.670>

******************************************************************************
  FLOW PROCESS FROM NODE  1350.00 TO NODE  1345.00 IS CODE =  1
  UPSTREAM NODE  1345.00     ELEVATION =   138.77  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      41.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      10.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.72           CRITICAL DEPTH(FT) =      2.11
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.72
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          0.723     31.904        16.538          2615.56
        10.000          0.761     29.674        14.443          2437.75
------------------------------------------------------------------------------
  NODE  1345.00 : HGL = <  139.493>;EGL= <  155.308>;FLOWLINE= <  138.770>

******************************************************************************
  FLOW PROCESS FROM NODE  1345.00 TO NODE  1345.00 IS CODE =  5
  UPSTREAM NODE  1345.00     ELEVATION =   139.10  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.80    36.00      7.82    139.10      1.97       38.647
    DOWNSTREAM     41.90    36.00       -      138.77      2.11       31.913
    LATERAL #1      5.10    18.00     90.00    140.60      0.87        4.804
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.46438
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.24293
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.35365
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.415 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 7.562)+( 0.000) =   7.562
------------------------------------------------------------------------------
  NODE  1345.00 : HGL = <  139.677>;EGL= <  162.870>;FLOWLINE= <  139.100>

******************************************************************************
  FLOW PROCESS FROM NODE  1345.00 TO NODE  1342.50 IS CODE =  1
  UPSTREAM NODE  1342.50     ELEVATION =   188.05  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.80 CFS     PIPE DIAMETER =  36.00 INCHES
```

```
  PIPE LENGTH =     102.94 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.57           CRITICAL DEPTH(FT) =      1.97
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.65
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM       FLOW DEPTH  VELOCITY       SPECIFIC         PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000           0.649     32.712         17.275            2352.18
         1.187           0.646     32.928         17.492            2367.36
         2.434           0.643     33.146         17.714            2382.72
         3.746           0.640     33.367         17.939            2398.27
         5.129           0.637     33.591         18.168            2414.00
         6.589           0.634     33.817         18.402            2429.92
         8.136           0.631     34.045         18.640            2446.03
         9.778           0.628     34.277         18.883            2462.33
        11.527           0.625     34.511         19.130            2478.83
        13.395           0.622     34.748         19.382            2495.54
        15.398           0.619     34.987         19.639            2512.44
        17.555           0.616     35.230         19.900            2529.56
        19.888           0.613     35.476         20.167            2546.89
        22.427           0.610     35.724         20.439            2564.43
        25.207           0.607     35.976         20.717            2582.19
        28.274           0.604     36.231         20.999            2600.17
        31.689           0.601     36.489         21.288            2618.38
        35.534           0.598     36.750         21.582            2636.82
        39.925           0.595     37.014         21.882            2655.49
        45.031           0.592     37.282         22.188            2674.40
        51.113           0.589     37.553         22.500            2693.56
        58.612           0.586     37.827         22.819            2712.96
        68.351           0.583     38.105         23.144            2732.61
        82.179           0.580     38.387         23.475            2752.52
       102.940           0.577     38.635         23.770            2770.06
------------------------------------------------------------------------------
  NODE  1342.50 : HGL = <  188.699>;EGL= <  205.325>;FLOWLINE= <  188.050>

******************************************************************************
  FLOW PROCESS FROM NODE  1342.50 TO NODE  1342.50 IS CODE =  5
  UPSTREAM NODE  1342.50     ELEVATION =   188.38  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.80    36.00       8.50    188.38      1.97       34.874
    DOWNSTREAM     36.80    36.00        -      188.05      1.97       32.723
    LATERAL #1      0.00     0.00       0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00       0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.34719
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.29000
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.31859
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.274 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.560)+( 0.000) =   2.560
------------------------------------------------------------------------------
  NODE  1342.50 : HGL = <  189.000>;EGL= <  207.885>;FLOWLINE= <  188.380>
```

```
****************************************************************************
  FLOW PROCESS FROM NODE  1342.50 TO NODE  1340.00 IS CODE =  1
  UPSTREAM NODE  1340.00     ELEVATION =   214.96  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.80 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      50.03 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.56          CRITICAL DEPTH(FT) =      1.97
============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.54
============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
----------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.538     10.082          3.118          868.19
         0.130          1.499     10.418          3.185          883.35
         0.283          1.460     10.777          3.264          900.45
         0.460          1.421     11.161          3.356          919.65
         0.666          1.381     11.573          3.462          941.11
         0.905          1.342     12.015          3.585          965.04
         1.183          1.303     12.491          3.727          991.67
         1.505          1.264     13.005          3.892         1021.26
         1.879          1.225     13.560          4.082         1054.10
         2.315          1.185     14.162          4.302         1090.53
         2.823          1.146     14.816          4.557         1130.95
         3.420          1.107     15.528          4.853         1175.81
         4.121          1.068     16.306          5.199         1225.65
         4.951          1.029     17.158          5.603         1281.09
         5.940          0.990     18.096          6.077         1342.86
         7.126          0.950     19.131          6.637         1411.85
         8.563          0.911     20.278          7.300         1489.10
        10.326          0.872     21.554          8.091         1575.87
        12.519          0.833     22.982          9.039         1673.69
        15.299          0.794     24.588         10.187         1784.42
        18.913          0.754     26.403         11.586         1910.39
        23.780          0.715     28.469         13.308         2054.49
        30.688          0.676     30.837         15.451         2220.37
        41.423          0.637     33.572         18.149         2412.72
        50.030          0.620     34.863         19.505         2503.68
----------------------------------------------------------------------------
  NODE  1340.00 : HGL = <  216.498>;EGL= <  218.078>;FLOWLINE= <  214.960>

****************************************************************************
  FLOW PROCESS FROM NODE  1340.00 TO NODE  1340.00 IS CODE =  5
  UPSTREAM NODE  1340.00     ELEVATION =   215.29  (FLOW IS AT CRITICAL DEPTH)
----------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.80    36.00      0.00    215.29      1.97       7.466
    DOWNSTREAM     36.80    36.00       -      214.96      1.97       7.466
    LATERAL #1      0.00     0.00      0.00      0.00      0.00       0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00       0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00515
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00515
```

```
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00515
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.021 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.330)+( 0.000) =   0.330
------------------------------------------------------------------------------
  NODE  1340.00 : HGL = <  217.263>;EGL= <  218.128>;FLOWLINE= <  215.290>

******************************************************************************
  FLOW PROCESS FROM NODE  1340.00 TO NODE  1335.00 IS CODE =  1
  UPSTREAM NODE  1335.00     ELEVATION =   215.69  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.80 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      84.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      2.03           CRITICAL DEPTH(FT) =      1.97
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.97
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)         (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.973      7.464          2.838            797.87
          0.013          1.975      7.454          2.838            797.87
          0.054          1.977      7.445          2.838            797.88
          0.126          1.980      7.435          2.838            797.88
          0.230          1.982      7.425          2.838            797.89
          0.371          1.984      7.416          2.839            797.91
          0.552          1.986      7.406          2.839            797.92
          0.778          1.989      7.397          2.839            797.94
          1.054          1.991      7.387          2.839            797.97
          1.385          1.993      7.378          2.839            797.99
          1.779          1.995      7.369          2.839            798.02
          2.245          1.997      7.359          2.839            798.05
          2.793          2.000      7.350          2.839            798.09
          3.436          2.002      7.341          2.839            798.12
          4.191          2.004      7.331          2.839            798.16
          5.080          2.006      7.322          2.839            798.21
          6.131          2.009      7.313          2.840            798.25
          7.382          2.011      7.304          2.840            798.30
          8.886          2.013      7.295          2.840            798.36
         10.722          2.015      7.285          2.840            798.41
         13.011          2.018      7.276          2.840            798.47
         15.958          2.020      7.267          2.841            798.53
         19.944          2.022      7.258          2.841            798.59
         25.828          2.024      7.249          2.841            798.66
         36.364          2.027      7.240          2.841            798.73
         84.000          2.027      7.240          2.841            798.73
------------------------------------------------------------------------------
  NODE  1335.00 : HGL = <  217.717>;EGL= <  218.531>;FLOWLINE= <  215.690>

******************************************************************************
  FLOW PROCESS FROM NODE  1335.00 TO NODE  1335.00 IS CODE =  5
  UPSTREAM NODE  1335.00     ELEVATION =   216.07  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                 (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM     21.00    36.00     90.00    216.07       1.47        3.066
    DOWNSTREAM    36.80    36.00       -      215.69       1.97        7.242
    LATERAL #1    14.30    24.00     48.30    216.69       1.36        5.315
```

```
    LATERAL #2      1.50    18.00     14.80    217.19      0.46        1.082
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00086
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00478
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00282
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.011 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.473)+( 0.000) =   0.473
------------------------------------------------------------------------------
  NODE  1335.00 : HGL = <  218.859>;EGL= <  219.005>;FLOWLINE= <  216.070>

******************************************************************************
  FLOW PROCESS FROM NODE  1335.00 TO NODE  1332.00 IS CODE =  1
  UPSTREAM NODE  1332.00     ELEVATION =   216.67  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      21.00 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     125.44 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.42          CRITICAL DEPTH(FT) =      1.47
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.79
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          2.789      3.065          2.935           694.33
         12.481          2.736      3.104          2.886           673.54
         24.862          2.683      3.147          2.837           653.23
         37.158          2.631      3.195          2.789           633.44
         49.379          2.578      3.248          2.742           614.17
         61.533          2.525      3.306          2.695           595.46
         73.626          2.473      3.368          2.649           577.33
         85.661          2.420      3.436          2.603           559.80
         97.640          2.367      3.509          2.559           542.90
        109.564          2.315      3.587          2.515           526.64
        121.434          2.262      3.672          2.471           511.06
        125.440          2.244      3.702          2.457           505.94
------------------------------------------------------------------------------
  NODE  1332.00 : HGL = <  218.914>;EGL= <  219.127>;FLOWLINE= <  216.670>

******************************************************************************
  FLOW PROCESS FROM NODE  1332.00 TO NODE  1332.00 IS CODE =  5
  UPSTREAM NODE  1332.00     ELEVATION =   217.00  (FLOW IS SUBCRITICAL)
  (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      19.30    30.00     90.00    217.00      1.49       16.006
    DOWNSTREAM     21.00    36.00       -      216.67      1.47        3.703
    LATERAL #1      1.70    36.00     58.70    217.00      0.40        0.565
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
```

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    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.06222
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00120
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03171
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.127 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 2.587)+( 0.000) =   2.587
------------------------------------------------------------------------------
 NODE  1332.00 : HGL = <  217.736>;EGL= <  221.714>;FLOWLINE= <  217.000>

******************************************************************************
 FLOW PROCESS FROM NODE  1332.00 TO NODE  1330.00 IS CODE =  1
 UPSTREAM NODE  1330.00     ELEVATION =   220.72  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =      19.30 CFS     PIPE DIAMETER =  30.00 INCHES
 PIPE LENGTH =      29.57 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
 NORMAL DEPTH(FT) =      0.61           CRITICAL DEPTH(FT) =      1.49
==============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.49
==============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
 DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
  CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          1.490      6.325          2.111           359.10
        0.014          1.455      6.509          2.113           359.41
        0.057          1.420      6.705          2.118           360.35
        0.133          1.385      6.913          2.127           361.97
        0.247          1.350      7.136          2.141           364.30
        0.405          1.315      7.374          2.160           367.40
        0.612          1.280      7.629          2.184           371.31
        0.876          1.245      7.902          2.215           376.11
        1.206          1.210      8.196          2.254           381.86
        1.614          1.175      8.512          2.301           388.64
        2.112          1.140      8.852          2.358           396.53
        2.718          1.105      9.221          2.426           405.64
        3.452          1.070      9.619          2.508           416.08
        4.340          1.035     10.052          2.605           428.00
        5.417          1.000     10.524          2.721           441.53
        6.726          0.965     11.038          2.858           456.87
        8.327          0.930     11.602          3.021           474.22
       10.301          0.895     12.220          3.215           493.84
       12.763          0.860     12.903          3.447           516.02
       15.884          0.825     13.658          3.724           541.11
       19.932          0.790     14.498          4.056           569.53
       25.355          0.755     15.436          4.457           601.80
       29.570          0.736     16.001          4.714           621.45
------------------------------------------------------------------------------
 NODE  1330.00 : HGL = <  222.210>;EGL= <  222.831>;FLOWLINE= <  220.720>

******************************************************************************
 FLOW PROCESS FROM NODE  1330.00 TO NODE  1330.00 IS CODE =  8
 UPSTREAM NODE  1330.00     ELEVATION =   220.72  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =      19.30 CFS          PIPE DIAMETER =  30.00 INCHES
 FLOW VELOCITY =   6.33 FEET/SEC.    VELOCITY HEAD =  0.622 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.622) =  0.124
------------------------------------------------------------------------------
 NODE  1330.00 : HGL = <  222.956>;EGL= <  222.956>;FLOWLINE= <  220.720>
```

```
******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1330.00           FLOWLINE ELEVATION =   220.72
  ASSUMED UPSTREAM CONTROL HGL =    222.21 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
 ♀
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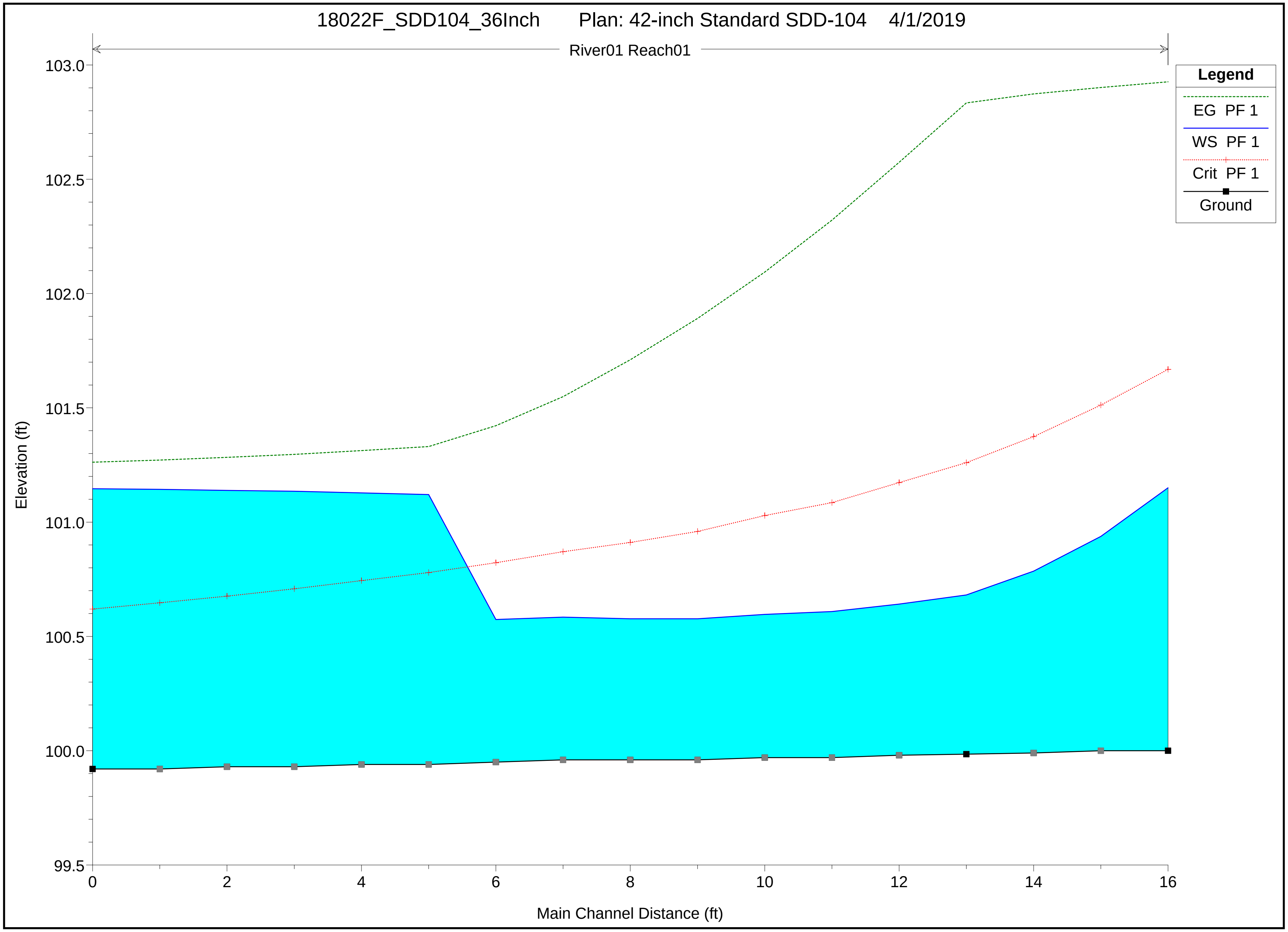
RIP RAP PAD AT NODE 1570
SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 36-inch_SDD104   River: River01   Reach: Reach01   Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		
Reach01	100	PF 1	36.90	100.00	101.15	101.67	102.93	0.007267	10.70	3.45	12.90	1.76	
Reach01	99.*	PF 1	36.90	100.00	100.94	101.51	102.90	0.010549	11.25	3.28	12.62	2.05	
Reach01	98.*	PF 1	36.90	99.99	100.79	101.37	102.87	0.013961	11.60	3.18	12.75	2.29	
Reach01	97	PF 1	36.90	99.99	100.68	101.26	102.83	0.196878	11.77	3.13	13.16	2.49	End of Wing Wall
Reach01	96.*	PF 1	36.90	99.98	100.64	101.17	102.57	0.189386	11.16	3.31	13.19	2.42	Start of 1/4 Ton
Reach01	95.*	PF 1	36.90	99.97	100.61	101.09	102.32	0.175760	10.50	3.51	13.30	2.32	
Reach01	94.*	PF 1	36.90	99.97	100.60	101.03	102.09	0.157861	9.82	3.76	13.48	2.19	
Reach01	93.*	PF 1	36.90	99.96	100.58	100.96	101.89	0.141231	9.20	4.01	13.67	2.06	
Reach01	92.*	PF 1	36.90	99.96	100.58	100.91	101.71	0.121776	8.54	4.32	13.91	1.92	
Reach01	91.*	PF 1	36.90	99.96	100.58	100.87	101.55	0.102139	7.88	4.68	14.19	1.76	
Reach01	90.*	PF 1	36.90	99.95	100.57	100.82	101.42	0.089770	7.39	4.99	14.45	1.65	
Reach01	89.*	PF 1	36.90	99.94	101.12	100.78	101.33	0.009503	3.68	10.03	17.56	0.60	Hydraulic Jump
Reach01	88.*	PF 1	36.90	99.94	101.13	100.74	101.31	0.008306	3.45	10.69	17.79	0.56	
Reach01	87.*	PF 1	36.90	99.93	101.14	100.71	101.30	0.007099	3.22	11.45	18.06	0.52	
Reach01	86.*	PF 1	36.90	99.93	101.14	100.68	101.28	0.006350	3.05	12.09	18.27	0.49	
Reach01	85.*	PF 1	36.90	99.92	101.14	100.65	101.27	0.005530	2.87	12.85	18.52	0.46	
Reach01	84	PF 1	36.90	99.92	101.15	100.62	101.26	0.005001	2.74	13.49	18.72	0.44	End of 1/4 Ton



18022F_SDD104_36Inch Plan: 42-inch Standard SDD-104 4/1/2019
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
103.0
102.5
102.0
101.5
101.0
100.5
100.0
99.5
0
2
4
6
8
10
12
14
16
Main Channel Distance (ft)

```
****************************************************************************
              PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
        (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
       (c) Copyright 1982-2014 Advanced Engineering Software (aes)
          Ver. 21.0  Release Date: 06/01/2014  License ID 1261

                          Analysis prepared by:

                         RICK ENGINEERING COMPANY
                             5620 Friars Road
                        San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

  ************************** DESCRIPTION OF STUDY **************************
 * J#18022-F MAPLE CANYON RESTORATION PHASE 1                              *
 * SYSTEM 15 - MAINLINE VELOCITY RUN FROM NODES 1570 TO 1520               *
 * TAILWATER ASSUMED TO BE FLOWLINE OF PIPE                                *
  **************************************************************************

   FILE NAME: 1570_V.PIP
   TIME/DATE OF STUDY: 11:26 03/31/2019

****************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
              (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                  DOWNSTREAM RUN
   NODE    MODEL   PRESSURE     PRESSURE+        FLOW       PRESSURE+
  NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 1570.00-             1.98 Dc         800.77       1.50*           888.73
        } FRICTION
 1565.00-             1.98 Dc         800.77       1.47*           897.98
        } JUNCTION
 1565.00-             2.57            886.96       0.81*          1745.62
        } FRICTION
 1560.00-             2.24            819.73       0.71*          2076.68
        } JUNCTION
 1560.00-             1.98 Dc         800.77       0.64*          2395.34
        } FRICTION
 1555.00-             1.98 Dc         800.77       0.69*          2159.48
        } JUNCTION
 1555.00-             1.98 Dc         800.77       0.65*          2340.69
        } FRICTION
 1535.00-             1.98 Dc         800.77       1.93*           801.51
        } JUNCTION
 1535.00-             1.98 Dc         800.77       1.87*           804.38
        } FRICTION
 1530.00-             1.98*Dc         800.77       1.97*Dc         800.77
        } JUNCTION
 1530.00-             2.59*           894.13       1.64            839.60
        } FRICTION        } HYDRAULIC JUMP
 1525.00-             1.98 Dc         800.77       1.81*           809.96
        } JUNCTION
 1525.00-             1.98 Dc         800.77       1.73*           820.91
        } FRICTION
 1520.00-             1.98*Dc         800.77       1.98*Dc         800.77
        } CATCH BASIN
 1520.00-             3.02*           668.95       1.98 Dc         266.27
----------------------------------------------------------------------------
  MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
  NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
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  CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
  DESIGN MANUALS.
******************************************************************************
  DOWNSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1570.00            FLOWLINE ELEVATION =    99.75
  PIPE FLOW =      36.90 CFS        PIPE DIAMETER =  36.00 INCHES
  ASSUMED DOWNSTREAM CONTROL HGL =    99.750 FEET
  *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
         IS LESS THAN CRITICAL DEPTH(  1.98 FT.)
  ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
       FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
  NODE  1570.00 : HGL = <  101.246>;EGL= <  102.951>;FLOWLINE= <   99.750>

******************************************************************************
  FLOW PROCESS FROM NODE  1570.00 TO NODE  1565.00 IS CODE =  1
  UPSTREAM NODE  1565.00     ELEVATION =    99.91  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      16.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.59           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.47
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.474     10.669          3.243           897.98
          3.353          1.479     10.625          3.233           895.87
          6.813          1.484     10.582          3.224           893.79
         10.390          1.489     10.539          3.214           891.74
         14.093          1.493     10.496          3.205           889.72
         16.000          1.496     10.475          3.201           888.73
------------------------------------------------------------------------------
  NODE  1565.00 : HGL = <  101.384>;EGL= <  103.153>;FLOWLINE= <   99.910>

******************************************************************************
  FLOW PROCESS FROM NODE  1565.00 TO NODE  1565.00 IS CODE =  5
  UPSTREAM NODE  1565.00     ELEVATION =   100.28  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     60.00    100.28      1.98       23.964
    DOWNSTREAM     36.90    36.00       -       99.91      1.98       10.673
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.12039
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01298
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.06669
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.267 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 6.854)+( 0.000) =   6.854
------------------------------------------------------------------------------
```

```
  NODE  1565.00 : HGL = <  101.090>;EGL= <  110.007>;FLOWLINE= <  100.280>

******************************************************************************
  FLOW PROCESS FROM NODE  1565.00 TO NODE  1560.00 IS CODE =  1
  UPSTREAM NODE  1560.00     ELEVATION =   100.54  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      26.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.59           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.71
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
        0.000          0.712     28.705         13.515         2076.68
        9.294          0.748     26.812         11.918         1944.21
       18.691          0.783     25.129         10.594         1826.92
       26.000          0.810     23.957          9.727         1745.62
------------------------------------------------------------------------------
  NODE  1560.00 : HGL = <  101.252>;EGL= <  114.055>;FLOWLINE= <  100.540>

******************************************************************************
  FLOW PROCESS FROM NODE  1560.00 TO NODE  1560.00 IS CODE =  5
  UPSTREAM NODE  1560.00     ELEVATION =   100.87  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     25.00    100.87      1.98       33.243
    DOWNSTREAM     36.90    36.00       -      100.54      1.98       28.714
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.30255
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.20013
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.25134
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.005 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 4.618)+( 0.000) =   4.618
------------------------------------------------------------------------------
  NODE  1560.00 : HGL = <  101.513>;EGL= <  118.673>;FLOWLINE= <  100.870>

******************************************************************************
  FLOW PROCESS FROM NODE  1560.00 TO NODE  1555.00 IS CODE =  1
  UPSTREAM NODE  1555.00     ELEVATION =   130.70  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      96.00 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.64           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     0.69
==============================================================================
```

```
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          0.692     29.885          14.569          2159.48
          1.428          0.690     30.018          14.691          2168.83
          2.924          0.688     30.152          14.814          2178.25
          4.494          0.686     30.287          14.938          2187.74
          6.145          0.684     30.423          15.065          2197.31
          7.884          0.682     30.560          15.192          2206.97
          9.722          0.679     30.698          15.322          2216.69
         11.669          0.677     30.838          15.453          2226.50
         13.736          0.675     30.978          15.586          2236.39
         15.939          0.673     31.120          15.720          2246.36
         18.296          0.671     31.263          15.856          2256.41
         20.828          0.669     31.406          15.994          2266.54
         23.560          0.666     31.551          16.134          2276.76
         26.525          0.664     31.698          16.276          2287.07
         29.764          0.662     31.845          16.419          2297.45
         33.329          0.660     31.994          16.564          2307.93
         37.288          0.658     32.144          16.711          2318.49
         41.736          0.656     32.295          16.861          2329.15
         46.802          0.653     32.447          17.012          2339.89
         52.679          0.651     32.601          17.165          2350.72
         59.662          0.649     32.755          17.320          2361.64
         68.251          0.647     32.912          17.477          2372.66
         79.377          0.645     33.069          17.636          2383.77
         95.137          0.643     33.228          17.798          2394.98
         96.000          0.643     33.233          17.803          2395.34
------------------------------------------------------------------------------
  NODE  1555.00 : HGL = <  131.392>;EGL= <  145.269>;FLOWLINE= <  130.700>

******************************************************************************
  FLOW PROCESS FROM NODE  1555.00 TO NODE  1555.00 IS CODE =  5
  UPSTREAM NODE  1555.00     ELEVATION =   131.03  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00    15.10    131.03      1.98       32.469
    DOWNSTREAM     36.90    36.00      -      130.70      1.98       29.894
    LATERAL #1      0.00     0.00     0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00     0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.28305
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.22419
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.25362
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  1.014 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 2.784)+( 0.000) =   2.784
------------------------------------------------------------------------------
  NODE  1555.00 : HGL = <  131.683>;EGL= <  148.053>;FLOWLINE= <  131.030>

******************************************************************************
  FLOW PROCESS FROM NODE  1555.00 TO NODE  1535.00 IS CODE =  1
  UPSTREAM NODE  1535.00     ELEVATION =   174.49  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
```

```
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =     109.11 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      0.60           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.93
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)          (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.926      7.692          2.846           801.51
          0.022          1.873      7.946          2.854           804.07
          0.062          1.820      8.220          2.870           808.56
          0.124          1.767      8.516          2.894           815.14
          0.209          1.714      8.836          2.927           823.98
          0.322          1.661      9.183          2.972           835.27
          0.468          1.608      9.561          3.028           849.22
          0.653          1.555      9.971          3.100           866.08
          0.883          1.502     10.419          3.189           886.15
          1.167          1.449     10.910          3.298           909.76
          1.516          1.396     11.448          3.432           937.32
          1.943          1.343     12.040          3.595           969.28
          2.467          1.290     12.694          3.794          1006.21
          3.109          1.237     13.420          4.035          1048.75
          3.899          1.184     14.228          4.329          1097.72
          4.878          1.131     15.132          4.689          1154.07
          6.098          1.078     16.149          5.130          1218.98
          7.636          1.025     17.299          5.674          1293.91
          9.602          0.972     18.607          6.351          1380.69
         12.161          0.919     20.106          7.200          1481.62
         15.575          0.866     21.838          8.275          1599.64
         20.292          0.812     23.855          9.654          1738.57
         27.165          0.759     26.228         11.448          1903.45
         38.129          0.706     29.053         13.821          2101.05
         59.429          0.653     32.458         17.023          2340.68
        109.110          0.653     32.458         17.023          2340.69
------------------------------------------------------------------------------
  NODE  1535.00 : HGL = <  176.416>;EGL= <  177.336>;FLOWLINE= <  174.490>

******************************************************************************
  FLOW PROCESS FROM NODE  1535.00 TO NODE  1535.00 IS CODE =  5
  UPSTREAM NODE  1535.00     ELEVATION =   174.78  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     30.00    174.78      1.98        7.971
    DOWNSTREAM     36.90    36.00       -      174.49      1.98        7.694
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00606
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00554
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00580
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.023 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.300)+( 0.000) =   0.300
```

```
------------------------------------------------------------------------------
  NODE  1535.00 : HGL = <  176.649>;EGL= <  177.635>;FLOWLINE= <  174.780>

******************************************************************************
  FLOW PROCESS FROM NODE  1535.00 TO NODE  1530.00 IS CODE =  1
  UPSTREAM NODE  1530.00     ELEVATION =   174.82  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =       4.81 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.69          CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.97
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)         (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.975      7.475          2.843           800.77
          0.047          1.963      7.525          2.843           800.81
          0.185          1.952      7.576          2.844           800.94
          0.421          1.940      7.628          2.844           801.15
          0.765          1.929      7.681          2.845           801.44
          1.228          1.917      7.734          2.847           801.82
          1.822          1.906      7.788          2.848           802.29
          2.560          1.894      7.844          2.850           802.84
          3.461          1.883      7.900          2.852           803.49
          4.544          1.871      7.957          2.855           804.22
          4.810          1.869      7.969          2.855           804.38
------------------------------------------------------------------------------
  NODE  1530.00 : HGL = <  176.795>;EGL= <  177.663>;FLOWLINE= <  174.820>

******************************************************************************
  FLOW PROCESS FROM NODE  1530.00 TO NODE  1530.00 IS CODE =  5
  UPSTREAM NODE  1530.00     ELEVATION =   175.19  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     61.50   175.19      1.98         5.684
    DOWNSTREAM     36.90    36.00       -     174.82      1.98         7.475
    LATERAL #1      0.00     0.00      0.00     0.00      0.00         0.000
    LATERAL #2      0.00     0.00      0.00     0.00      0.00         0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00282
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00516
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00399
  JUNCTION LENGTH =   4.00 FEET
  FRICTION LOSSES =  0.016 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.621)+( 0.000) =   0.621
------------------------------------------------------------------------------
  NODE  1530.00 : HGL = <  177.782>;EGL= <  178.284>;FLOWLINE= <  175.190>

******************************************************************************
  FLOW PROCESS FROM NODE  1530.00 TO NODE  1525.00 IS CODE =  1
  UPSTREAM NODE  1525.00     ELEVATION =   175.81  (HYDRAULIC JUMP OCCURS)
------------------------------------------------------------------------------
```

```
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      61.90 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.59           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.81
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          1.807       8.289          2.875          809.96
         1.108          1.799       8.337          2.879          810.96
         2.322          1.790       8.384          2.883          812.02
         3.652          1.782       8.433          2.887          813.14
         5.108          1.773       8.482          2.891          814.31
         6.703          1.764       8.532          2.896          815.55
         8.451          1.756       8.582          2.900          816.84
        10.369          1.747       8.633          2.905          818.19
        12.477          1.739       8.685          2.911          819.61
        14.798          1.730       8.737          2.916          821.08
        17.359          1.722       8.790          2.922          822.62
        20.194          1.713       8.844          2.928          824.22
        23.345          1.704       8.899          2.935          825.89
        26.861          1.696       8.954          2.941          827.62
        30.807          1.687       9.010          2.948          829.42
        35.264          1.679       9.066          2.956          831.28
        40.343          1.670       9.124          2.963          833.21
        46.189          1.661       9.182          2.971          835.21
        53.008          1.653       9.241          2.980          837.28
        61.102          1.644       9.301          2.988          839.43
        61.900          1.644       9.306          2.989          839.60
------------------------------------------------------------------------------
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
==============================================================================
  DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     2.59
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
         0.000          2.592       5.682          3.094          894.13
         2.317          2.568       5.727          3.077          887.42
         4.591          2.543       5.774          3.061          880.92
         6.822          2.518       5.823          3.045          874.63
         9.007          2.494       5.874          3.030          868.56
        11.146          2.469       5.927          3.015          862.72
        13.237          2.444       5.982          3.000          857.10
        15.278          2.420       6.038          2.986          851.71
        17.265          2.395       6.097          2.973          846.56
        19.197          2.370       6.158          2.959          841.65
        21.070          2.346       6.221          2.947          836.99
        22.880          2.321       6.287          2.935          832.57
        24.624          2.296       6.354          2.924          828.42
        26.298          2.272       6.424          2.913          824.52
        27.895          2.247       6.496          2.903          820.90
        29.410          2.222       6.571          2.893          817.54
        30.838          2.198       6.648          2.884          814.47
        32.169          2.173       6.728          2.876          811.69
        33.396          2.148       6.810          2.869          809.21
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         34.509          2.124      6.896          2.862           807.02
         35.497          2.099      6.984          2.857           805.15
         36.347          2.074      7.075          2.852           803.60
         37.044          2.050      7.169          2.848           802.37
         37.570          2.025      7.267          2.845           801.49
         37.904          2.000      7.368          2.844           800.95
         38.022          1.976      7.472          2.843           800.77
         61.900          1.976      7.472          2.843           800.77
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    22.81 FEET UPSTREAM OF NODE 1530.00 |
|      DOWNSTREAM DEPTH = 2.322 FEET, UPSTREAM CONJUGATE DEPTH = 1.672 FEET |
------------------------------------------------------------------------------
  NODE  1525.00 : HGL = <  177.617>;EGL= <  178.685>;FLOWLINE= <  175.810>

******************************************************************************
  FLOW PROCESS FROM NODE  1525.00 TO NODE  1525.00 IS CODE =  5
  UPSTREAM NODE  1525.00     ELEVATION =   176.14  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE JUNCTION LOSSES:
       PIPE       FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
     UPSTREAM      36.90    36.00     30.00    176.14      1.98        8.734
    DOWNSTREAM     36.90    36.00       -      175.81      1.98        8.292
    LATERAL #1      0.00     0.00      0.00      0.00      0.00        0.000
    LATERAL #2      0.00     0.00      0.00      0.00      0.00        0.000
       Q5           0.00===Q5 EQUALS BASIN INPUT===

  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
  UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00765
  DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00670
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00718
  JUNCTION LENGTH =   5.00 FEET
  FRICTION LOSSES =  0.036 FEET         ENTRANCE LOSSES =  0.000 FEET
  JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
  JUNCTION LOSSES = ( 0.371)+( 0.000) =   0.371
------------------------------------------------------------------------------
  NODE  1525.00 : HGL = <  177.871>;EGL= <  179.056>;FLOWLINE= <  176.140>

******************************************************************************
  FLOW PROCESS FROM NODE  1525.00 TO NODE  1520.00 IS CODE =  1
  UPSTREAM NODE  1520.00     ELEVATION =   176.36  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
  CALCULATE FRICTION LOSSES(LACFCD):
  PIPE FLOW   =      36.90 CFS     PIPE DIAMETER =  36.00 INCHES
  PIPE LENGTH =      21.53 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
  NORMAL DEPTH(FT) =      1.58           CRITICAL DEPTH(FT) =      1.98
==============================================================================
  UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =     1.98
==============================================================================
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
  DISTANCE FROM      FLOW DEPTH  VELOCITY      SPECIFIC        PRESSURE+
   CONTROL(FT)           (FT)    (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
          0.000          1.976      7.472          2.843           800.77
          0.049          1.960      7.541          2.843           800.84
          0.202          1.944      7.611          2.844           801.07
          0.470          1.928      7.682          2.845           801.45
          0.861          1.913      7.755          2.847           801.99
          1.390          1.897      7.830          2.850           802.69
          2.071          1.881      7.906          2.853           803.56
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        2.920          1.866      7.984          2.856           804.59
        3.958          1.850      8.064          2.860           805.80
        5.207          1.834      8.145          2.865           807.18
        6.696          1.819      8.229          2.871           808.74
        8.459          1.803      8.314          2.877           810.49
       10.536          1.787      8.402          2.884           812.42
       12.980          1.771      8.491          2.892           814.54
       15.854          1.756      8.583          2.900           816.86
       19.242          1.740      8.677          2.910           819.38
       21.530          1.731      8.731          2.916           820.91
------------------------------------------------------------------------------
  NODE  1520.00 : HGL = <  178.336>;EGL= <  179.203>;FLOWLINE= <  176.360>

******************************************************************************
  FLOW PROCESS FROM NODE  1520.00 TO NODE  1520.00 IS CODE =  8
  UPSTREAM NODE  1520.00     ELEVATION =   176.36  (FLOW UNSEALS IN REACH)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      36.90 CFS          PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =   7.47 FEET/SEC.    VELOCITY HEAD =  0.868 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.868) =  0.174
------------------------------------------------------------------------------
  NODE  1520.00 : HGL = <  179.377>;EGL= <  179.377>;FLOWLINE= <  176.360>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1520.00            FLOWLINE ELEVATION =   176.36
  ASSUMED UPSTREAM CONTROL HGL =    178.34 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
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APPENDIX F

Channel Capacity – Normal Depth

Hydraulic Analysis Report

Project Data

Project Title: 18022-F Main Channel

Designer:

Project Date: Monday, June 17, 2019

Project Units: U.S. Customary Units

Notes:

Channel Analysis: 8'_Trap_b=8_n=0.03_s=0.005

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 8.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0300

Flow: 37.0000 cfs

Result Parameters

Depth: 1.1211 ft

Area of Flow: 11.4822 ft^2

Wetted Perimeter: 13.0136 ft

Hydraulic Radius: 0.8823 ft

Average Velocity: 3.2224 ft/s

Top Width: 12.4843 ft

Froude Number: 0.5921

Critical Depth: 0.8127 ft

Critical Velocity: 4.7298 ft/s

Critical Slope: 0.0155 ft/ft

Critical Top Width: 11.25 ft

Calculated Max Shear Stress: 0.3498 lb/ft^2

Calculated Avg Shear Stress: 0.2753 lb/ft^2

Channel Analysis: 8'_Trap_b=8_n=0.06_s=0.005

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 8.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0600

Flow: 37.0000 cfs

Result Parameters

Depth: 1.6467 ft

Area of Flow: 18.5976 ft^2

Wetted Perimeter: 15.3645 ft

Hydraulic Radius: 1.2104 ft

Average Velocity: 1.9895 ft/s

Top Width: 14.5870 ft

Froude Number: 0.3105

Critical Depth: 0.8129 ft

Critical Velocity: 4.7288 ft/s

Critical Slope: 0.0619 ft/ft

Critical Top Width: 11.25 ft

Calculated Max Shear Stress: 0.5138 lb/ft^2

Calculated Avg Shear Stress: 0.3777 lb/ft^2

Channel Analysis: 8'_Trap_b=8_n=0.1_s=0.005

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 8.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.1000

Flow: 37.0000 cfs

Result Parameters

Depth: 2.1674 ft

Area of Flow: 26.7348 ft^2

Wetted Perimeter: 17.6930 ft

Hydraulic Radius: 1.5110 ft

Average Velocity: 1.3840 ft/s

Top Width: 16.6697 ft

Froude Number: 0.1926

Critical Depth: 0.8128 ft

Critical Velocity: 4.7295 ft/s

Critical Slope: 0.1720 ft/ft

Critical Top Width: 11.25 ft

Calculated Max Shear Stress: 0.6762 lb/ft^2

Calculated Avg Shear Stress: 0.4714 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: 18022-F System 13/14 Low-water crossing

Designer:

Project Date: Monday, June 17, 2019

Project Units: U.S. Customary Units

Notes:

Channel Analysis: 12'_Rectangle_b=12_h_=1_n=0.02_s=0.005

Notes:

Input Parameters

Channel Type: Rectangular

Channel Width: 12.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0200

Depth: 1.0000 ft

Result Parameters

Flow: 56.8884 cfs

Area of Flow: 12.0000 ft^2

Wetted Perimeter: 14.0000 ft

Hydraulic Radius: 0.8571 ft

Average Velocity: 4.7407 ft/s

Top Width: 12.0000 ft

Froude Number: 0.8354

Critical Depth: 0.8870 ft

Critical Velocity: 5.3444 ft/s

Critical Slope: 0.0073 ft/ft

Critical Top Width: 12.00 ft

Calculated Max Shear Stress: 0.3120 lb/ft^2

Calculated Avg Shear Stress: 0.2674 lb/ft^2

Channel Analysis: 12'_Rectangle_b=12_h=0.5_n=0.02_s=0.005

Notes:

Input Parameters

Channel Type: Rectangular

Channel Width: 12.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0200

Depth: 0.5000 ft

Result Parameters

Flow: 18.8262 cfs

Area of Flow: 6.0000 ft^2

Wetted Perimeter: 13.0000 ft

Hydraulic Radius: 0.4615 ft

Average Velocity: 3.1377 ft/s

Top Width: 12.0000 ft

Froude Number: 0.7820

Critical Depth: 0.4244 ft

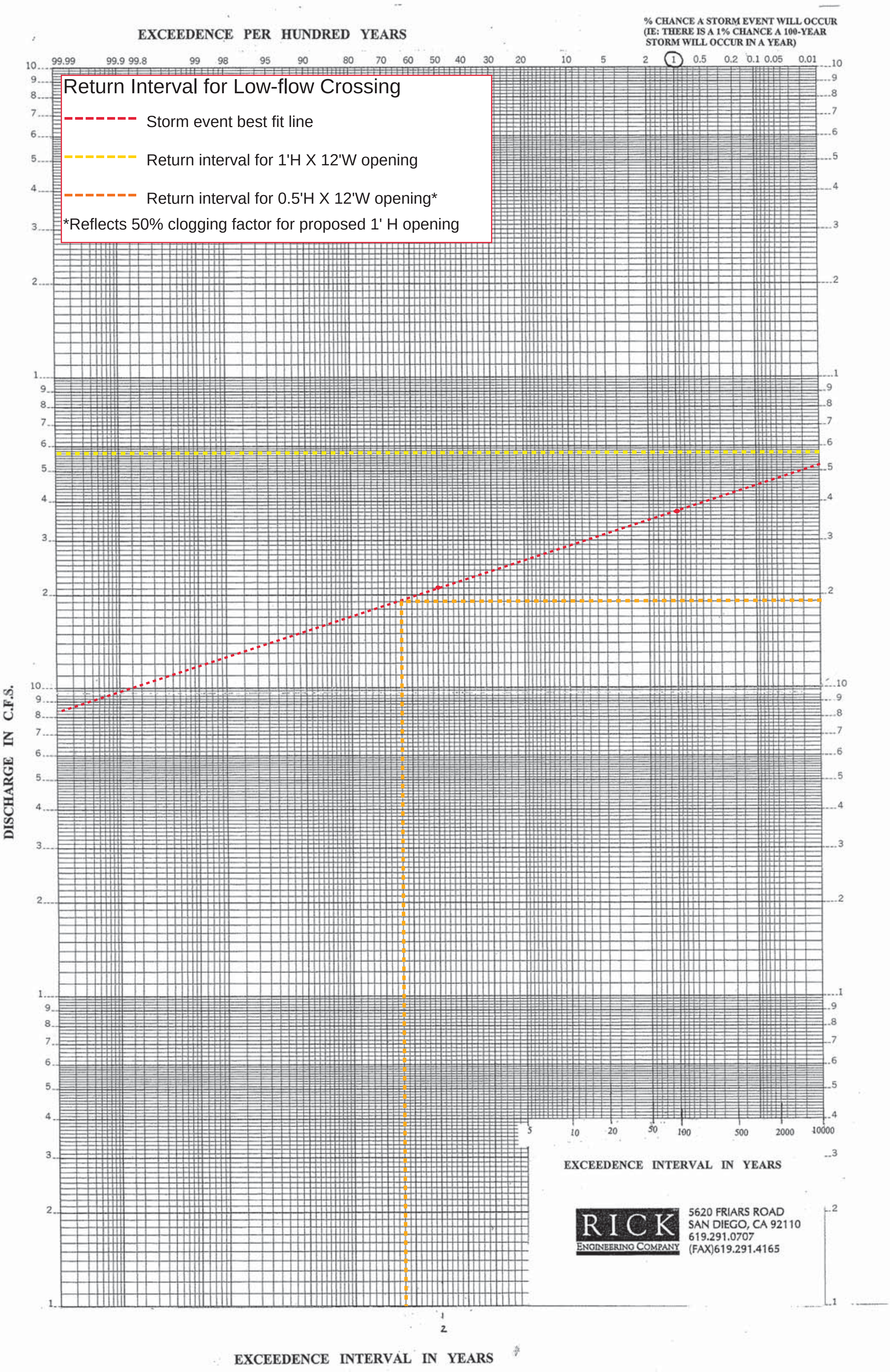
Critical Velocity: 3.6967 ft/s

Critical Slope: 0.0085 ft/ft

Critical Top Width: 12.00 ft

Calculated Max Shear Stress: 0.1560 lb/ft^2

Calculated Avg Shear Stress: 0.1440 lb/ft^2



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MAP POCKET 1

Drainage Study Map
for
Maple Canyon Restoration – Phase I
[Pre-project Condition]

DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(PRE-PROJECT)
SHEET 1 OF 4

J-18022F

Date: June 21, 2019

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LEGEND:

- - - - SUB BASIN BOUNDARY
—— BASIN BOUNDARY
(XX.X AC) SUB BASIN AREA
[XXX] NODE NUMBER
[SYSTEM-X] SYSTEM ID
→ - → FLOW DIRECTION

DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(PRE-PROJECT)
SHEET 2 OF 4

J-18022F

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DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(PRE-PROJECT)
SHEET 3 OF 4

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PRE-PROJECT	POST-PROJECT
Q = 54.7 CFS	Q = 54.7 CFS
A = 21.6 AC	A = 21.6 AC
Tc = 16.9 MIN	Tc = 16.9 MIN

LEGEND:

- - - - -	SUB BASIN BOUNDARY
———	BASIN BOUNDARY
(XX.X AC)	SUB BASIN AREA
XXX	NODE NUMBER
SYSTEM-X	SYSTEM ID
→ → →	FLOW DIRECTION

DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(PRE-PROJECT)
SHEET 4 OF 4

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MAP POCKET 2

Drainage Study Map
for
Maple Canyon Restoration – Phase I
[Post-project Condition]

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'

DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(POST-PROJECT)
SHEET 1 OF 4

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DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(POST-PROJECT)
SHEET 2 OF 4

J-18022F

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DRAINAGE STUDY MAP
FOR
MAPLE CANYON RESTORATION - PHASE 1
(POST-PROJECT)
SHEET 3 OF 4

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DRAINAGE STUDY MAP
FOR
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(POST-PROJECT)
SHEET 4 OF 4

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