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 ENGINEERING COMPANY RICK ENGINEERING CO



DRAINAGE STUDY

FOR

MAPLE CANYON RESTORATION

PHASE I

(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.

Revised: 6-21-19

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 |

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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).

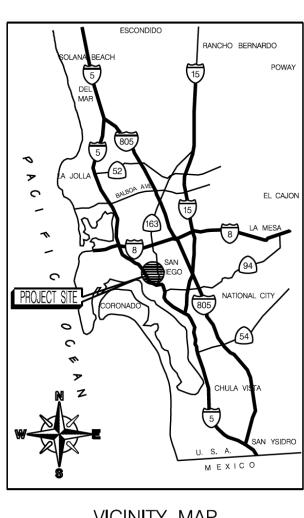


Figure 1: Vicinity Map

VICINITY MAP

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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.

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2.4 Results

The results of the Modified Rational Method analysis for the pre- and post-project Q₁₀₀ 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. |

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| 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 <math>y = 0.4)

a = depth of depression of curb at inlet (ft; use <math>a = 0.33)

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

Curb Inlets in Sump

Curb Inlet Capacity Operating as Shallow Depth Weir

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

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

 C_w = weir coefficient (3.0)

 $L_{\rm w}=$ weir length, in feet (ft)

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

Curb Inlet Capacity Operating as Orifice

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

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

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)Sin Θ =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.

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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,

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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

a 1 (

1

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.

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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

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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.

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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.

Revised: 6-21-19

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).

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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:

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```
******************** DESCRIPTION OF STUDY ******************
  J#18022-F MAPLE CANYON RESTORATION - PHASE 1
 PRE-PROJECT CONDITION HYDROLOGY RUN
 SYSTEM O CANYON HYDROLOGY
 FILE NAME: MCPREO. 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
       5. 00Ō;
               4.400
   1)
  2)
3)
      10.000;
               3.450
               2.900
      15.000;
   4)
      20.000;
               2.500
  5)
      25.000;
               2.200
  6)
      30.000:
               2.000
      40.000;
               1.700
      50.000;
               1.500
  8)
      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*
                                         CURB GUTTER-GEOMETRIES:
           CROWN TO
                      STREET-CROSSFALL:
    HALF-
                                                                  MANNI NG
                     IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
    WI DTH
                                        HEIGHT WIDTH LIP
                                                            HI KE
                                                                  FACTOR
NO.
     (FT)
              (FT)
                                        (FT)
                                                (FT) (FT)
                                                            (FT)
                                                                    (n)
           =======
    =====
                      ==========
                                        =====
                                                0.67
 1
     30.0
              20.0
                      0.018/0.018/0.020
                                                 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<
 ______
```

Page 1

```
*USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S. C. S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = UPSTREAM ELEVATION(FEET) = 283.00
DOWNSTREAM ELEVATION(FEET) = 281.00
ELEVATION DIFFERENCE(FEET) = 2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
  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 (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
  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. 97
                                             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
                            I NTENSI TY
 ** CONFLUENCE DATA **
 STREAM
         RUNOFF
                     Tc
(MIN.)
                                             AREA
 NUMBER
            (CFS)
                              (INCH/HOUR)
                                             (ACRE)
                                                1. 90
                      7. 25
              3. 58
                                  3. 973
     1
             54.72
                     16. 92
                                  2.746
     2
                                               21.60
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.
 ** PEAK FLOW RATE TABLE **
 STREAM
        RUNOFF
                       Tc
                               I NTENSI TY
            (CFS)
                     (MIN.)
 NUMBER
                              (INCH/HOUR)
     1
             41. 40
                      7. 25
                                 3.973
             57. 19
     2
                     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 TRAPEZOI DAL 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
TOTAL AREA(ACRES) = 24.20
                                     SUBAREA RUNOFF(CFS) = 0.86
PEAK FLOW RATE(CFS) = 58
 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 1.02 FLOW VELOCITY(FEET/SEC.) = 10.31
 LONGEST FLOWPATH FROM NODE
                               0.00 \text{ TO NODE} 525.00 = 585.00 \text{ 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) =
```

```
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) =
 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 **
                     Tc
 STREAM
         RUNOFF
                              INTENSITY
                                              AREA
                      (MIN.)
                               (INCH/HOUR)
                                              (ACRE)
24. 20
 NUMBER
             (CFS)
                     17. 11<sup>°</sup>
             58.05
     1
                                  2. 732
              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)
             40. 02
                              4. 107
     1
                       6. 54
             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
                               0.00 TO NODE 525.00 = 585.00 FEET.
 LONGEST FLOWPATH FROM NODE
******************
 FLOW PROCESS FROM NODE 525.00 TO NODE 755.00 IS CODE = 51
______
 >>>>COMPUTE TRAPEZOI DAL 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 SUBARRA 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
PEAK FLOW RATE(CFS) = 60.33
 TOTAL AREA(ACRES) =
 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 =
******************
 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) =
*******************
 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 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
                   (MIN.)
                          (INCH/HOUR)
 NUMBER
          (CFS)
                                       (ACRE)
                              2.709
                                         25.70
    1
           60. 33
                 17. 38
            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 **
                Tc
 STREAM
          RUNOFF
                           INTENSITY
                   (MIN.)
 NUMBER
           (CFS)
                          (INCH/HOUR)
    1
           50.87
                   9. 14
                             3.613
           64.55
                  17. 38
                             2.709
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 64.55 Tc(MIN.) = TOTAL AREA(ACRES) = 27.50
                                        17.38
                     27. 50
 LONGEST FLOWPATH FROM NODE
                          O. OO TO NODE
                                        755.00 = 759.00 FEET.
*******************
 FLOW PROCESS FROM NODE 755.00 TO NODE 430.00 IS CODE = 51
                               Page 5
```

```
>>>>COMPUTE TRAPEZOI DAL 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
TOTAL AREA(ACRES) = 28.30
                                    SUBAREA RUNOFF(CFS) = 0.97
                                     PEAK FLOW RATE(CFS) =
 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 =
********************
 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<
______
 TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 6.76
 RAINFALL INTENSITY(INCH/HR) =
 TOTAL STREAM AREA(ACRES) =
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
 ** CONFLUENCE DATA **
 STREAM
          RUNOFF
                       Tc
                               INTENSITY
                                             AREA
 NUMBER
                     (MIN.)
            (CFS)
                              (INCH/HOUR)
                                            (ACRE)
                                               28.30
             65. 52
                     17. 68<sup>°</sup>
     1
                                  2. 686
              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
                            I NTENSI TY
 NUMBER
           (CFS)
                    (MIN.) (INCH/HOUR)
                           4. 066
                    6. 76<sup>°</sup>
            45. 38
     1
            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 TRAPEZOI DAL 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 MANNI NG'S FACTOR = 0.030 MAXI MUM 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
TOTAL AREA(ACRES) = 32.20
                                  SUBAREA RUNOFF(CFS) = 3.91
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
PAINFALL INTENSITY(INCH/HR) = 2.63
 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) =
*******************
 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(ÀCRES) = 0.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                       1. 10
 ** CONFLUENCE DATA **
                     Tc
(MIN.)
 STRFAM
            RUNOFF
                               INTENSITY
                                             ARFA
             (CFS)
 NUMBER
                              (INCH/HOUR)
                                            (ACRE)
                                               32.20
             70.82
                     18. 31
     1
                                  2. 635
     2
                                  4.054
                                                0.30
                      6.82
              1. 10
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.
 ** PEAK FLOW RATE TABLE **
 STREAM
            RUNOFF
                      Tc
                               I NTENSI TY
                     (MIN.)
 NUMBER
             (CFS)
                              (INCH/HOUR)
                      6.82
             47. 13
     1
                                4. 054
             71.53
                                 2.635
                     18. 31
 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
TOTAL AREA(ACRES) = 33.10
                                     SUBAREA RUNOFF(CFS) = 0.71
PEAK FLOW RATE(CFS) = 72.24
                                     SUBAREA RUNOFF(CFS) =
 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(ÀCRES) = 33.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
******************
 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(ÀCRES) = 2.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                        5.86
 ** CONFLUENCE DATA **
        RUNOFF
 STREAM
                     Tc
(MIN.)
                             INTENSITY
                                            AREA
           (CFS)
72. 24
                                            (ACRE)
 NUMBER
                             (INCH/HOUR)
                     18. 44
                                              33.10
     1
                                 2. 625
             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 **
           RUNOFF
                   Tc
 STREAM
                              I NTENSI TY
                     (MIN.)
 NUMBER
            (CFS)
                             (INCH/HOUR)
             63. 91
                     11. 67
     1
                                3.266
            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
                        35. 10
 LONGEST FLÒWPATH 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 TRAPEZOI DAL 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 MANNI NG'S FACTOR = 0.030 MAXI MUM DEPTH(FEET) = 20.00 100 YEAR RAI NFALL I NTENSI TY(I NCH/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 (FEÉT/SEC.) = 8.98
 AVERAGE FLOW DEPTH(FEET) = 1.26
                                   TRAVEL TIME(MIN.) = 0.15
                                   Page 9
```

```
Tc(MIN.) = 18.59
 SUBAREA AREA (ACRES) = 1.20
                              SUBAREA RUNOFF(CFS) = 1.41
PEAK FLOW RATE(CFS) = 78
 TOTAL AREA(ACRES) =
                   36. 30
                                                   78. 36
 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 1.26 FLOW VELOCITY(FEET/SEC.) = 9.01
 LONGEST FLÓWPATH FROM NODE
                        0.00 \text{ TO NODE} = 1045.00 = 1442.00 \text{ 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) =
******************
 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
                          3.51
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                 4. 53
 ** CONFLUENCE DATA **
 STREAM
       RUNOFF
                 Tc
                         INTENSITY
                                     AREA
                 (MIN.)
 NUMBER
          (CFS)
                         (INCH/HOUR)
                                     (ACRE)
                                       36.30
                 18. 59
                            2.613
    1
           78. 36
           4.53
                            3.507
                  9.70
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.
 ** PEAK FLOW RATE TABLE **
                   Tc
 STREAM
          RUNOFF
                         INTENSITY
                  (MIN.)
 NUMBER
           (CFS)
                         (INCH/HOUR)
          62. 91
                  9. 70
                        3. 507
    1
          81.74
                 18.59
    2
                           2.613
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 81.74 Tc(MIN.) = TOTAL AREA(ACRES) = 37.80
                                      18.59
                          0.00 TO NODE 1045.00 = 1442.00 FEET.
 LONGEST FLOWPATH FROM NODE
*********************
```

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```
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
TOTAL AREA(ACRES) = 39.60
                                       SUBAREA RUNOFF(CFS) = 2.10
                                        PEAK FLOW RATE(CFS) =
 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 =
**************************
 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 ÁREA(ACRES) = 0.50 TOTAL RUNOFF(CFS) =
******************
 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
 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
                       (MIN.)
 NUMBER
             (CFS)
                                (INCH/HOUR)
                                                (ACRE)
                                                   39.60
              83.83
                      18. 90
                                    2. 588
      1
                       6. 27
                                    4. 159
               7.77
                                                   0.50
                                     Page 11
```

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS. ** PEAK FLOW RATE TABLE ** Tc STREAM RUNOFF INTENSITY NUMBER (CFS) (MIN.) (INCH/HOUR) 4. 159 6. 27[´] 59. 93 1 2.588 88. 67 18. 90 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE(CFS) = 88.67 Tc(MIN.) = TOTAL AREA(ACRES) = 40.10 18.90 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): Tc(MIN.) = 19.49SUBAREA AREA(ACRES) = 4.10 TOTAL AREA(ACRES) = 44.20 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE(CFS) = 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 ÁREA(ACRES) = 1.60 TOTAL RUNOFF(CFS) = 5. 12 *******************

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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
                       Tc
(MIN.)
             RUNOFF
                                INTENSITY
                                                 AREA
 NUMBER
              (CFS)
                                (INCH/HOUR)
                                                (ACRE)
              93. 36
                       19. 49´
                                                   44. 20
                                    2.541
     1
      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
                       (MIN.)
                                (INCH/HOUR)
 NUMBER
             (CFS)
              68.66
                        8. 51
                                   3.733
     1
      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(ACRÈS) =
                          45.80
  LONGEST FLÒWPATH 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
TOTAL AREA(ACRES) = 51.60
                                        SUBAREA RUNOFF(CFS) = 6.46
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 \text{ TO NODE} 225.00 = 2344.00 \text{ 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:
                                      Page 13
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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) =
*******************
 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 **
                     Tc
(MIN.)
 STREAM
           RUNOFF
                              INTENSITY
                                            AREA
 NUMBER
                             (INCH/HOUR)
            (CFS)
                                           (ACRE)
                     20. 40
           103.30
                                              51.60
     1
                                 2.476
             2.95
                     10.58
                                 3.386
     2
                                               1.00
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.
 ** PEAK FLOW RATE TABLE **
           RUNOFF
 STRFAM
                      Tc
                              INTENSITY
                     (MIN.)
            (CFS)
78. 49
 NUMBER
                             (INCH/HOUR)
                     10.58
                                3. 386
                     20.40
     2
           105.46
                                2.476
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 105.46 Tc(MIN.) =
                                             20.40
 TOTAL AREA(ACRÈS) =
                       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 TRAPEZOI DAL 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) =
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEÉT/SEC.) = 10.63
                                  Page 14
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```
AVERAGE FLOW DEPTH(FEET) = 2.35 TRAVEL TIME(MIN.) = 0.30
 Tc(MIN.) = 20.70
 TC(MIN.) = \angle 0...0
SUBAREA AREA(ACRES) = 5.10
57.70
                     5.10
                               SUBAREA RUNOFF(CFS) = 5.64
PEAK FLOW RATE(CFS) = 111.10
 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 2.38 FLOW VELOCITY(FEET/SEC.) = 10.69
 LONGEST FLÓWPATH 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 **
                  Tc
 STREAM
        RUNOFF
                          I NTENSI TY
                                       AREA
          (CFS)
111. 10
                  (MIN.)
20.70
 NUMBER
                                       (ACRE)
57.70
                          (INCH/HOUR)
                             2. 458
    1
           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
           (CFS)
 NUMBER
                   (MIN.)
                          (INCH/HOUR)
                  11. 16
    1
          124. 14
                            3.322
          142.13
                  20.70
                             2.458
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 142.13 Tc(MIN.) =
                                        20.70
 TOTAL AREA(ACRÈS) =
                     72.30
 LONGEST FLOWPATH FROM NODE
                           O. OO 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
 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 =
***************************
 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) =
******************
 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
                                I NTENSI TY
                                                 AREA
                       (MIN.)
21.65
                                                (ACRE)
78. 20
 NUMBER
             (CFS)
                                (INCH/HOUR)
             148. 50
     1
                                2. 401
              36. 94
8. 79
      2
                       11.89
                                    3.242
                                                   12.90
                                                    3.30
      3
                                    2.961
                       14.45
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 3 STREAMS.
  ** PEAK FLOW RATE TABLE **
            RUNOFF
 STREAM
                         Tc
                                 INTENSITY
                       (MIN.)
11.89
 NUMBER
             (CFS)
                                (INCH/HOUR)
             154. 95
      1
                                   3.242
             162.97
                                   2.961
      2
                       14. 45
      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 TRAPEZOI DAL 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 MANNI NG'S FACTOR = 0.030 MAXI MUM 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

TOTAL AREA(ACRES) = 96.50
                                       SUBAREA RUNOFF(CFS) = 2.25
PEAK FLOW RATE(CFS) = 185
                                                                  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.
                                      Page 17
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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 1615.0
                                            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
                             2. 37
 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) =
*******************
 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) = TOTAL STREAM AREA(ACRES) =
                             0.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                      2.40
 ** CONFLUENCE DATA **
 STREAM
           RUNOFF
                      Tc
                             INTENSITY
                                           AREA
                    (MIN.)
 NUMBER
            (CFS)
                            (INCH/HOUR)
                                          (ACRE)
                    22. 10<sup>°</sup>
                                             96. 50
                                2.374
     1
           185. 24
             2.40
                                4.001
                                              0.70
     2
                     7. 10
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.
 ** PEAK FLOW RATE TABLE **
 STREAM
                      Tc
           RUNOFF
                             INTENSITY
 NUMBER
            (CFS)
                    (MI N.)
                            (INCH/HOUR)
                                 Page 18
```

MCPREO. RES

1 7. 10 112. 32 4.001 186.66 22. 10 2.374

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE(CFS) = 186.66 Tc(MIN.) = TOTAL AREA(ACRES) = 97.20

22.10

0.00 TO NODE 1615.00 = 3437.00 FEET. LONGEST FLOWPATH FROM NODE

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) 97.20 TC(MIN.) =22.10

= 47.20 PEAK FLOW RATE(CFS)

_____ ______

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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Analysis prepared by:

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

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********************* 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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
            CROWN TO
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
            CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                                HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                        (n)
     =====
            =======
                       ===========
                                           =====
                       0.018/0.018/0.020
      30.0
               20.0
                                           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
                       0. 020/0. 020/0. 020
      25.0
                                                    1.50 0.0100 0.125 0.0160
  3
               20.0
                                           0.50
               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 Page 1

MCPRE1. RES

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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) =
  UPSTREAM ELEVATION(FEET) = 252.00
                                 250. 00
  DOWNSTREAM ELEVATION(FEET) =
  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)
  TOTAL AREA(ACRÈS) =
                            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) =
  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 TREVEL 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) =
  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<
______
  UPSTREAM ELEVATION(FEET) = 196.00 DOWNSTREAM ELEVATION(FEET) = 191.00
  STREET LENGTH(FEET) = 323.00
                                   CURB HEIGHT(INCHES) = 6.0
  STREET HALFWI DTH(FÉET) = 15.00
```

MCPRE1. RES

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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) =
 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) =
 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<
______
 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 AMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PI PE-FLOW(CFS) = 5.45

PI PE TRAVEL TI ME(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
                                  Page 3
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MCPRE1. RES
  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
 HALFSIREEI FLOUD 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) =
     HALFSTREET FLOOD WIDTH(FEET) =
  TOTAL AREA(ACRES) =
  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<
______
  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
PIPE-FLOW(CFS) = 4.06
PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) =
LONGEST FLOWPATH FROM NODE 120.00 TO NODE
                                                      NUMBER OF PIPES = 1
                                                                    140.00 = 650.00 FEET.
                                                    Page 4
```

MCPRE1. RES

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*********************
 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) = TOTAL STREAM AREA(ACRES) =
                              3.62
                             1.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                      4.06
 ** CONFLUENCE DATA **
           RUNOFF
 STREAM
                      Tc
                             INTENSITY
                                           AREA
                    (MIN.)
            (CFS)
                             (INCH/HOUR)
 NUMBER
                                          (ACRE)
                                              2.00
     1
             5.45
                    14. 38
                                2. 968
     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
                    (MIN.)
 NUMBER
            (CFS)
                             (INCH/HOUR)
     1
             8.54
                     9. 12
                               3.618
             8.79
                    14. 38
                               2.968
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE(CFS) = 8.79 Tc(MIN.) = TOTAL AREA (ACRES) = 3.30
                                            14.38
 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<
______
 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
PEAK FLOW RATE(CFS) = 8.79
                           3.30 \text{ TC}(MIN.) =
                                             14. 45
______
______
 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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Analysis prepared by:

RICK ENGINEERING COMPANY 5620 Friars Road San Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
                       STREET-CROSSFALL:
            CROWN TO
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                               HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                        (n)
     =====
            =======
                       ===========
                                          =====
                       0.018/0.018/0.020
      30.0
               20.0
                                           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
                       0. 020/0. 020/0. 020
      25.0
                                                   1.50 0.0100 0.125 0.0160
  3
               20.0
                                           0.50
               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

MCPRE2. RES

```
>>>>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) =
 UPSTREAM ELEVATION(FEET) = 252.00
                             250. 00
 DOWNSTREAM ELEVATION(FEET) =
 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(ACRÈS) =
                         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 HALFWI DTH(FÉET) = 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) =
 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 TREVEL 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) =
 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:
 PEAK FLOW RATE(CFS) =
                             1.00 \text{ TC}(MIN.) = 10.58
                             2.95
______
______
 END OF RATIONAL METHOD ANALYSIS
```

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MCPRE3. RES

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT 2003, 1985, 1981 HYDROLOGY MANUAL

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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 SIZÈ(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
       5. 00Ō;
               4.400
   1)
  2)
3)
       10.000;
               3.450
               2.900
      15.000;
   4)
      20.000;
               2.500
  5)
      25.000;
               2.200
  6)
      30.000:
               2.000
      40.000;
               1.700
      50.000;
               1.500
  8)
      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*
                                         CURB GUTTER-GEOMETRIES:
                      STREET-CROSSFALL:
           CROWN TO
     HALF-
                                                                   MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                         HEIGHT WIDTH LIP
                                                             HI KE
                                                                   FACTOR
NO.
      (FT)
              (FT)
                                         (FT)
                                                 (FT) (FT)
                                                             (FT)
                                                                      (n)
            =======
                      =============
                                         =====
                                                 ===== ======
                      0.018/0.018/0.020
 1
      30.0
              20.0
                                          0.67
                                                  2. 00 0. 0313 0. 167 0. 0150
                      0. 020/0. 020/ ---
0. 020/0. 020/ ---
                                                  1.50 0.0100 0.125 0.0160
 2
              25.0
                                          0.50
      30.0
                                                  1.50 0.0100 0.125 0.0160
      25.0
              20.0
                                          0.50
 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
     ______
```

Page 1

```
MCPRE3. RES
  >>>>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.
  UPSTREAM ELEVATION(FEET) = 277.00
                                    274. 00
  DOWNSTREAM ELEVATION(FEET) =
  ELEVATION DIFFERENCE(FEET) =
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NÓMOGRAPH
  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.) = 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.471

*USED SPECIFIED(SUPAREA)
                                                                   9.89
  *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) =
                                              PEAK FLOW RATE(CFS) =
  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<
```

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

```
MCPRE3. RES
  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) =
  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
TOTAL AREA(ACRES) = 2.00
                                      SUBAREA RUNOFF (CFS) = 1.67
                                           PEAK FLOW RATE(CFS) =
  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
```

2

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT 2003, 1985, 1981 HYDROLOGY MANUAL

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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 SIZÈ(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
       5. 00Ō;
               4.400
  1)
  2)
3)
       10.000;
               3.450
               2.900
      15.000;
   4)
      20.000;
               2.500
  5)
      25.000;
               2.200
  6)
      30.000:
               2.000
      40.000;
               1.700
      50.000;
               1.500
  8)
      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*
                                         CURB GUTTER-GEOMETRIES:
                      STREET-CROSSFALL:
           CROWN TO
     HALF-
                                                                   MANNI NG
                     IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                         HEIGHT WIDTH LIP
                                                             HI KE
                                                                   FACTOR
NO.
     (FT)
              (FT)
                                         (FT)
                                                 (FT) (FT)
                                                             (FT)
                                                                     (n)
            =======
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                                         =====
                                                 ===== ======
                      0.018/0.018/0.020
 1
      30.0
              20.0
                                          0.67
                                                  2. 00 0. 0313 0. 167 0. 0150
                      0. 020/0. 020/ ---
0. 020/0. 020/ ---
                                                  1.50 0.0100 0.125 0.0160
 2
              25.0
                                          0.50
      30.0
                                                  1.50 0.0100 0.125 0.0160
      25.0
              20.0
                                          0.50
 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
    ______
```

Page 1

MCPRE4. RES

```
>>>>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.
  UPSTREAM ELEVATION(FEET) =
                                 276.00
  DOWNSTREAM ELEVATION(FEET) =
                                 272. 00
  ELEVATION DIFFERENCE(FEET) =
                                     4.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NÓMOGRAPH
  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<
______
  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) =
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) = 0.22
    HALFSTREET FLOOD WIDTH(FEET) =
 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.) =
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.066
                                                           6.76
  *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) =
  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.) = PEAK FLOW RATE(CFS) = 2.09
______
______
  END OF RATIONAL METHOD ANALYSIS
```

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MCPRE5. RES

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT 2003, 1985, 1981 HYDROLOGY MANUAL

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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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
            CROWN TO
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                       IN- / OUT-/PARK-
SIDE / SIDE/ WAY
            CROSSFALL
     WI DTH
                                           HEIGHT WIDTH LIP
                                                                HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                         (n)
     =====
            =======
                       ===========
                                           =====
                       0.018/0.018/0.020
      30.0
               20.0
                                            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
                       0. 020/0. 020/0. 020
      25.0
                                                    1.50 0.0100 0.125 0.0160
  3
               20.0
                                            0.50
               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 Page 1

MCPRE5. RES

```
>>>>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) =
  UPSTREAM ELEVATION(FEET) = 277.00
 ELEVATION DIFFERENCE (FEET) = 3.00
URBAN SUBARFA OVERLAND TO 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) =
*********************
  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(FÉET) = 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) =
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =
    **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.)
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.108
                                              Tc(MIN.) =
                                                             6.54
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S. C. S. CURVE NUMBER (AMC II) = 0
SUBAREA AREA(ACRES) = 0.30
TOTAL AREA(ACRES) = 0.40
                                        SUBAREA RUNOFF(CFS) =
                                          PEAK FLOW RATE(CFS) =
  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
PEAK FLOW RATE(CFS) = 1.41
                                 O.40 TC(MIN.) =
______
______
  END OF RATIONAL METHOD ANALYSIS
```

```
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                     2003, 1985, 1981 HYDROLOGY MANUAL
```

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Analysis prepared by:

RICK ENGINEERING COMPANY 5620 Friars Road San Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
            CROWN TO
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
            CROSSFALL
     WI DTH
                                           HEIGHT WIDTH LIP
                                                                HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                         (n)
     =====
            =======
                       ===========
                                           =====
                       0.018/0.018/0.020
      30.0
               20.0
                                            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
                       0. 020/0. 020/0. 020
      25.0
                                                    1.50 0.0100 0.125 0.0160
  3
               20.0
                                            0.50
               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) =
  UPSTREAM ELEVATION(FEET) = 296.00
                                 295. 00
  DOWNSTREAM ELEVATION (FEET) =
  ELEVATION DIFFERENCE (FEET) =
  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)
  TOTAL AREA(ACRÈS) =
                            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) =
  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) =
                                         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
                                 600.00 TO NODE
                                                                989.00 FEET.
  LONGEST FLOWPATH FROM NODE
                                                     610.00 =
*******************
  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 HALFWI DTH(FÉET) = 25.00
```

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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
    HALFSTREET FLOOD WIDTH(FEET) =
   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) = 2
  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<
______
 UPSTREAM ELEVATION(FEET) = 286.00 DOWNSTREAM ELEVATION(FEET) = 276.00
  STREET LENGTH(FEET) = 263.00 CURB HEIGHT(INCHES) = 6.0
  STREET HALFWI DTH(FÉET) = 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) =
    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) = DEAK FLOW RATE(CFS) =
                                          PEAK FLOW RATE(CFS) =
  TOTAL AREA(ACRES) =
                              8.60
  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.
 UPSTREAM ELEVATION(FEET) = 292.00
 DOWNSTREAM ELEVATION(FEÉT) =
                                  290.00
 ELEVATION DIFFERENCE (FEET) =
 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) = 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
                                          Page 4
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S.C.S. CURVE NUMBER (AMC II) =
 SUBAREA AREA(ACRES) = 4.80
                                      SUBAREA RUNOFF (CFS) = 13.64
 TOTAL AREA(ACRES) =
                           4. 90
                                        PEAK FLOW RATE(CFS) =
 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.) = 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
TOTAL AREA(ACRES) = 6.40
                                   SUBAREA RUNOFF(CFS) = 4.05
PEAK FLOW RATE(CFS) =
 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
 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
                        (MIN.)
 NUMBER
              (CFS)
                                 (INCH/HOUR)
                                                 (ACRE)
                                        Page 5
```

```
MCPST6. RES
               22. 16
                        16. 67
                                        2.766
                                                         8.60
                                        3. 174
                                                         6.40
               18.04
                         12. 51
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS.
  ** PEAK FLOW RATE TABLE **
           RUNOFF Tc
  STREAM
                                    I NTENSI TY
                         (MIN.)
 NUMBER
               (CFS)
                                   (INCH/HOUR)
               37. 35
                         12. 51
                                      3. 174
      1
               37.88
                         16.67
                                       2.766
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 37.88
TOTAL AREA(ACRES) = 15.00
                                       Tc(MIN.) =
                                                      16.67
 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<
______
 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 DIRECTION (CES.) = 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) = 1.0
TOTAL AREA(ACRES) = 15.70 TOTAL RUNOFF (CFS) = 39.52
                                     SUBAREA RUNOFF(CFS) = 1.64
 TC(MIN.) = 16.83
***********************
 FLOW PROCESS FROM NODE 680.00 TO NODE 685.00 IS CODE = 41
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
______
 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) =
 UPSTREAM ELEVATION(FEET) = 291.00
 DOWNSTREAM ELEVATION (FEÉT) = 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) =
 FLOW PROCESS FROM NODE 631.00 TO NODE 635.00 IS CODE = 62
______
 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
_____
 UPSTREAM ELEVATION(FEET) = 290.00 DOWNSTREAM ELEVATION(FEET) = 278.00
 STREET LENGTH(FEET) = 615.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWI DTH(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) =
 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.) =
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
TOTAL AREA(ACRES) = 4.90
                                   SUBAREA RUNOFF(CFS) = 14.97
PEAK FLOW RATE(CFS) = 15.33
 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.48 HALFSTREET FLOOD WIDTH(FEET) = 18.79
 FLOW VELOCÍTY(FEET/SEC.) = 4.24 DEPTH*VELOCITÝ(FT*FT/SEC.) =
                                   Page 7
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*******************
 FLOW PROCESS FROM NODE 635.00 TO NODE 685.00 IS CODE = 62
 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
______
  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) =
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =

***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) = 1
  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
 RAINFALL INTENSITY(INCH/HR) = TOTAL STREAM AREA(ACRES) =
  PEAK FLOW RATE(CFS) AT CONFLUENCE =
  ** CONFLUENCE DATA **
  STREAM RUNOFF
                          Tc
                                   I NTENSI TY
                                                   AREA
             (CFS)
                        (MIN.)
                                  (INCH/HOUR)
  NUMBER
                                                   (ACRE)
                                                  1<u>5</u>. 70
               39. 52
                                  2. 747
      1
                        16. 92
                        11. 60
                                      3. 274
              18. 11
                                        Page 8
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RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS.

| ** PEAK F STREAM NUMBER 1 2 | (CFS) 51. 27 | Tc (MIN.) | (I NCI | ENSI TY H/HOUR) . 274 . 747 | | | | |
|---|---|---------------------|----------------------------|--------------------------------------|-------|--------|----------|---------|
| PEAK FLOW TOTAL ARE | CONFLUENCE W RATE(CFS) EA(ACRES) = FLOWPATH FR | = 54 | . 72 - 1 0 | Tc(MIN.) = | 16. | | 1725. 00 | FEET. |
| TOTAL ARE | TUDY SUMMAR EA(ACRES) W RATE(CFS) | = . | ====== 21. 60 54. 72 | TC(MIN.) | = | 16. 92 | | |
| END OF RA | ATI ONAL MET | ====== HOD ANALY | ======: SI S | ======= | ===== | ====== | ====== | ======= |

9

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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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Analysis prepared by:

RICK ENGINEERING COMPANY 5620 Friars Road San Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
            CROWN TO
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                                HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                        (n)
     =====
            =======
                       ===========
                                          =====
                       0.018/0.018/0.020
      30.0
               20.0
                                           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
                       0.020/0.020/0.020
                                                    1.50 0.0100 0.125 0.0160
               20.0
                                           0.50
               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. *
******************
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FLOW PROCESS FROM NODE 700.00 TO NODE 705.00 IS CODE = 21Page 1

MCPRE7. RES

```
>>>>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) =
  UPSTREAM ELEVATION(FEET) = 286.00
                                 285. 00
  DOWNSTREAM ELEVATION (FEET) =
  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)
  TOTAL AREA(ACRÈS) =
                            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) =
  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 TREVEL 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) =
  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 =
*******************
  FLOW PROCESS FROM NODE 710.00 TO NODE 730.00 IS CODE = 41
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
______
 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
                                         Page 2
```

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MCPRE7. RES
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 =
*********************
  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) =
 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) =
*************************
  FLOW PROCESS FROM NODE 720.00 TO NODE 725.00 IS CODE = 62
 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
______
 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) =
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: STREET FLOW DEPTH(FEET) = 0.20
                                                                  0.66
    HALFSTREET FLOOD WIDTH(FEET) =
 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
                                        Page 3
```

MCPRE7. RES

```
*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) =
 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.) =
 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<
 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
 PI PE-FLOW(CFS) = 0.96
PI PE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) =
LONGEST FLOWPATH FROM NODE 715.00 TO NODE
                                             9.61
                                            730.00 = 322.00 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 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.61
RAINFALL INTENSITY(INCH/HR) = 3.52
 TOTAL STREAM AREA(ACRES) =
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                       0.96
 ** CONFLUENCE DATA **
 STREAM RUNOFF
                     Tc
                             I NTENSI TY
                                           AREA
                     (MIN.)
 NUMBER
           (CFS)
                             (INCH/HOUR)
                                           (ACRE)
                                              1.30
     1
             4.07
                     9.04
                                3.632
             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
                     (MIN.)
            (CFS)
 NUMBER
                             (INCH/HOUR)
             5. 00
     1
                     9.04
                               3.632
             4.91
                     9. 61
                                3.524
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 5.00 Tc(MIN.) = TOTAL AREA(ACRES) = 1.60
                                             9.04
 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<
```

MCPRE7. RES

```
>>>>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 TO(MIN) = 9.14
 PIPE TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = LONGEST FLOWPATH FROM NODE 700.00 TO NODE
                                    Tc(MIN.) =
                                                    9. 14
                                                  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) = 3.6°
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.) =
  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) = 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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MCPRE7. RES
   HALFSTREET FLOOD WIDTH(FEET) =
 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.) =
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.458
                                                     9.96
  *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) =
 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
                                               7\dot{4}5.00 = 3\dot{1}6.00 \text{ 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
                                              AREA
                       Tc
                               INTENSITY
                      (MIN.)
 NUMBER
             (CFS)
                              (INCH/HOUR)
                                             (ACRE)
              5.00
                      9. 14´
     1
                                  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 **
                       Tc
 STREAM
            RUNOFF
                               INTENSITY
                      (MIN.)
 NUMBER
             (CFS)
                              (INCH/HOUR)
     1
              5. 63
                       9. 14´
                                 3.613
              5.44
                      9.96
                                 3.458
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 5.63 Tc(MIN.) =
                                                9.14
 TOTAL AREA(ACRÈS) =
                          1.80
 LONGEST FLOWPATH FROM NODE 700.00 TO NODE 745.00 = 583.00 FEET.
END OF STUDY SUMMARY:
 TOTAL AREA(ACRES) = 1.80
PEAK FLOW RATE(CFS) = 5.63
                             1.80 TC(MIN.) =
______
______
 END OF RATIONAL METHOD ANALYSIS
```

9

MCPRE8. RES

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT 2003, 1985, 1981 HYDROLOGY MANUAL

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Analysis prepared by:

RICK ENGINEERING COMPANY 5620 Friars Road San Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
            CROWN TO
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                               HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                        (n)
     =====
            =======
                       ===========
                                          =====
                       0.018/0.018/0.020
      30.0
               20.0
                                           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
      25.0
                       0.020/0.020/0.020
                                                   1.50 0.0100 0.125 0.0160
  3
               20.0
                                           0.50
               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 = 21Page 1

MCPRE8. RES

```
>>>>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) =
 UPSTREAM ELEVATION(FEET) = 285.00
                                284.00
 DOWNSTREAM ELEVATION (FEET) =
 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)
  TOTAL AREA(ACRÈS) =
                            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) =
 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) = TOTAL AREA(ACRES) = 2.40 PEAK FLOW RATE(CFS) =
  TOTAL AREA(ACRES) =
                            2.40
                                        PEAK FLOW RATE(CFS) =
 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
                                 800.00 TO NODE
  LONGEST FLOWPATH FROM NODE
                                                    810.00 =
*******************
 FLOW PROCESS FROM NODE 810.00 TO NODE 820.00 IS CODE = 41
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
______
 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
                                        Page 2
```

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MCPRE8. RES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.19
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PI PE-FLOW(CFS) = 7.47

PI PE TRAVEL TI ME(MI N.) = 0.13 Tc(MI N.) = 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
TOTAL AREA(ACRES) = 2.70
                                  SUBAREA RUNOFF(CFS) = 0.92
                                 TOTAL RUNOFF(CFS) = 8.40
 TC(MIN.) =
******************
                           820.00 TO NODE 830.00 IS CODE = 41
 FLOW PROCESS FROM NODE
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
______
 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.
TOTAL AREA(ACRES) = 3.30 TOTAL RUNOFF(CFS) = 10.21
                                  SUBAREA RUNOFF(CFS) = 1.82
 TC(MIN.) = 9.38
******************
 FLOW PROCESS FROM NODE 830.00 TO NODE 850.00 IS CODE = 41
______
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
______
 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 DAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PI PE-FLOW(CFS) = 10.21

PI PE TRAVEL TIME(MIN.) = 0.22 Tc(MIN.) = LONGEST FLOWPATH FROM NODE 800.00 TO NODE
                                                   9 60
                                                  850.00 = 821.00 FEET.
*******************
```

MCPRE8. RES
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) = 0.00 SUBAREA RUNOFF(CFS) = 1.00 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 DUNOFF (CES

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.) = PEAK FLOW RATE(CFS) = 12.91

9.60

END OF RATIONAL METHOD ANALYSIS

4

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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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Analysis prepared by:

RICK ENGINEERING COMPANY 5620 Friars Road San Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 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 SIZÈ(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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
       30.000:
                2.000
   6)
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
            CROWN TO
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
     HALF-
                                                                      MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
            CROSSFALL
     WI DTH
                                           HEIGHT WIDTH LIP
                                                                HI KE
                                                                      FACTOR
NO.
      (FT)
               (FT)
                                           (FT)
                                                   (FT)
                                                         (FT)
                                                                (FT)
                                                                         (n)
     =====
            =======
                       ============
                                           =====
                       0.018/0.018/0.020
      30.0
               20.0
                                            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
                       0. 020/0. 020/0. 020
      25.0
                                                    1.50 0.0100 0.125 0.0160
  3
               20.0
                                            0.50
               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. *
**************
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FLOW PROCESS FROM NODE 900.00 TO NODE 905.00 IS CODE = 21 Page 1

MCPRE9. RES

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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) =
 UPSTREAM ELEVATION(FEET) = 272.00
                               271. 00
 DOWNSTREAM ELEVATION(FEET) =
 ELEVATION DIFFERENCE (FEET) =
 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(ACRÈS) =
                          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) =
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
                                                             0.70
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
    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.) =
STREET FLOW TRAVEL TIME (MIN.) = 0.82 Tc(MIN.)
                                           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) =
  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:
 IUIAL AREA(ACRES) = 0.30
PEAK FLOW RATE(CFS) = 1.05
  TOTAL AREA(ACRES)
                               0.30 \text{ TC}(MIN.) =
______
______
 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

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********************* 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 SIZÈ(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
       5. 00Ō;
               4.400
   1)
  2)
3)
       10.000;
               3.450
               2.900
      15.000;
   4)
      20.000;
               2.500
  5)
      25.000;
               2.200
  6)
      30.000:
               2.000
      40.000;
               1.700
               1.500
  8)
      50.000;
      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*
                      STREET-CROSSFALL:
                                          CURB GUTTER-GEOMETRI ES:
           CROWN TO
     HALF-
                                                                    MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                         HEIGHT WIDTH LIP
                                                             HI KE
                                                                    FACTOR
NO.
      (FT)
              (FT)
                                         (FT)
                                                 (FT) (FT)
                                                              (FT)
                                                                      (n)
            =======
                      ===========
                                         =====
                                                 ===== ======
                      0.018/0.018/0.020
 1
      30.0
              20.0
                                          0.67
                                                  2. 00 0. 0313 0. 167 0. 0150
                      0. 020/0. 020/ ---
0. 020/0. 020/ ---
                                                  1.50 0.0100 0.125 0.0160
 2
              25.0
                                          0.50
      30.0
                                                  1.50 0.0100 0.125 0.0160
      25.0
              20.0
                                          0.50
 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
     ______
```

Page 1

MCPRE10. RES >>>>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.
  UPSTREAM ELEVATION(FEET) =
                                273.00
                                272.00
  DOWNSTREAM ELEVATION (FEET) =
  ELEVATION DIFFERENCE(FEET) =
  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) =
    **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) =
    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.) = 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.507
                                                         9.70
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S. C. S. CURVE NUMBER (AMC II) = 0
 SUBAREA AREA(ACRES) = 1.40
TOTAL AREA(ACRES) = 1.50
                                      SUBAREA RUNOFF(CFS) = 4.17
                                       PEAK FLOW RATE(CFS) =
  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.) = 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 Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 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 SIZÈ(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
        5. 00Ō;
               4.400
   1)
   2)
3)
       10.000;
                3.450
               2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
   6)
       30.000:
                2.000
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
                       STREET-CROSSFALL:
                                          CURB GUTTER-GEOMETRI ES:
           CROWN TO
     HALF-
                                                                     MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                              HI KE
                                                                     FACTOR
NO.
      (FT)
               (FT)
                                          (FT)
                                                  (FT) (FT)
                                                               (FT)
                                                                       (n)
            =======
                      =============
                                          =====
                                                  ===== ======
                       0.018/0.018/0.020
  1
      30.0
              20.0
                                          0.67
                                                   2. 00 0. 0313 0. 167 0. 0150
                                                   1.50 0.0100 0.125 0.0160
  2
               25.0
                      0.020/0.020/ ---
                                          0.50
      30.0
                      0.020/0.020/0.020
                                                   1.50 0.0100 0.125 0.0160
      25.0
              20.0
                                           0.50
  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.
  UPSTREAM ELEVATION(FEET) =
                                 256.00
  DOWNSTREAM ELEVATION (FEET) =
                                 255.00
  ELEVATION DIFFERENCE(FEET) =
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
  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) =
    **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) =
    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.) = 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.160
                                                          6.27
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S. C. S. CURVE NUMBER (AMC II) = 0
 SUBAREA AREA(ACRES) = 0.40
TOTAL AREA(ACRES) = 0.50
                                      SUBAREA RUNOFF(CFS) = 1.41
                                        PEAK FLOW RATE(CFS) =
  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
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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 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 SIZÈ(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
        5. 00Ō;
               4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
   6)
       30.000:
                2.000
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
           CROWN TO
     HALF-
                                                                     MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                               HI KE
                                                                     FACTOR
NO.
      (FT)
               (FT)
                                          (FT)
                                                  (FT) (FT)
                                                               (FT)
                                                                       (n)
            =======
                       =============
                                          =====
                                                  ===== ======
                       0.018/0.018/0.020
  1
      30.0
               20.0
                                           0.67
                                                   2. 00 0. 0313 0. 167 0. 0150
                                                   1.50 0.0100 0.125 0.0160
  2
               25.0
                       0.020/0.020/ ---
                                           0.50
      30.0
                       0.020/0.020/0.020
                                                   1.50 0.0100 0.125 0.0160
      25.0
               20.0
                                           0.50
  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
```

Page 1

MCPRE12. RES >>>>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. UPSTREAM ELEVATION(FEET) = 253.00 250.00 DOWNSTREAM ELEVATION(FEET) = ELEVATION DIFFERENCE(FEET) = 3.00 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NÓMOGRAPH 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< ______ 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) = 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.) = STREET FLOW TRAVEL TIME(MIN.) = 2.51 Tc(MIN.) = 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.734 8. 51 *USER SPECIFIED(SUBAREA): USER-SPECIFIED RUNOFF COEFFICIENT = .8500 S. C. S. CURVE NUMBER (AMC II) = 0 SUBAREA AREA(ACRES) = 0.90 TOTAL AREA(ACRES) = 1.00 SUBAREA RUNOFF(CFS) = 2.86 PEAK FLOW RATE(CFS) = 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 MCPRF12. RFS

| S.C.S. CURVE NUMBER (AMC II) = 0 SUBAREA AREA(ACRES) = 0.60 SUBAREA RU TOTAL AREA(ACRES) = 1.60 TOTAL RUNO TC(MIN.) = 8.51 | INOFF(CFS) = 1.90 |
|--|---|
| END OF STUDY SUMMARY: TOTAL AREA(ACRES) = 1.60 TC(MIN. PEAK FLOW RATE(CFS) = 5.12 |) = 8.51 |
| 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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Analysis prepared by:

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

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********************* 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 SIZÈ(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
       5. 00Ō;
               4.400
  1)
  2)
3)
      10.000;
               3.450
               2.900
      15.000;
   4)
      20.000;
               2.500
  5)
      25.000;
               2.200
  6)
      30.000:
               2.000
      40.000;
               1.700
      50.000;
               1.500
  8)
      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*
                      STREET-CROSSFALL:
                                         CURB GUTTER-GEOMETRI ES:
           CROWN TO
     HALF-
                                                                   MANNI NG
                     IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                         HEIGHT WIDTH LIP
                                                             HI KE
                                                                   FACTOR
NO.
     (FT)
              (FT)
                                         (FT)
                                                (FT) (FT)
                                                             (FT)
                                                                     (n)
           =======
                      =============
                                         =====
                                                ===== ======
                      0.018/0.018/0.020
 1
     30.0
              20.0
                                         0.67
                                                 2. 00 0. 0313 0. 167 0. 0150
                                                 1.50 0.0100 0.125 0.0160
 2
              25.0
                      0.020/0.020/ ---
                                         0.50
     30.0
                      0.020/0.020/0.020
                                                 1.50 0.0100 0.125 0.0160
     25.0
              20.0
                                         0.50
 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
     ______
```

Page 1

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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) = 97.
  UPSTREAM ELEVATION(FEET) =
                                      271.00
                                      270.00
  DOWNSTREAM ELEVATION(FEÉT) =
  ELEVATION DIFFERENCE(FEET) =
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
  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<
______
 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) = 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 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.) =
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.489
                                                                    9.79
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S. C. S. CURVE NUMBER (AMC II) = 0
  SUBAREA AREA(ACRES) = 4.70
TOTAL AREA(ACRES) = 4.80
                                             SUBAREA RUNOFF(CFS) = 13.94
  TOTAL AREA(ACRES) =
                                               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
```

Page 2

MCPRE14. RES 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<
 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 (MINING) = 24.00 TOWNSTREAM(FEET) = 217.83
______
 PIPE-FLOW(CF3) = 10.37

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) =
UPSTREAM ELEVATION(FEET) = 268.00
DOWNSTREAM ELEVATION(FEET) = 266.00
ELEVATION DIFFERENCE(FEET) = 2.00
                                      87.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
 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<
______
 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
                                   Page 3
```

```
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
    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
 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) =
TOTAL AREA(ACRES) = 6.70 PEAK FLOW RATE(CFS) =
                                          SUBAREA RUNOFF(CFS) = 18.92
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
  PI PE-FLOW(CFS) = 19.28

PI PE TRAVEL TI ME (MI N.) = 0.04 Tc (MI N.) = 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
TOTAL AREA(ACRES) = 7.30
                                       SUBAREA RUNOFF(CFS) = 1.72
                                       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<
______
 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 BIOMETER(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 1315.0
                                            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 **
           RUNOFF
 STREAM
                      Tc
                             INTENSITY
                                           AREA
                    (MIN.)
 NUMBER
            (CFS)
                             (INCH/HOUR)
                                          (ACRE)
                                3.470
                                              5.50
                     9. 89´
            16. 37
     1
                    10.99
     2
            21.00
                                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
            (CFS)
                    (MIN.)
 NUMBER
                             (INCH/HOUR)
            36. 59
                     9.89
                               3.470
     1
            36.76
                    10.99
                               3.342
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 36.76 Tc(MIN.) = TOTAL AREA(ACRES) = 12.80
                                            10.99
 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<
______
 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 =
 PIPE-FLOW(CFS) = 36.76
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 11.16
LONGEST FLOWPATH FROM NODE 1320.00 TO NODE 1355.0
                                            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
                             3. 32
 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) =
 UPSTREAM ELEVATION(FEET) = 232.00
 DOWNSTREAM ELEVATION (FEET) = 226.00
ELEVATION DIFFERENCE (FEET) = 6.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 1
*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) =
***********************
 FLOW PROCESS FROM NODE 1405.00 TO NODE 1410.00 IS CODE = 62
 ______
 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
______
 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) =
 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) =
 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.) =
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.625
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .8500
                                                         9.08
 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) =
 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<
 ______
```

```
MCPRE14. RES
  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 SUI
                            SUBAREA RUNOFF(CFS) = 2.46
 TOTAL AREA(ACRES) =
                      1.80
                            TOTAL RUNOFF(CFS) =
 TC(MIN.) = 9.08
*******************
 FLOW PROCESS FROM NODE 1410.00 TO NODE 1355.00 IS CODE = 41
______
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
______
 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
                   5. 60
 PIPE-FLOW(CFS) =
 PIPE TRAVÈL TÍME(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) =
 TOTAL STREAM AREA(ACRES) =
                           1.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =
                                    5.60
 ** CONFLUENCE DATA **
          RUNOFF
 STREAM
                    Tc
                           I NTENSI TY
                                        AREA
                   (MI N.)
 NUMBER
                           (INCH/HOUR)
           (CFS)
                                       (ACRE)
                                          12.80
           36.76
                   11. 16
                              3. 323
     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
                   (MIN.)
           (CFS)
39.53
                           (INCH/HOUR)
 NUMBER
    1
                    9. 21
                             3.600
           41.93
     2
                   11. 16
                             3.323
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 41.93
TOTAL AREA(ACRES) = 14.60
                              Tc(MIN.) = 11.16
 LONGEST FLOWPATH FROM NODE 1320.00 TO NODE 1355.00 = 1802.39 FEET.
 END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 14.60
ALL OF STUDY RATE(CFS) = 41.93
______
                         14.60 \text{ TC}(MIN.) =
                                           11. 16
______
______
```

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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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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 SIZÈ(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
        5. 00Ō;
               4.400
   1)
   2)
3)
       10.000;
                3.450
                2.900
       15.000;
   4)
       20.000;
                2.500
   5)
       25.000;
                2.200
   6)
       30.000:
                2.000
       40.000;
                1.700
                1.500
   8)
       50.000;
       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*
                       STREET-CROSSFALL:
                                           CURB GUTTER-GEOMETRI ES:
           CROWN TO
     HALF-
                                                                     MANNI NG
                      IN- / OUT-/PARK-
SIDE / SIDE/ WAY
           CROSSFALL
     WI DTH
                                          HEIGHT WIDTH LIP
                                                               HI KE
                                                                     FACTOR
NO.
      (FT)
               (FT)
                                          (FT)
                                                  (FT) (FT)
                                                               (FT)
                                                                       (n)
            =======
                       =============
                                          =====
                                                  ===== ======
                       0.018/0.018/0.020
  1
      30.0
               20.0
                                           0.67
                                                   2. 00 0. 0313 0. 167 0. 0150
                                                   1.50 0.0100 0.125 0.0160
  2
               25.0
                       0.020/0.020/ ---
                                           0.50
      30.0
                       0.020/0.020/0.020
                                                   1.50 0.0100 0.125 0.0160
      25.0
               20.0
                                           0.50
  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
```

Page 1

```
>>>>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.
  UPSTREAM ELEVATION(FEET) =
                                       259.00
                                      256.00
  DOWNSTREAM ELEVATION(FEET) =
  ELEVATION DIFFERENCE(FEET) =
  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) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
     **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) = 0.43
  HALFSTREET FLOW DEPTH(FEET) = 0.45
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
TOTAL AREA(ACRES) = 10.80
                                             SUBAREA RUNOFF(CFS) = 30.79
                                                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<
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

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MCPRE15. RES
  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) = 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) =
SPLIT FLOW(CFS) = 5.43 SPLIT VELOCITY(FEET/SEC.) =
                                                                        13.24
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) = 0.61
    HALFSTREET FLOOD WIDTH(FEET) =
  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
                            12. 90
                                             PEAK FLOW RATE(CFS) =
  TOTAL AREA(ACRES) =
  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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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                     2003, 1985, 1981 HYDROLOGY MANUAL
```

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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 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
        5. 00Ō;
                4.400
   1)
   2)
3)
       10.000;
                 3.450
                 2.900
       15.000;
   4)
       20.000;
                 2.500
   5)
       25.000;
                 2.200
   6)
       30.000:
                 2.000
       40.000;
                 1.700
       50.000;
                 1.500
   8)
       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*
                                             CURB GUTTER-GEOMETRIES:
HEIGHT WIDTH LIP HIKE
            CROWN TO
                        STREET-CROSSFALL:
     HALF-
                                                                          MANNI NG
                        IN- / OUT-/PARK-
SIDE / SIDE/ WAY
            CROSSFALL
     WI DTH
                                                                          FACTOR
NO.
      (FT)
                (FT)
                                             (FT)
                                                     (FT) (FT)
                                                                   (FT)
                                                                            (n)
     =====
             =======
                        ===========
                                             =====
                                                     ===== ======
                20.0
                        0.018/0.018/0.020
                                              0.67
  1
      30.0
                                                       2. 00 0. 0313 0. 167 0. 0150
                                                      1.50 0.0100 0.125 0.0160
  2
      20.0
                15.0
                        0.020/0.020/ ---
                                              0.50
  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) =
 UPSTREAM ELEVATION(FEET) = 190.00
DOWNSTREAM ELEVATION(FEET) = 176.00
ELEVATION DIFFERENCE(FEET) = 14.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =
  *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) =
*******************
 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) =
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
    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.) =
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.003
                                                       7.09
  *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S. C. S. CURVE NUMBER (AMC II) = 0
SUBAREA AREA(ACRES) = 0.60
TOTAL AREA(ACRES) = 0.70
                                  SUBAREA RUNOFF(CFS) = 2.04
                                      PEAK FLOW RATE(CFS) =
 ._____
  END OF STUDY SUMMARY:
 TOTAL AREA(ACRES) = 0.70
PEAK FLOW RATE(CFS) = 2.40
                              0.70 \text{ TC}(MIN.) =
______
______
 END OF RATIONAL METHOD ANALYSIS
```

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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/s²)

d₀ = 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) $\sin\Theta$ = 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) $\sin\Theta$ = 3.1 inches (0.26 ft)

| Inlet ID | Depth of Flow in Adjacent Gutter, y (ft) | Curb Inlet Depression, a (ft) | (h/2) sin ⊖ (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 <math>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

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

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

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

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

System 5, System 9

Grate Inlet Sizing (Weir vs. Orifice)

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

| 3.0 |
|------|
| 0.60 |
| 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) | | |
|---|-------------------|--|--|------|--|
| 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

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

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

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

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

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

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

System 5, System 9

Grate Inlet Sizing (Weir vs. Orifice)

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

| 3.0 |
|------|
| 0.60 |
| 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

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

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

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_Combolnlet

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

Curb and Gutter Analysis: System13_Node1310_Combolnlet

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

Curb and Gutter Analysis: System13_Node1311_Combolnlet

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

Curb and Gutter Analysis: System13_Node1330_Combolnlet

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

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

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

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

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

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

APPENDIX D

Hydraulic Analyses – AES Pipeflow [Post-project Condition]

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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

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 "*" indicates nodal point data used.)

| ` UPSTREAM RUN | | | | DOWNSTRÉAM 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´ | |
| } | FRI CTI ON | } | HYDRAULIC JUMP | | | |
| 140.00- | | 1. 43 | 161. 21 | 0.82* | 174. 11 | |
| } | JUNCTI ON | | | | | |
| 140.00- | | 1. 86 | 206. 90 | 0.40* | 404. 13 | |
| } | FRI CTI ON | | | | | |
| 135.00- | | 1. 15*Dc | 150. 14 | 1. 15*Dc | 150. 14 | |
| } | JUNCTI ON | | | | | |
| 135.00- | | 1. 81* | 149. 52 | 0. 78 | 82. 53 | |
| } | FRI CTI ON | | | | | |
| 115. 00- | | 1. 55* | 121. 33 | 0.90 Dc | 79. 82 | |
| } | CATCH BAS | I N | | | | |
| 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 ČFS

PIPE DIAMETER = 18.00 INCHES Page 1

145. RES

| 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: |
| DI STANCE FROM CONTROL (FT) FLOW DEPTH VELOCITY (FT/SEC) SPECIFIC ENERGY (FT) PRESSURE+ 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 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> |
| ************************************** |
| 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 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.00 0.00 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)- |

145. RES

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) JUNCTION LOSSES = (6.892)+(0.000) = 6.892 140.00 : 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+ 1. 719 1. 721 CONTROL(FT) (FT) (FT/SEC) MOMENTUM (POUNDS) 6. 06**1** 0.000 1. 148 150. 14 1. 117 0.005 6.235 150.30 0.019 1.086 6. 423 1. 727 150.81 6. 629 0.045 1.054 1.737 151.68 6. 852 7. 096 1.753 0.084 1.023 152.94 0. 992 0.137 1. 774 154.63 7. 361 7. 652 7. 969 8. 317 0.960 156. 79 0.209 1.802 0.300 1.839 0. 929 159.45 0.415 0.898 1.885 162.66 0.559 0.867 1. 941 166.49 8. 699 170. 99 0.737 0.835 2.011 9. 120 0.956 0.804 2.096 176.25 2. 20 i 2. 327 2. 482 3. 470 0.773 9. 586 1. 224 182.35 10. 102 10. 677 11. 320 1.554 0. 741 189.42 1. 961 0. 710 197. 57 2.670 2. 464 0. 679 11. 320 206.98 12.042 2. 901 3.091 0. 648 217.82 12. 858 13. 784 3.881 0. 616 3. 185 230.35 3. 537 3. 977 4. 531 5. 238 6. 152 7. 350 0. 585 244.86 4.889 0.554 14. 843 6.199 261.73 7.942 0.523 16.063 281.42 10.345 0. 491 17. 479 304.56 19. 139 13.837 0.460 331.94 19.390 0.429 21. 107 7. 350 364.64 0. 397 23. 466 0. 397 23. 466 30. 145 8. 953 404.12 8. 954 201. 420 404.13 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: FLOW DIAMETER ANGLE FLOWLI NE CRI TI CAL PI PE **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) UPSTREAM 5. 50 57. 30[°] 18.00 184. 48 0. 90 3. 112 DOWNSTREAM 8.80 18.00 184. 15 1. 15 6.063 0.00 0.00 0.00 0.00 LATERAL #1 0.00 0.00 0.000 LATERAL #2 0.00 0.000 3.30===Q5 EQUALS BASIN INPUT=== **Q5**

```
145. RES
 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
        135.00 : HGL = < 186.285>; EGL= < 186.436>; FLOWLINE= < 184.480>
 NODE
*******************
 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):
            = 5.50 <u>CFS</u>
                                   PIPE DIAMETER = 18.00 INCHES
 PIPE FLOW
                                     MANNING'S N = 0.01300
 PIPE LENGTH =
                      34.41 FEET
 SF = (Q/K)^{**}2 = ((5.50)/(105.046))^{**}2 = HF = L^*SF = (34.41)^*(0.00274) = 0.094
                                 105.046)) **2 = 0.00274
 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
FLOW VELOCITY = 3.11 FEET/SEC.
                                        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
```

Page 4

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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 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

"*" indicates nodal point data used.)

| | · | UPSTREAM | DOWNSTRÉAM 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 |
| } | FRI CTI ON | | | | |
| 220. 00- | | 1. 35* | 76. 55 | 0. 45 | 44. 62 |
| } | JUNCTI ON | | | | |
| 220. 00- | | 1. 06 | 52. 41 | 0. 22* | 107. 23 |
| } | FRI CTI ON | | | | |
| 215. 00- | | 0.66 Dc | 36. 26 | 0. 25* | 93. 80 |
| | JUNCTI ON | | | | |
| 215. 00- | | 0.66 Dc | 36. 26 | 0. 22* | 112. 18 |
| } | FRI CTI ON | | | | |
| 210.00- | | 0.66*Dc | 36. 26 | 0.66*Dc | 36. 26 |
| } | CATCH BAS | | | | |
| 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 3.00 CFS PIPE FLOW = PIPE DIAMETER = 18.00 INCHES ASSUMED DOWNSTREAM CONTROL HGL = 129.590 FEET

225.00 : HGL = < 129.590>; EGL= < 129.635>; FLOWLINE= < 128.090> NODE

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 DIAMETER = 18.00 INCHES PIPE FLOW = 3.00 ČFS Page 1

| PIPE LENGTH = | 16.00 FEET | 225. RES MANNI NG' S N = | 0. 01300 |
|--|---|--|--|
| NORMAL DEPTH(FT) = | 0. 55 | CRITICAL DEPTH | (FT) = 0.66 |
| DOWNSTREAM CONTROL | ASSUMED PRESSUR | RE HEAD(FT) = 1.5 | |
| GRADUALLY VARIED F | LOW PROFILE COMP | UTED INFORMATION: | |
| DI STANCE FROM CONTROL(FT) 0. 000 3. 588 7. 112 10. 598 14. 056 16. 000 | FLOW DEPTH VEL (FT) (FT 1.500 1.466 1.433 1.399 1.365 1.346 | OCITY SPECIFIC (SEC) ENERGY (FT) 1. 697 1. 541 1. 725 1. 479 1. 748 1. 449 1. 776 1. 396 | PRESSURE+) MOMENTUM(POUNDS) 5 92.57 2 88.92 9 85.36 6 81.86 4 78.45 6 76.55 |
| NODE 220.00 : HG | $L = \langle 129.596 \rangle;$ | EGL= < 129. 646>; FL | OWLI NE= < 128. 250> |
| FLOW PROCESS FROM UPSTREAM NODE 22 | NODE 220.00 TO | NODE 220.00 IS CO | ************************************** |
| | | | CRITICAL VELOCITY DEPTH(FT.) (FT/SEC) 0. 66 18. 286 0. 66 1. 794 0. 00 0. 000 0. 00 0. 000 |
| LACFCD AND OCEMA F DY=(Q2*V2-Q1*V1*CO Q4*V4*COS(DELT UPSTREAM: MANNI DOWNSTREAM: MANNI AVERAGED FRICTION | LOW JUNCTION FOR S(DELTA1) - Q3*V3* A4))/((A1+A2)*16 NG'S N = 0.01300 NG'S N = 0.01300 SLOPE IN JUNCTIO 4.00 FEET 0.718 FEET (DY+HV1-HV2)+(EN (4.349)+(0.000 | MULAE USED: COS(DELTA3) - 5.1) + FRICTION LOSSES b; FRICTION SLOPE = b; FRICTION SLOPE = bN ASSUMED AS 0. 1795: ENTRANCE LOSSES TRANCE LOSSES b) = 4.349 | 0. 35831 0. 00072 2 = 0. 000 FEET |
| NODE 220.00 : HG | | EGL= < 133. 995>; FL | |
| ************************************** | ************************************** | ************************************** | ****** |
| CALCULATE FRICTION PIPE FLOW = PIPE LENGTH = | LOSSES(LACFCD): 3.00 CFS P 78.00 FEET | PIPE DIAMETER = 18.0 MANNING'S N = | 00 I NCHES 0. 01300 |
| NORMAL DEPTH(FT) = | 0. 22 | CRITICAL DEPTH | (FT) = 0.66 |
| UPSTREAM CONTROL A | SSUMED FLOWDEPTH | I(FT) = 0.25 | ======================================= |
| GRADUALLY VARIED F | LOW PROFILE COMP | PUTED INFORMATION: | |
| DISTANCE FROM CONTROL(FT) O.000 | FLOW DEPTH VEL (FT) (FT 0.245 1 | OCITY SPECIFIC /SEC) ENERGY(FT 5. 929 4. 18 Page 2 | PRESSURE+) MOMENTUM(POUNDS) 8 93.80 |

```
225. RES
                                            16.016
            0.353
                               0.244
                                                                 4. 230
                                                                                       94.30
                                            16. 104
            0.723
                               0.243
                                                                                       94.80
                                                                 4. 273
                               0. 242
0. 242
                                            16. 192
16. 282
                                                                                       95.30
            1. 112
                                                                 4. 316
                                                            4. 360
4. 405
4. 451
4. 497
4. 544
4. 592
4. 640
4. 740
4. 790
4. 842
4. 895
4. 948
5. 002
5. 057
5. 113
5. 170
5. 228
5. 286
5. 346
5. 407
            1.522
                                                                                       95.81
                                            16. 372
            1.954
                               0.241
                                                                                       96.33
            2. 411
                               0.240
                                            16. 463
                                                                                       96.85
                                            16. 555
                                                                                       97.37
            2.895
                               0.239
            3.410
                               0. 238
                                            16. 648
                                                                                       97.90
                                            16. 742
                                                                                       98.44
            3.960
                               0. 237
            4. 548
                               0. 236
                                            16.836
                                                                                       98.98
                                                                                       99. 52
                               0. 235
                                            16. 932
            5. 181
                                            17. 028
17. 126
17. 224
17. 324
                               0. 234
0. 233
                                                                                      100.07
            5.865
            6.608
                                                                                      100.63
                               0. 232
0. 231
                                                                                      101. 19
101. 76
            7. 420
            8. 315
            9.310
                               0.230
                                            17. 424
                                                                                      102.34
                                            17. 526
           10. 429
                              0. 230
                                                                                      102.92
                              0. 229
                                            17. 628
           11. 706
                                                                                      103.50
           13. 187
14. 950
                              0. 228
                                            17. 732
                                                                                      104.09
                                        17. 732
17. 836
17. 942
18. 049
18. 156
18. 265
18. 280
                              0. 227
                                                                                      104.69
           17. 121
19. 935
                               0. 226
                                                                                      105. 30
105. 91
                               0. 225
                               0. 224
           23. 926
                                                                                      106.52
                               0. 223
                                                                                      107.15
           30. 801
           78.000
                               0. 223
                                                                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:
                     FLOW DIAMETER ANGLE FLOWLINE
        PI PF
                                                                      CRI TI CAL
                                                                                       VFI OCI TY
                              (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                       (CFS)
                        3.00 18.00 0.00 157.27 0.66 19.149
3.00 18.00 - 156.94 0.66 15.934
0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00
                       3. 00
3. 00
      UPSTREAM
    DOWNSTREAM
    LATERAL #1
    LATERAL #2
                         O. OO===Q5 EQUALS BASIN INPUT===
        Q5
  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
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                                  ENTRANCE LOSSES = 0.000 FEET
  JUNCTI ON LOSSES = (2.053)+(0.000) = 2.053
        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 Page 3
                                                 Page 3
```

225. RES

```
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.66
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
                   FLOW DEPTH VELOCITY
                                               SPECIFIC PRESSURE+
 DISTANCE FROM
  CONTROL(FT)
                        (FT)
                                 (FT/SEC)
                                               ENERGY (FT)
                                                             MOMENTUM (POUNDS)
                         0.658
                                    4.017
                                                    0.909
         0.000
                                                                     36. 26
          0.002
                         0.640
                                    4.170
                                                    0.910
                                                                     36.30
                         0.622
                                                    0.914
          0.007
                                    4. 335
                                                                     36.45
                         0.603
                                    4.512
                                                    0.919
                                                                     36.70
          0.018
          0.033
                         0.585
                                    4.703
                                                    0.928
                                                                     37.06
                         0.566
                                    4. 910
                                                    0.941
                                                                     37.55
          0.054
                         0.548
                                    5.135
                                                   0.958
          0.083
                                                                     38. 17
                         0.529
                                    5.379
                                                   0.979
                                                                     38.93
          0.120
          0.167
                         0.511
                                    5.646
                                                   1.006
                                                                     39.86
                                                   1.040
          0.226
                        0.493
                                   5. 938
                                                                     40.96
                                   6. 258
          0. 299
                        0. 474
                                                   1.083
                                                                     42.25
                                  6. 611
7. 001
7. 434
7. 918
          0.390
                        0. 456
                                                   1. 135
                                                                     43.77
                        0.437
                                                   1. 199
          0.503
                                                                     45.53
          0.642
                         0.419
                                                   1. 278
                                                                     47.57
                                                    1. 374
          0.815
                         0.400
                                    7. 918
                                                                     49.93
                         0. 382
                                   8. 460
                                                                     52.67
                                                    1.494
          1.031
          1. 302
                         0.363
                                    9.072
                                                   1.642
                                                                     55.83
                         0.345
                                                                     59.50
          1.646
                                    9. 765
                                                   1.827
                         0.327
                                                   2.059
                                   10. 558
          2.089
                                                                     63.76
          2.669
                         0.308
                                   11. 470
                                                   2. 352
                                                                     68.76
                                                    2. 729
          3.449
                         0.290
                                   12. 529
                                                                     74.62
                                   13. 769
15. 238
17. 000
          4.533
                         0. 271
                                                    3. 217
                                                                     81.57
          6.125
                         0. 253
                                                    3.861
                                                                     89.88
                         0. 234
         8. 681
                                                    4.725
                                                                     99.91
                         0.216
                                   19. 143
                                                    5.910
         13.679
                                                                    112. 18
                        0. 216
                                   19. 143
                                                    5.910
         82. 030
                                                                    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 SUBO
                                           206.12 (FLOW IS SUBCRITICAL)
 UPSTREAM NODE 210.00 ELEVATION = 206.12 (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
                                 PIPE DIAMETER = 18.00 INCHES
VELOCITY HEAD = 0.396 FEET
 PIPE FLOW = 3.00 CFS
                  5.05 FEET/SEC.
 FLOW VELOCITY =
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.396) = 0.079
        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:

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

| 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 |
| | FRI CTI ON | | HYDRAULIC JUMP | | |
| 330.00- | | 1. 07 | 90. 05 | 0. 59* | 113. 57 |
| | JUNCTI ON | | | | |
| 330. 00- | | 1. 07 | 89. 86 | 0. 31* | 254. 25 |
| | FRI CTI ON | | | | |
| 320.00- | | 0.94 Do | 87.58 | 0. 32* | 246. 31 |
| | JUNCTI ON | | | | |
| 320.00- | | 0. 94 Do | 87. 58 | 0. 29* | 281. 65 |
| - | FRI CTI ON | | | | |
| 315. 00- | | 0. 94*Dc | 87. 58 | 0. 94*Dc | 87. 58 |
| | CATCH BAS | | | | |
| 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 P

5. 90 CFS PIPE DIAMETER = 18.00 INCHES
Page 1

335. RES

| PIPE LENGTH = | 44.00 FEET | SSS. R MAN | INI NG' S N = 0. | 01300 |
|--|---|--|--|---|
| HYDRAULIC JUMP: D | | | | |
| NORMAL DEPTH(FT) | = 0.80 | CRI | TICAL DEPTH(FT) | = 0.94 |
| UPSTREAM CONTROL | ASSUMED FLOWD | EPTH(FT) = | 0. 59 | ======================================= |
| GRADUALLY VARIED | FLOW PROFILE | COMPUTED INF | FORMATION: | |
| DI STANCE FROM CONTROL (FT) 0.000 2.129 4.289 6.483 8.716 10.990 13.311 15.684 18.115 20.611 23.182 25.837 28.591 31.458 34.459 37.620 40.977 44.000 | FLOW DEPTH (FT) 0.595 0.603 0.611 0.620 0.628 0.636 0.645 0.653 0.662 0.670 0.678 0.687 0.703 0.712 0.720 0.729 0.736 | VELOCI TY (FT/SEC) 9. 046 8. 878 8. 717 8. 560 8. 409 8. 263 8. 121 7. 984 7. 851 7. 723 7. 599 7. 478 7. 361 7. 247 7. 137 7. 030 6. 927 6. 842 | SPECIFIC ENERGY(FT) 1. 866 1. 828 1. 792 1. 758 1. 727 1. 697 1. 670 1. 644 1. 619 1. 597 1. 575 1. 556 1. 537 1. 520 1. 537 1. 520 1. 488 1. 474 1. 463 | PRESSURE + MOMENTUM (POUNDS) 113.57 111.99 110.49 109.06 107.69 106.39 105.15 103.96 102.84 101.76 100.74 99.77 98.85 97.98 97.15 96.36 95.61 95.02 |
| DOWNSTREAM CONTRO ==================================== | ======== | ======== | :===================================== | ======================================= |
| DI STANCE FROM CONTROL (FT) 0.000 3.049 5.902 8.648 11.311 13.906 16.440 18.918 21.344 23.718 26.041 28.311 30.527 32.685 34.780 36.808 38.761 40.629 42.400 44.000 | FLOW DEPTH (FT) 1.500 1.478 1.455 1.433 1.410 1.388 1.365 1.343 1.320 1.298 1.275 1.253 1.208 1.185 1.163 1.140 1.118 1.095 1.074 | VELOCITY (FT/SEC) 3. 338 3. 348 3. 367 3. 392 3. 421 3. 455 3. 493 3. 535 3. 581 3. 631 3. 684 3. 741 3. 803 3. 869 3. 939 4. 013 4. 092 4. 177 4. 266 4. 358 YDRAULIC JUM | SPECIFIC ENERGY (FT) 1. 673 1. 652 1. 631 1. 611 1. 592 1. 573 1. 555 1. 537 1. 519 1. 502 1. 486 1. 470 1. 455 1. 440 1. 426 1. 413 1. 400 1. 389 1. 378 1. 369 | PRESSURE+ MOMENTUM(POUNDS) 120.88 118.52 116.27 114.10 112.01 109.99 108.04 106.17 104.36 102.63 100.98 99.41 97.92 96.51 95.19 93.96 92.83 91.79 90.85 90.05 |
| DOWNSTREAM | DEPTH = 1. 291 | FEET, UPSTF | REAM CONJUGATE D | EPTH = 0.667 FEET |

335. RES

330.00 : HGL = < 171.755>; EGL= < 173.026>; FLOWLINE= < 171.160> NODE ****************** 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: FLOW DIAMETER ANGLE FLOWLINE CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 5. 90 5. 90 UPSTREAM 18. 00 60. 00 171. 49 0. 94 22. 05Ô **DOWNSTREAM** 18.00 171. 16 0.94 9.049 0. 00 2. 00 0.00 0.000 0.00 0.00 0.00 LATERAL #1 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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
JUNCTION LOSSES = (0Y+HV1-HV2)+(ENTRANCE LOSSES) ENTRANCE LOSSES = 0.000 FEET JUNCTION LOSSES = (6.327) + (0.000) = 6.327NODE 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 (FT/SEC) ENERGY(FT) ______ SPECI FI C PRESSURE+ MOMENTUM (POUNDS) 21. 339 0.000 0.320 7.396 246. 31 21. 368 21. 396 7.414 0.320 246.63 0.601 0.320 246. 96 247. 28 1. 228 7.433 21. 425 21. 453 21. 482 1.884 0.320 7.452 0.319 7.470 247.60 2. 571 3. 293 0.319 247.92 7.489 0.319 4.053 21. 511 7. 508 248.25 0.318 21.540 7. 527 248.57 4.855 21. 568 21. 597 5.704 0.318 7. 546 248.90 249.22 6.606 0. 318 7. 565 7. 584 0. 317 21.626 249.55 7. 567 7. 604 7. 623 7. 642 8. 597 0. 317 21.655 249.88 0. 317 0. 317 21. 685 21. 714 9.703 250.20 10.901 250.53 7. 662 12.204 0. 316 21. 743 250.86 13.633 0. 316 21. 773 7. 681 251.19 7. 701 0. 316 21.802 251.53 15. 215 16. 986 0. 315 21. 832 7. 721 251.86 18. 997 21.861 0. 315 7.741 252. 19 Page 3

```
335. RES
                                         21.891
          21. 321
                            0. 315
                                                            7. 760
                                                                                252.53
                             0. 314
                                                            7. 780
          24. 074
                                         21. 920
                                                                               252.86

      24. 074
      0. 314
      21. 920
      7. 780

      27. 448
      0. 314
      21. 950
      7. 800

      31. 803
      0. 314
      21. 980
      7. 820

      37. 951
      0. 314
      22. 010
      7. 841

      48. 493
      0. 313
      22. 040
      7. 861

      110. 000
      0. 313
      22. 043
      7. 863

                                                                                253.20
                                                                                253.53
                                                                                253.87
                                                                                254. 21
                                                                               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:
                   FLOW DIAMETER ANGLE
        PI PF
                                                     FLOWLI NE
                                                                   CRI TI CAL
                                                                                 VELOCITY
                              (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                     (CFS)
                     5. 90
5. 90
                                                                                 24. 477
     UPSTREAM
                                 18. 00 0. 00 209. 97
                                                                      0. 94
                                                       209.64
    DOWNSTREAM
                                 18.00
                                                         09. 64 0. 94
0. 00 0. 00
0. 00 0. 00
                                                                      0.94
                                                                                   21.346
                                             0.00
0.00
                       LATERAL #1
                     0.00
                                                                                   0.000
                                                                                   0.000
    LATERAL #2
                       O. OO===Q5 EQUALS BASIN INPUT===
        05
  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 ENTRANCE LOSSES)
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (2.529)+(0.000) = 2.529
                                            ENTRANCE LOSSES = 0.000 FEET
  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:
 ______
                      FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
(FT) (FT/SEC) ENERGY(FT) MOMENTUM(POUNDS)
  DISTANCE FROM
   CONTROL(FT)
                             0. 938
           0.000
                                          5.075
                                                            1.338
                                                                                 87.58
                             0. 911
                                          5. 251
           0.002
                                                            1. 339
                                                                                 87.69
                                     5. 251
5. 442
5. 649
5. 873
6. 117
6. 383
6. 673
6. 991
7. 725
           0.010
                                                            1. 344
1. 353
                             0.884
                                                                                 88.03
                             0.857
           0.024
                                                                                 88.62
                                                            1. 367
1. 385
           0.045
                             0.831
                                                                                 89.47
                                                                                 90.61
           0.074
                             0.804
                                                           1. 410
                             0. 777
                                                                                 92.07
           0. 112
                            0.750
                                                           1.442
           0.162
                                                                                93.88
                                                           1. 483
                            0.723
                                                                                96. 07
           0. 226
           0.306
                            0. 697
                                                           1. 534
                                                                                98. 69
           0.406
                            0. 670
                                                            1. 597
                                                                               101.78
                                             Page 4
```

```
335. RES
         0.530
                      0.643
                                8. 151
                                              1.675
                                                             105.40
                                                             109.63
         0.683
                      0.616
                               8. 623
                                              1. 772
                                9. 150
9. 741
                                              1.890
         0.873
                      0.589
                                                             114.55
         1. 110
                      0.563
                                              2.037
                                                             120.26
                      0.536
                               10.407
                                              2.219
         1.406
                                                             126.90
                      0.509
                               11. 161
         1.780
                                              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
                      0.402
                               15. 489
                                              4. 129
                                                             181.07
         4.775
         6.306
                      0. 375
                               17.067
                                              4.901
                                                             198.51
                               18. 952
        8. 568
                      0. 348
                                              5. 929
                                                             219.53
        12. 227
                      0.321
                               21. 236
                                              7.329
                                                             245.16
                                              9.280
                      0. 295
                               24.047
        19. 445
                                                             276.87
                      0. 291
                               24. 470
                                              9. 595
        80.000
                                                             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
FLOW VELOCITY = 5.08 FFFT/SE
                              PIPE DIAMETER = 18.00 INCHES
VELOCITY HEAD = 0.400 FEET
                  5.08 FEET/SEC.
 FLOW VELOCITY =
 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:
                                FLOWLINE ELEVATION = 262.11
 NODE NUMBER = 315.00
 ASSUMED UPSTREAM CONTROL HGL = 263.05 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 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 | | DOWNSTRE | AM RUN |
|----------|------------|----------|-------------------|-----------|-------------------|
| | | | | | PRESSURE+ |
| NUMBER | | | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 430. 00- | | 1. 50* | 87. 54 | 0. 45 | 24. 32 |
| | FRI CTI ON | | | | |
| 425. 00- | | 1. 12* | 50. 46 | 0. 40 | 26. 51 |
| | JUNCTI ON | | | | |
| 425. 00- | | 0. 82 | 30. 28 | 0. 19* | 65. 98 |
| | FRI CTI ON | | | | |
| 420.00- | | 0.55 Dc | 22. 94 | 0. 20* | 60. 21 |
| | JUNCTI ON | | 00.04 | 0.474 | 7. 0. |
| 420.00- | | 0.55 Dc | 22. 94 | 0. 17* | 76. 04 |
| | FRI CTI ON | | 00.04 | 0.404 | |
| 415. 00- | | 0.55 Dc | 22. 94 | 0. 19* | 66. 49 |
| | JUNCTI ON | 0 EE D. | 22.24 | 0.45+ | 05.40 |
| 415. 00- | | 0.55 Dc | 22. 94 | 0. 15* | 95. 12 |
| | FRI CTI ON | 0 [[*] | 22.04 | 0 FF*Da | 22.04 |
| 410.00- | CATCH DAG | 0. 55*Dc | 22. 94 | 0. 55*Dc | 22. 94 |
| | CATCH BAS | 0. 79* | 12 22 | O EE Do | 9 27 |
| 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 PIPE FLOW = 2.10 FLOWLINE ELEVATION = 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 = 1Page 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) MOMFNTUM(POUR
   CONTROL(FT)
                             (FT)
1. 500
                                       (FT/SEC)
                                                      ENERGY(FT)
                                                                       MOMENTUM (POUNDS)
           Ò. 0Ó0
                                          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
                                       1. 211
1. 231
1. 255
1. 283
1. 315
1. 351
1. 391
                             1. 386
                                                            1.409
                                                                                 75.28
          11. 692
                             1. 347
          15. 547
                                                            1. 372
                                                                                 71.36
                             1. 309
1. 271
1. 233
1. 195
                                                            1. 335
1. 298
1. 261
1. 225
                                                                                 67.53
          19.387
          23. 212
27. 024
                                                                                 63.82
                                                                                 60.21
          30.821
                                                                                 56.73
          34. 601
                             1. 157
                                                            1. 189
                                                                                 53.38
                                         1. 480
          38.000
                             1. 122
                                                            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:
                              DIAMETER ANGLE FLOWLINE CRITICAL VELOCITY (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
        PI PE
                     FLOW
                                                                                 VELOCITY
                     (CFS)
                      2. 10
2. 10
                                                      196. 08
                                 18. 00<sup>°</sup>
                                             60. 00<sup>°</sup>
     UPSTREAM
                                                                      0. 55
                                                                                 16. 05<sup>7</sup>
                                 18.00
                                                        195. 75
    DOWNSTREAM
                                                                      0.55
                                                                                    1. 481
                                                     0.00
    LATERAL #1
                       0.00
                                  0.00
                                              0.00
                                                                      0.00
                                                                                    0.000
    LATERAL #2
                       0.00
                                              0.00
                                                                                    0.000
                                  0.00
                                                          0.00
                                                                      0.00
                       O. OO===Q5 EQUALS BASIN INPUT===
        Q5
  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
                        4. 00 FEET
  JUNCTION LENGTH =
  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 SPECI FI C PRESSURE+ (FT) (FT/SEC) ENERGY(FT) CONTROL(FT) MOMENTUM (POUNDS) 0. 204 3. 520 0.000 14. 609 60.21 0.304 0.203 14.664 3.544 60.43 0. 202 0.622 14. 720 3.569 60.65 14. 777 14. 834 0. 202 0. 956 3.595 60.88 1.307 0. 201 3.620 61.11 0. 201 14.891 61.33 1.676 3. 646 3. 672 3. 699 3. 725 3. 752 3. 780 3. 807 3. 835 3. 863 3. 892 3. 950 3. 979 4. 009 4. 039 4. 069 4. 100 4. 131 4. 162 4. 194 3.646 0. 200 14. 948 61.56 2.066 0. 200 2. 478 15.006 61.79 2. 916 0. 199 15. 064 62.03 0. 199 15. 123 3. 382 62.26 15. 182 15. 241 15. 301 15. 362 3.881 0. 198 62.50 0. 198 62.73 4. 416 4. 992 0. 197 62.97 5. 618 0. 197 63.21 15. 422 0. 196 6.300 63.46 7.051 0. 196 15. 483 63.70 0. 195 15. 545 7.884 63.95 8.818 0. 195 15. 607 64.19 0. 194 9.882 15. 669 64.44 15. 732 15. 795 15. 858 15. 922 64.69 11. 116 0. 193 12.580 0. 193 64.95 14. 379 0. 192 65.20 16.709 0. 192 65.46 15. 987 20.005 0. 191 65.71 25. 673 0. 191 16. 052 4. 194 65.97 16. 052 4. 194 29. 000 0. 191 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: PI PE FLOW DIAMETER ANGLE FLOWLINE CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 2. 10 UPSTREAM 18. 00 0. 00 206. 24 0. 55 18. 563 205. 91 0.55 DOWNSTREAM 2. 10 18.00 14.613 0.00 0.00 LATERAL #1 0.000 LATERAL #2 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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. 190
          0.000
                                    16. 180
                                                     4. 258
                                                                       66.49
                                    16. 268
                         0.189
                                                     4.301
          0. 258
                                                                       66.84
          0.529
                         0.188
                                    16. 357
                                                     4.346
                                                                       67.20
          0.813
                         0.188
                                    16. 447
                                                    4. 391
                                                                       67.56
                                                 4. 436
4. 483
4. 530
4. 578
4. 626
4. 676
4. 726
4. 776
4. 828
4. 881
4. 934
4. 988
5. 043
5. 099
5. 156
5. 213
5. 272
                         0.187
                                    16. 538
                                                    4.436
                                                                       67.92
          1. 112
          1.428
                         0.186
                                    16.629
                                                                       68.29
                         0.186
                                    16. 721
          1.762
                                                                       68.66
          2. 115
                         0. 185
                                    16.814
                                                                       69.03
                         0. 184
                                    16. 908
                                                                      69. 41
          2.491
          2.893
                         0. 183
                                    17.003
                                                                       69.79
                                    17.099
                                                                       70. 17
          3. 322
                         0. 183
                                    17. 196
17. 294
17. 392
17. 492
                                                                       70.56
          3. 784
                         0. 182
                         0. 181
                                                                       70.95
          4. 283
                         0. 181
                                                                       71. 35
71. 75
          4.825
                         0.180
          5. 418
                                    17. 592
                         0.179
          6.070
                                                                       72.16
          6. 796
                         0.178
                                    17.694
                                                                       72.56
                         0. 178
                                    17. 797
                                                                       72.98
          7.612
          8.542
                         0. 177
                                    17. 900
                                                                       73.39
          9.623
                         0. 176
                                    18.005
                                                                       73.81
                                   18. 111
18. 217
18. 325
                                                    5. 272
5. 331
5. 392
         10.907
                         0. 176
                                                                       74.24
                                                                       74.67
         12.489
                         0. 175
         14.540
                         0. 174
                                   18. 325
18. 434
18. 544
18. 558
                                                                       75.10
         17.447
                         0.174
                                                                       75.54
                                                     5. 453
                         0. 173
                                                                       75.98
         22. 455
                                                     5.516
         55.000
                         0. 173
                                                     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:
       PI PE
                  FLOW DIAMETER ANGLE
                                              FLOWLI NE
                                                           CRI TI CAL
                                                                       VELOCITY
                           (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
                    2. 10
2. 10
     UPSTREAM
                             18.00
                                       20. 00 234. 88
                                                             0. 55
                                                                         23. 290
                                                 234.55
    DOWNSTREAM
                             18.00
                                        _
                                                             0. 55
                                                                         16. 185
                    0.00
0.00
0.00
                                               0. 00
0. 00
                    0.00
                                        0.00
                                                             0.00
                                                                         0.000
    LATERAL #1
                                    0.00
    LATERAL #2
                                                             0.00
                                                                         0.000
                    O. OO===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
               MANNING'S N = 0.01300;
  DOWNSTREAM:
                                       FRICTION SLOPE = 0.34285
                                        Page 4
```

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AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.65667
  JUNCTION LENGTH = 4.00 FEET ENTRANCE LOSSES | UNCTION LOSSES = (2.627 FEET ENTRANCE LOSSES) | JUNCTION LOSSES = (4.643)+(0.000) = 4.643
                                                       ENTRANCE LOSSES = 0.000 FEET
         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(POUN
                                                                 ENERGY(FT)
                                                                                     MOMENTUM (POUNDS)
                                                                      0.749
                                   Ò. 547
                                                  3.603
                                                                                                22. 94
             0.000
                                                  3.751
                                                                        0.750
                                  0. 531
                                                                                                22.97
             0.001
                                                 3. 911
                                                                                                23.07
             0.004
                                  0. 515
                                                                       0.753
                                  0.499
             0.010
                                                  4.083
                                                                       0. 758
                                                                                                23.25
                                  0. 483
                                                  4. 269
                                                                                                23.51
              0.018
                                                                       0. 766
                                  0.467
                                                  4. 472
                                                                                                23.86
              0.030
                                                                       0. 778
                                                 4. 692
                                                                       0.793
              0.046
                                  0. 451
                                                                                                24.30
                                                4. 933
                                  0. 435
                                                                       0.813
                                                                                                24.84
              0.067
                                              4. 933
5. 197
5. 487
5. 807
6. 161
6. 556
6. 997
7. 493
8. 053
8. 691
9. 422

      5. 197
      0. 839

      5. 487
      0. 871

      5. 807
      0. 911

      6. 161
      0. 961

      6. 556
      1. 023

      6. 997
      1. 100

      7. 493
      1. 196

      8. 053
      1. 315

      8. 691
      1. 465

      9. 422
      1. 655

      10. 266
      1. 897

      11. 250
      2. 210

      12. 409
      2. 620

      13. 788
      3. 166

      15. 452
      3. 906

      17. 492
      4. 934

      20. 037
      6. 402

      23. 283
      8. 571

              0.094
                                  0. 419
                                                                       0.839
                                                                                                25.50
                                  0.403
             0. 128
                                                                                                26, 29
              0.170
                                  0. 387
                                                                                                27.22
                                  0. 371
                                                                                                28.32
              0. 222
                                                                                                29.59
              0. 288
                                  0. 355
                                  0. 339
              0.370
                                                                                                31.08
                                  0. 323
0. 308
              0.472
                                                                                                32.81
                                                                                                34.82
              0.601
                                  0. 292
                                                                                                37.17
              0.764
                                  0. 276
             0.974
                                                                                                39.92
              1. 247
                                  0. 260
                                                                                                43.14
              1.610
                                  0. 244
                                                                                                46.95
                                  0. 228
                                                                                                51.49
              2. 105
                                                                                                56.94
                                  0. 212
              2.803
              3.844
                                  0. 196
                                                                                                63.58
              5.544
                                  0. 180
                                                                                                71.75
             8. 931
                                  0. 164
                                                                                                82.00
            25. 230
                                0. 148
                                                                                                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>
                                                      Page 5
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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

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 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 **PRESSURE** PRESSURE+ PRESSURE+ MODEL FLOW NUMBER **PROCESS** MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) HEAD(FT) 1.50* 525.00-84.85 0.26 19.64 FRI CTI ON } 1.40* 520.00-74.12 24.89 0.22 JUNCTI ON 520.00-1.07* 42.96 0.15 41.93 } HYDRAULIC JUMP } FRICTION 0.44 Dc 515.00-13.68 0.31* 16.37 JUNCTI ON } 515.00-0.44 Dc 0.37*13.68 14.32 } FRICTION 0.44*Dc 510.00-0.44*Dc 13.68 13.68 } CATCH BASIN 510.00-0.36 4.07 0.44*Dc 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 = 1.40 CFS PIPE FLOW = PIPE DIAMETER = 18.00 INCHES ASSUMED DOWNSTREAM CONTROL HGL = 215.640 FEET 525.00 : HGL = < 215.640>: EGL= < 215.650>: FLOWLINE= < 214.140> NODE

NUDE 525. UU : HGL = < 215. 640>; EGL= < 215. 650>; FLUWLINE= < 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
Page 1

| PIPE LENGTH = | 9. 67 FEET | 525. RES MANNI NG' S N = 0 | . 01300 |
|---|---|--|---|
| NORMAL DEPTH(FT) = | 0. 37 | CRITICAL DEPTH(FT | 0.44 |
| DOWNSTREAM CONTROL | ASSUMED PRESSURE I | HFAD(FT) = 1.50 | |
| GRADUALLY VARIED FL | OW PROFILE COMPUTI | ED INFORMATION: | |
| DISTANCE FROM CONTROL(FT) 0.000 4.138 8.258 9.670 | FLOW DEPTH VELOC (FT) (FT/SI 1.500 0.1 1.458 0.1 1.415 0.8 1.401 0.8 | SPECIFIC EC) ENERGY(FT) 792 1.510 798 1.468 810 1.426 815 1.411 | PRESSURE+ MOMENTUM(POUNDS) 84.85 80.22 75.66 74.12 |
| NODE 520.00 : HGL | = < 215. 641>; EGI | L= < 215.651>; FLOWL | I NE= < 214. 240> |
| ************************************** | ODE 520.00 TO NO .00 ELEVATION | ************************************** | = 5 S SUBCRITICAL) |
| CALCULATE JUNCTION PIPE FLO (CF UPSTREAM 1 DOWNSTREAM 1 LATERAL #1 0 LATERAL #2 0 | LOSSES: | NGLE FLOWLINE C GREES) ELEVATION DE 40.00 214.57 - 214.24 0.00 0.00 0.00 0.00 | DITICAL VELOCITY |
| UPSTREAM: MANNIN DOWNSTREAM: MANNIN AVERAGED FRICTION S JUNCTION LENGTH = | G(DELTA1) - Q3*V3*C0(A)) / ((A1+A2)*16.1) G'S N = 0.01300; G'S N = 0.01300; GLOPE IN JUNCTION A 4.00 FEET 0.001 FEET DY+HV1-HV2) + (ENTRA | S(DELTA3) -)+FRICTION LOSSES FRICTION SLOPE = 0. FRICTION SLOPE = 0. ASSUMED AS 0.00020 ENTRANCE LOSSES = ANCE LOSSES) | 0.000 FEET |
| NODE 520.00 : HGL | = < 215. 643>; EGI | L= < 215. 659>; FLOWL | |
| ************************************** | ODE 520.00 TO NO | ************************************** | = 1 |
| CALCULATE FRICTION PIPE FLOW = PIPE LENGTH = 1 | 1. 40 CFS PI PI | E DIAMETER = 18.00 MANNING'S N = 0 | I NCHES . 01300 |
| HYDRAULIC JUMP: DOW | 'NSTREAM RUN ANALY | | |
| NORMAL DEPTH(FT) = | 0. 15 | CRITICAL DEPTH(FT | 0.44 |
| UPSTREAM CONTROL AS | SUMED FLOWDEPTH(F | T) = 0. 31 ========== | =========== |
| GRADUALLY VARIED FL | | | |
| DISTANCE FROM CONTROL(FT) O. 000 O. 046 | | EC) ENERGY(FT) 250 0. 741 | PRESSURE+ MOMENTUM(POUNDS) 16.37 16.71 |

| | | 525. RES | | |
|------------------|------------------|--------------------|------------------|------------------|
| 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 0. 947 | 18. 86 19. 40 |
| 0. 475 0. 582 | 0. 266 0. 259 | 6. 624 6. 871 | 0. 947 | 19. 40 19. 99 |
| 0. 362 | 0. 259 | 7. 135 | 1. 043 | 20. 62 |
| 0. 703 | 0. 232 | 7. 133 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 8. 822 | 0. 166 0. 159 | 13. 174 13. 994 | 2. 862 3. 201 | 36. 20 38. 38 |
| 12. 532 | 0. 159 | 14. 903 | 3. 603 | 40. 81 |
| 100. 750 | 0. 132 | 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:

| GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION: | | | | | |
|---|--|---|---|--|--|
| DI STANCE FROM CONTROL (FT) 0. 000 0. 052 0. 105 0. 157 0. 209 0. 260 0. 311 0. 362 0. 413 0. 463 0. 512 0. 561 0. 610 0. 657 0. 704 0. 749 0. 793 0. 836 0. 876 0. 915 0. 950 | FLOW DEPTH (FT) 1. 073 1. 048 1. 022 0. 997 0. 972 0. 947 0. 922 0. 897 0. 871 0. 846 0. 821 0. 796 0. 771 0. 746 0. 720 0. 695 0. 670 0. 645 0. 620 0. 594 0. 569 | VELOCI TY (FT/SEC) 1. 035 1. 062 1. 091 1. 122 1. 155 1. 191 1. 229 1. 270 1. 314 1. 362 1. 414 1. 470 1. 530 1. 596 1. 668 1. 746 1. 832 1. 927 2. 031 2. 147 2. 275 | SPECI FI C ENERGY (FT) 1. 089 1. 065 1. 041 1. 017 0. 993 0. 969 0. 945 0. 922 0. 898 0. 875 0. 852 0. 852 0. 829 0. 807 0. 785 0. 764 0. 743 0. 722 0. 702 0. 684 0. 666 | PRESSURE+ MOMENTUM(POUNDS) 42. 96 40. 93 38. 97 37. 06 35. 22 33. 44 31. 73 30. 08 28. 50 26. 98 25. 54 24. 17 22. 86 21. 63 20. 48 19. 41 18. 41 17. 50 16. 67 15. 93 15. 28 | |
| 0. 982 | 0. 544 | 2. 419 | 0. 635 | 14. 73 | |
| 1. 009 | 0. 519 | 2. 580 | 0. 622 | 14. 29 | |
| 1. 031 1. 046 | 0. 494 0. 469 | 2. 762 2. 968 | 0. 612 0. 605 | 13. 96 13. 75 | |
| 1. 052 | 0.443 | 3. 204 | 0.603 | 13. 68 | |
| 100. 750 | 0. 443 | 3. 204 | 0.603 | 13. 68 | |

PRESSURE+MOMENTUM BALANCE OCCURS AT 0.03 FEET UPSTREAM OF NODE 520.00 | DOWNSTREAM DEPTH = 1.060 FEET, UPSTREAM CONJUGATE DEPTH = 0.149 FEET Page 3

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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:
                FLOW DIAMETER ANGLE
                                             FLOWLI NE
                                                                     VELOCITY
       PI PE
                                                        CRI TI CAL
                          (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                  (CFS)
                                                           0. 44
    UPSTREAM
                  1. 40
                            18. 00 35. 00
                                               261. 60
                                                                        4.063
                   1.40
   DOWNSTREAM
                            18.00
                                               261. 27
                                                           0.44
                                                                        5. 252
                    LATERAL #1
                    0.00
                                                           0.00
                                                                       0.000
   LATERAL #2
                                                           0.00
                                                                       0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       05
  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(POUN
                    (FT) (FT/SEC)
                                                            MOMENTUM (POUNDS)
                         Ò. 443
                                    3. 204
          0.000
                                                   0.603
                                                                     13.68
                        0.440
                                    3. 233
          0.008
                                                   0.603
                                                                     13.68
          0.031
                         0.438
                                    3. 263
                                                   0.603
                                                                     13.68
                                    3. 293
                         0.435
                                                                     13.69
         0.072
                                                   0.603
                         0.432
                                    3. 324
          0. 132
                                                   0.604
                                                                     13.69
                                                   0.604
         0.213
                        0.429
                                   3. 355
                                                                     13.70
                        0.426
                                   3. 386
          0.317
                                                   0.604
                                                                     13.71
                                  3. 418
3. 451
3. 484
3. 518
3. 552
3. 587
          0.447
                        0.423
                                                   0.605
                                                                     13.73
          0.606
                        0.420
                                                   0.605
                                                                     13.74
                        0.418
          0.797
                                                   0.606
                                                                     13. 76
                        0.415
          1.025
                                                   0.607
                                                                     13.78
          1.294
                        0.412
                                                   0.608
                                                                     13.80
          1.610
                        0.409
                                                   0.609
                                                                     13.83
                                   3. 623
                        0.406
                                                                     13.85
          1. 983
                                                   0. 610
          2. 420
                        0.403
                                   3. 659
                                                   0. 611
                                                                    13.88
          2. 936
                        0.400
                                   3. 696
                                                                    13. 92
                                                   0. 613
                                  3. 733
3. 772
                        0. 397
                                                                    13. 95
          3.545
                                                   0. 614
                        0.395
                                                                     13.99
          4. 271
                                                   0. 616
                                       Page 4
```

| 6. 213 7. 546 9. 263 11. 587 15. 021 | 0.374 | 3. 850 3. 890 3. 931 3. 973 4. 016 | 0. 617 0. 619 0. 621 0. 623 0. 625 0. 628 0. 631 | 14. 07 14. 11 14. 16 14. 21 14. 26 | |
|---|-----------------------------|--|--|--|--|
| NODE 510.00 : HO | GL = < 262.413 | 3>; EGL= < 2 | 62. 573>; FLOWLI NE= | = < 261. 970> | |
| ************************************** | NODE 510. 00 0. 00 ELEVA | TO NODE 5 | 10.00 IS CODE = 22.24 (FLOW IS SU | 8 | |
| 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 : HO | GL = < 262.683 | 3>; EGL= < 2 | 62. 683>; FLOWLI NE= | = < 262. 240> | |
| ************************************** | | | | | |
| END OF GRADUALLY N | /ARIED FLOW ANA | LYSIS | ======================================= | | |

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

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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.)

| | UPSTREA | DOWNSTRE <i>A</i> | AM RUN | |
|---------------------------|----------|-------------------|-----------|-------------------|
| NODE MODEL PF | RESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER PROCESS HE 695.00- | EAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 695.00- | 3.`50´ | 1653, 29 | 0.`78* | 3628.24 |
| } FRICTION | 0.00 | .000 / | 0.70 | 0020.2. |
| 690. 00- | 3. 41 | 1601. 06 | 0.74* | 3933. 09 |
| JUNCTI ON | J. 71 | 1001.00 | 0.74 | 3733.07 |
| | 3.00 | 1421. 95 | 0. 72* | 4106 40 |
| 690.00- | 3.00 | 1421. 93 | 0.72 | 4106. 40 |
| FRICTION | 0.04*D | 1005 70 | 0.01+0- | 1005 70 |
| 685. 00- | 2. 31*Dc | 1285. 72 | 2. 31*Dc | 1285. 72 |
| } JUNCTION | | | | |
| 685. 00- | 3. 11* | 1139. 11 | 1. 74 | 910. 27 |
| <pre>} FRICTION</pre> | | | | |
| 680. 00- | 2. 73* | 991. 82 | 2.05 Dc | 877. 18 |
| <pre>} JUNCTION</pre> | | | | |
| 680. 00- | 3.44* | 1249. 45 | 1. 67 | 870. 12 |
| } FRICTION | | | | |
| 675. 00- | 2. 92* | 1021. 30 | 2.00 Dc | 829. 90 |
| } JUNCTION | 2. /2 | 1021.00 | 2.00 00 | 027.70 |
| 675. 00- | 3. 56* | 978. 26 | 1. 06 | 274.77 |
| FRICTION | 3. 30 | 770. 20 | 1.00 | 274.77 |
| | 3. 33* | 074 21 | 1 24 Do | 262 20 |
| 665. 00- | | 874. 31 | 1.26 Dc | 262. 39 |
| } CATCH BASIN | | 0.47.00 | 4 0/ D | 00.44 |
| 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:

FLOWLINE ELEVATION = NODE NUMBER = 695.00 54.70 CFS PIPE FLOW = PIPE DIAMETER = 42.00 INCHES

ASSUMED DOWNSTREAM CONTROL HGL = 227.810 FEET

```
695.00 : HGL = < 225.095>; EGL= < 242.964>; FLOWLINE= < 224.310>
 NODE
******************
 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 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(POUI
0.000 0.741 36.828 21.814 3933.00
                                                          MOMENTUM (POUNDS)
                                                                3933.09
        11. 941
                        0.785
                                  33. 926
                                                18. 668
                                                                3629.61
        12.000
                        0.785
                                  33. 913
                                                                3628.24
                                                18.654
 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:
                 FLOW
                        DI AMETER
                                  ANGLE
                                           FLOWLI NE
                                                       CRI TI CAL
      PI PE
                                                                  VELOCITY
                         (INCHES) (DEGREES) ELEVATION
                                                      DEPTH(FT.)
                 (CFS)
                                                                  (FT/SEC)
                  54. 70
54. 70
    UPSTREAM
                           42.00
                                     0.00
                                             224. 76
                                                         2. 31
                                                                    38. 494
   DOWNSTREAM
                           42.00
                                             224.43
                                                         2. 31
                                                                    36.839
                                                                    0.000
                  0.00
                                     0.00
   LATERAL #1
                            0.00
                                               0.00
                                                         0.00
   LATERAL #2
                   0.00
                            0.00
                                     0.00
                                               0.00
                                                         0.00
                                                                    0.000
                   O. OO===Q5 EQUALS BASIN INPUT===
      Q5
 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:
                                     Page 2
```

| 1. 687 | 1. 583 | 12. 937 | 4. 184 4. 427 4. 727 5. 097 5. 557 6. 129 6. 848 7. 756 8. 918 10. 423 12. 400 15. 045 18. 660 23. 727 23. 727 | PRESSURE+ MOMENTUM (POUNDS) 1285. 72 1287. 32 1292. 28 1300. 86 1313. 37 1330. 14 1351. 57 1378. 11 1410. 31 1448. 78 1494. 27 1547. 66 |
|--|--|--|--|---|
| NODE 685.00 : H | | 75>: FGI = < | 268 194>: FLOWLL | NF= < 264 860> |
| | | • | • | ***** |
| FLOW PROCESS FROM | M NODE 685.00 |) TO NODE | 685.00 IS CODE | = 5 |
| OALOULATE HIMOTIA | ON 1 000E0 | | | ITICAL VELOCITY TH(FT.) (FT/SEC) 2.05 5.588 2.31 8.101 0.00 0.000 0.00 0.000 |
| LACFCD AND OCEMA DY=(Q2*V2-Q1*V1*(Q4*V4*COS(DEI | FLOW JUNCTION COS(DELTA1) - 03* LTA4))/((A1+A2) NING'S N = 0.01 NING'S N = 0.01 N SLOPE IN JUNC = 4.00 FEET = 0.017 FEET = (DY+HV1-HV2)+ | FORMULAE U: *V3*COS(DEL:)*16.1)+FRI(: 1300; FRIC: 1300; FRIC: CTION ASSUM ENT: +(ENTRANCE | SED: TA3) - CTION LOSSES TION SLOPE = 0.0 TION SLOPE = 0.0 ED AS 0.00421 RANCE LOSSES = LOSSES) | 0351 0492 |
| NODE 685.00 : H | | 73>; EGL= < | 268. 958>; FLOWLI | NE= < 265. 360> |
| | | • | | ****** |
| FLOW PROCESS FROM UPSTREAM NODE | M NODE 685.00 680.00 ELEV | O TO NODE /ATION = | 680.00 IS CODE 265.86 (FLOW SE | = 1 |
| CALCULATE FRICTIO | ON LOSSES(LACFO | | | |

| | 39. 50 CFS 49. 95 FEET | | IETER = 36.00 INI NG' S N = 0 | |
|---|---|--|---|--|
| DOWNSTREAM CONT | ROL ASSUMED PRE | SSURE HEAD(F | T) = 3.11 | |
| | PROFILE COMPUTED | | | ======================================= |
| DISTANCE FROM CONTROL(FT) 0.000 17.340 | PRESSURE HEAD(FT) 3.113 3.000 | (FT/SFC) | SPECIFIC ENERGY(FT) 3.598 3.485 | PRESSURE+ MOMENTUM(POUNDS) 1139.11 1089.37 |
| NORMAL DEPTH(FT | 1.66 | CRI | TICAL DEPTH(FT) |) = 2.05 ==================================== |
| ASSUMED DOWNSTR | REAM PRESSURE HE | EAD(FT) = | 3. 00 | ======================================= |
| | D FLOW PROFILE | | | ============ |
| DI STANCE FROM CONTROL (FT) 17. 340 22. 698 27. 630 32. 321 36. 827 41. 176 45. 385 49. 466 49. 950 | FLOW DEPTH (FT) 3.000 2.962 2.924 2.886 2.847 2.809 2.771 2.733 2.728 | VELOCITY (FT/SEC) 5. 586 5. 600 5. 625 5. 657 5. 696 5. 740 5. 789 5. 843 5. 850 | SPECIFIC ENERGY (FT) 3. 485 3. 449 3. 415 3. 383 3. 351 3. 321 3. 292 3. 263 3. 260 | PRESSURE+ MOMENTUM(POUNDS) 1089.37 1073.59 1058.74 1044.54 1030.92 1017.84 1005.29 993.25 991.82 |
| ***** | | ****** | ***** | I NE= < 265.860> ******** = 5 |
| | | | | NSEALS IN REACH) |
| LIDCTDEAM | TION LOSSES: FLOW DI AMET (CFS) (I NCHE 37. 90 36. 0 39. 50 36. 0 0. 00 0. 0 1. 60===05 E0 | S) (DEGREES) | ELEVATION DE | RITICAL VELOCITY PTH(FT.) (FT/SEC) 2.00 5.362 2.05 5.851 0.00 0.000 0.00 0.000 |
| LACFCD AND OCEM DY=(Q2*V2-Q1*V1 Q4*V4*COS(E UPSTREAM: MA DOWNSTREAM: MA AVERAGED FRICTI JUNCTION LENGTH FRICTION LOSSES JUNCTION LOSSES | MA FLOW JUNCTION *COS(DELTA1)-Q3 DELTA4))/((A1+A2 NNNING'S N = 0.0 NNNING'S N = 0.0 ON SLOPE IN JUN I = 4.00 FEET | I FORMULAE US 1*V3*COS(DELT 2)*16.1)+FRIC 11300; FRICT ICTION ASSUME +(ENTRANCE L | SED: (A3) - (TION LOSSES (ION SLOPE = 0.6) (ION SLOPE = 0.6) (D AS 0.00315) (ANCE LOSSES = 0.0055ES) | 00306 |
| NODE 680.00 : | HGL = < 269. 6 | 30>; EGL= < | 270. 076>; FLOWL | I NE= < 266. 190> |
| FLOW PROCESS FR | ROM NODE 680.0 675.00 ELE | OO TO NODE EVATION = 2 | 675.00 IS CODE 66.95 (FLOW S | EALS IN REACH) |
| CALCULATE FRICT | ION LOSSES(LACF | | 4 | |

```
37. 90 CFS
                                      PIPE DIAMETER = 36.00 INCHES
  PIPE FLOW =
 PIPE LENGTH =
                      76.00 FEET MANNING'S N = 0.01300
______
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 3.44
 ______
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
   ______
 DI STANCE 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:
 DI STANCE FROM CONTROL (FT) (FT) (FT/SEC) SPECIFIC PRESSURE+ 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:
       PI PE
                   FLOW
                          DIAMETER ANGLE
                                                FLOWLI NE
                                                              CRI TI CAL
                                                                          VELOCITY
                            (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                    (CFS)
                                                                           (FT/SEC)
                    15. 70
37. 90
                                                                1. 26
     UPSTREAM
                              36. 00 81. 90 267. 28
                                                                              2. 221
    DOWNSTREAM
                              36.00
                                                   266. 95
                                                                              5.405
                                                                 2.00
                     0.00
                               0.00
                                          0.00
                                                                0.00
                                                                              0.000
    LATERAL #1
                                                     0.00
    LATERAL #2
                     0.00
                               0.00
                                          0.00
                                                     0.00
                                                                0.00
                                                                              0.000
       05
                    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)

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                           ENTRANCE LOSSES = 0.091 FEET
  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 = SF=(Q/K)**2 = (( 15.70)/( 666.509))**2 = 0.00055 HF=L*SF = ( 25.85)*(0.00055) = 0.014
                                      MANNING'S N = 0.01300
```

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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

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

"*" indicates nodal point data used.)

| | UPSTREAM RUN | | | DOWNSTREAM RUN | | |
|----------|--------------|----------|-------------------|----------------|-------------------|--|
| | | | | FLOW | | |
| | | | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) | |
| 755. 00- | | 1. 50 | 118. 33 | 0. 42* | 158. 25 | |
| | FRI CTI ON | 4 00 | 00.44 | 0 004 | 0.40 0.4 | |
| | IIINOTI ON | 1. 29 | 99. 66 | 0. 30* | 248. 21 | |
| | JUNCTI ON | 0 00 00 | 02 (0 | 0.27* | 207 40 | |
| | EDI CTI ON | 0.92 Dc | 83. 68 | 0. 27* | 287. 40 | |
| 745. 00- | FRI CTI ON | 0.92 Dc | 83. 68 | 0. 59* | 107. 64 | |
| | JUNCTI ON | 0. 72 DC | 83. 08 | 0. 57 | 107.04 | |
| 745. 00- | | 1. 09 | 78. 43 | 0. 45* | 119. 54 | |
| | FRI CTI ON | 1.07 | 70. 10 | 0. 10 | 117.01 | |
| 730.00- | | 0.87 Dc | 72. 26 | 0.83* | 72. 52 | |
| | JUNCTI ON | | | | | |
| 730. 00- | | 0.78 Dc | 54. 33 | 0. 67* | 56. 15 | |
| | FRI CTI ON | | | | | |
| | | 0. 78*Dc | 54. 33 | 0. 78*Dc | 54. 33 | |
| | CATCH BAS | | | | | |
| 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 = PIPE FLOW = 755.00 FLOWLINE ELEVATION = 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 = 1Page 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(POUL
0 000 0 303 22 285 8 020 248 2
                                                                 MOMENTUM (POUNDS)
          Ò. 0Ó0
                           ò. 3ó3
                                      22. 285
                                                       8. 02Ó
                                                                         248. 21
                                                                         227.39
          3. 982
                          0.323
                                     20. 371
                                                       6.771
                                     18. 726
17. 300
                                                                         209.57
          8.009
                          0.343
                                                       5. 791
         12.080
                          0.363
                                                       5.013
                                                                         194.21
                                  16. 055
14. 960
13. 991
13. 920
         16. 195
                          0.382
                                                       4. 387
                                                                         180.87
                                                    3. 879
3. 463
         20. 353
                          0.402
                                             3. 879
3. 463
3. 434
                                                                         169.22
                   0. 402
0. 422
0. 423
         24. 558
                                                                         159.00
         24.890
                                                                         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:
                           DIAMETER ANGLE FLOWLINE (INCHES) (DEGREES) ELEVATION
                   FLOW
                                                              CRI TI CAL
       PI PE
                                                                          VELOCITY
                                                                          (FT/SEC)
25.880
                                                             DEPTH(FT.)
                   (CFS)
                     5. 70
5. 70
     UPSTREAM
                              18. 00<sup>°</sup>
                                          0. 00
                                                   202.54
                                                                0. 92
    DOWNSTREAM
                              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
                     O. OO===Q5 EQUALS BASIN INPUT===
       Q5
 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
         750.00 : HGL = < 202.813>; EGL= < 213.214>; FLOWLINE= < 202.540>
 NODE
*******************
 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
 ______
```

| DI STANCE FROM CONTROL (FT) 0. 000 0. 099 0. 208 0. 331 0. 468 0. 622 0. 794 0. 988 1. 207 1. 454 1. 736 2. 057 2. 425 2. 849 3. 342 | FLOW DEPTH (FT) 0. 589 0. 576 0. 563 0. 550 0. 537 0. 524 0. 511 0. 498 0. 485 0. 472 0. 458 0. 445 0. 445 0. 432 0. 419 0. 406 | VELOCI TY (FT/SEC) 8. 847 9. 117 9. 403 9. 707 10. 028 10. 371 10. 735 11. 123 11. 537 11. 980 12. 455 12. 964 13. 513 14. 104 14. 743 | SPECIFIC ENERGY (FT) 1. 805 1. 868 1. 937 2. 014 2. 099 2. 195 2. 301 2. 420 2. 553 2. 701 2. 869 3. 057 3. 269 3. 510 3. 783 4. 005 | PRESSURE+ MOMENTUM(POUNDS) 107. 64 110. 11 112. 77 115. 63 118. 72 122. 04 125. 62 129. 49 133. 65 138. 15 143. 02 148. 29 153. 99 160. 19 166. 93 174. 27 182. 28 191. 05 200. 67 211. 25 222. 94 235. 88 250. 27 266. 33 284. 34 287. 40 |
|---|--|--|---|--|
| 4. 601 5. 416 6. 405 7. 626 9. 172 11. 198 13. 997 18. 227 25. 999 96. 270 | 0. 343 0. 380 0. 367 0. 354 0. 341 0. 328 0. 315 0. 302 0. 289 0. 275 0. 273 | 16. 187 17. 006 17. 901 18. 882 19. 961 21. 152 22. 474 23. 945 25. 593 25. 872 | 4. 451 4. 860 5. 333 5. 880 6. 518 7. 267 8. 149 9. 198 10. 453 10. 674 | 174. 27 182. 28 191. 05 200. 67 211. 25 222. 94 235. 88 250. 27 266. 33 284. 34 287. 40 |
| | | | | |
| FLOW PROCESS FROUPSTREAM NODE | OM NODE 745. 0 745. 00 ELE | O TO NODE VATION = 2 | | ************************************** |
| CALCULATE JUNCTI | ON LOSSES: | ED ANOLE | ELOWILINE OR | ITICAL VELOCITY TH(FT.) (FT/SEC) 0.87 11.584 0.92 8.849 0.00 0.000 0.000 |
| LACFCD AND OCEMADY=(Q2*V2-Q1*V1* | A FLOW JUNCTION COS(DELTA1) - Q3 ELTA4))/((A1+A2) INING'S N = 0.0 ININ | FORMULAE US *V3*COS(DELT)*16.1)+FRIC 1300; FRIC 1300; FRIC CTION ASSUME ENTF | SED: (TA3) - CTION LOSSES (TION SLOPE = 0.0 (TION SLOPE = 0.0 ED AS 0.04571 RANCE LOSSES = LOSSES) | 6368 2773 |
| NODE 745.00 : | HGL = < 267.0 | 56>; EGL= < | 269. 139>; FLOWLI | NE= < 266. 610> |
| FLOW PROCESS FROUPSTREAM NODE | | | | ************************************** |

```
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 CONTROL(FT) FLOW DEPTH VELOCITY SPECIFIC PRESSURE+

(FT) (FT/SEC) ENERGY(FT) MOMENTUM(POUND O. 000 0. 828 5. 093 1. 232 72. 52

0. 059 0. 812 5. 217 1. 235 72. 76
                                                                      MOMENTUM (POUNDS)
                                                                               72. 52
72. 76
           0.143
                            0. 797
                                  5. 346

5. 485

5. 630

5. 783

5. 944

6. 114

6. 294

6. 485

6. 688

6. 902

7. 131

7. 374

7. 634

7. 911

8. 208

8. 526

8. 867

9. 235

9. 632
                                         5.348
                                                           1. 241
                                                                               73.09
           0.253
                            0. 781
                                                           1. 248
                                                                               73.51
                                                      1. 257
1. 268
1. 298
1. 316
1. 338
1. 364
1. 393
1. 427
1. 466
1. 511
1. 562
1. 620
1. 687
1. 763
1. 851
1. 951
2. 066
2. 199
2. 352
2. 529
           0.392
                           0. 765
                                                          1. 257
                                                                               74.03
                           0. 749
                                                                               74.65
           0.566
                            0.733
                                                                               75. 38
           0.777
           1.032
                                                                               76.22
                            0. 717
                            0. 701
                                                                               77.18
           1.335
           1.696
                            0. 685
                                                                               78.28
                                                                               79.51
                            0.669
           2. 121
           2. 623
                            0.653
                                                                               80.89
                                                                               82.42
           3. 214
                            0. 637
                            0.621
           3. 910
                                                                               84.13
                           0.605
           4.734
                                                                               86.02
           5. 711
                            0. 589
                                                                               88.11
           6.878
                            0.573
                                                                               90.41
                                                                               92. 95
95. 74
                            0.557
           8. 285
                            0.542
           9.999
          12. 123
                            0.526
                                                                               98.82
          14.814
                            0.510
                                                                              102.20
                                       9. 632
10. 060
10. 525
11. 030
11. 580
11. 580
                                                                              105.92
                           0.494
          18. 337
          23. 189
                           0.478
                                                                              110.02
                           0. 462
                                                                              114.54
          30. 486
                            0.446
                                                                              119.54
          43.817
                                                           2.529
          43.900
                           0. 446
                                                           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
                              (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                    (CFS)
                    4. 10
                                                      270. 16
                                18. 00 0. 00 18. 00 -
                                                                    0. 78 5. 386
0. 87 5. 095
     UPSTREAM
                      5. 10
                                                       269.83
    DOWNSTREAM
                      1. 00 18. 00 66. 80 270. 12
0. 00 0. 00 0. 00 0. 00
    LATERAL #1
                                                                    0.37
                                                                                  1.440
    LATERAL #2
                                                                                  0.000
                                                                    0.00
                       O. OO===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)
                                             Page 4
```

```
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/SEC)
                                          ENERGY(FT)
                                                        MOMENTUM (POUNDS)
                      (FT)
                      0. 775
0. 770
0. 765
                                 4. 448
                                               1. 083
                                                               Š4. 33
         0.000
                                                               54. 33
54. 34
         0.014
                                 4.484
                                               1.083
                                 4. 521
         0.057
                                               1.083
                       0.760
         0. 132
                                4. 559
                                               1.083
                                                               54.36
                      0.755
                                4. 597
         0. 242
                                               1.084
                                                               54.38
                      0.750
         0.391
                                4. 636
                                               1.084
                                                               54.42
         0.582
                      0. 745
                                4. 675
                                               1. 085
                                                               54.46
                      0.740
                                4. 716
                                               1.086
         0.820
                                                               54.50
                                4. 757
                                               1.087
         1. 111
                       0.735
                                                               54.56
                      0. 730
0. 725
                                 4. 798
                                               1.088
         1.461
                                                               54.62
                                4. 841
         1.879
                                               1.090
                                                               54.70
                      0. 720
0. 715
                                4.884
                                               1.091
                                                               54.78
         2. 373
         2. 954
                                4. 928
                                               1.093
                                                               54.87
                                               1.095
                      0.710
                                4. 973
                                                               54.96
         3.638
                               5. 018
5. 064
5. 112
5. 160
5. 208
5. 258
5. 309
         4.442
                      0.705
                                               1. 097
                                                               55.07
                                               1.099
         5.389
                       0.700
                                                               55.18
                                               1. 101
1. 104
1. 107
1. 110
1. 113
                       0.695
                                                               55.31
         6.510
         7.845
                       0.690
                                                               55.44
         9.453
                       0.685
                                                               55.58
        11.419
                       0. 681
                                                               55.74
                                                               55.90
        13.872
                       0.676
        17.034
                                5. 361
                                               1. 117
                      0.671
                                                               56.07
                                5. 385
                      0. 668
        18. 980
                                              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
FLOW VELOCITY = 4.45 FEET/SEC.
                                  PIPE DIAMETER = 18.00 INCHES
                                   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 =
 ASSUMED UPSTREAM CONTROL HGL =
                                 271.13 FOR DOWNSTREAM RUN ANALYSIS
______
```

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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 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 **PRESSURE** PRESSURE+ PRESSURE+ MODEL FLOW NUMBER **PROCESS** HEAD(FT) MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) 730.00-59.95 0.32 9.31 } FRICTION 725 00-48. 59 0.37 Dc 8.92 1.15* } CATCH BASIN 1. 16* 47.70 725.00-0.37 Dc 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: FLOWLINE ELEVATION = NODE NUMBER = 730.00 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 = 0.01300NORMAL DEPTH(FT) = 0.31 CRITICAL DEPTH(FT) = 0.37______ DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.27 ______ GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

| DI STANCE FROM CONTROL (FT) 0.000 3.605 7.206 10.805 12.000 | 1. 166 | (FT/SEC) 0. 625 | SPECIFIC ENERGY(FT) | |
|---|--------------------------|----------------------|-----------------------------------|-----------------|
| NODE 725.00 : HG | L = < 271. 2 | 74>; EGL= < | 271. 281>; FLOWLI | NE= < 270. 120> |
| ************************************** | NODE 725. 0 | O TO NODE | | = 8 |
| | 1.00 CFS 0.69 FEET/SE | PI PE [C. VELOCI | OLAMETER = 18.0 TY HEAD = 0.00 | 7 FEET |
| NODE 725.00 : HG | L = < 271. 2 | 83>; EGL= < | 271. 283>; FLOWLI | NE= < 270. 120> |
| ************************************** | CONTROL DAT 5.00 | A: Flowline | E ELEVATION = | 270. 12 |
| END OF GRADUALLY V | ARIED FLOW A | NALYSIS | | |

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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 **PRESSURE** PRESSURE+ MODEL PRESSURE+ FLOW NUMBER **PROCESS** MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) HEAD(FT) 1.50* 925.00-84.03 0.33 10.55 FRI CTI ON } 920.00-1.32* 64.91 0.39 Dc 10.07 JUNCTI ON 920.00-35.88 1.00* 0.13 31. 24 } HYDRAULIC JUMP } FRICTION 0.39 Dc 915.00-10.07 0.16* 24.01 JUNCTI ON } 915.00-0.39 Dc 10.07 0.13*33.30 } FRICTION 0.39*Dc 910.00-10.07 0.39*Dc 10.07 } CATCH BASIN 910.00-0.56*5.33 0.39 Dc 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 = 1.10 CFS PIPE FLOW = PIPE DIAMETER = 18.00 INCHES ASSUMED DOWNSTREAM CONTROL HGL = 174.430 FEET 925.00 : HGL = < 174.430>: EGL= < 174.436>: FLOWLINE= < 172.930> NODE

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 1.10 CFS PIPE DIAMETER = 18.00 INCHES
Page 1

925.00 TO NODE

UPSTREAM NODE 920.00 ELEVATION = 173.11 (FLOW SEALS IN REACH)

920.00 IS CODE = 1

FLOW PROCESS FROM NODE

| PIPE LENGTH = | 18.00 FEET | 925. RES MANNI NG' S N = 0.0 | 01300 |
|---|--|--|---|
| NORMAL DEPTH(FT) = | 0. 33 | CRITICAL DEPTH(FT) | = 0.39 |
| DOWNSTREAM CONTROL | ASSUMED PRESSURE | ====================================== | |
| GRADUALLY VARIED FL | OW PROFILE COMPUT | | |
| DI STANCE FROM CONTROL (FT) 0. 000 4. 468 8. 925 13. 374 17. 818 18. 000 | FLOW DEPTH VELOC (FT) (FT/S 1.500 0. 1.456 0. 1.411 0. 1.367 0. 1.323 0. 1.321 0. | SPECIFIC EC) ENERGY(FT) 622 1.506 628 1.462 638 1.418 651 1.374 667 1.330 667 1.328 | PRESSURE+ MOMENTUM (POUNDS) 84.03 79.17 74.38 69.68 65.09 64.91 |
| NODE 920.00 : HGL | = < 174. 431>; EG | L= < 174.438>; FLOWLIN | NE= < 173. 110> |
| FLOW PROCESS FROM N | IODE 920.00 TO N | ************************************** | = 5 |
| CALCULATE JUNCTION PIPE FLC (CF UPSTREAM DOWNSTREAM LATERAL #1 LATERAL #2 Q5 | LOSSES: OW DI AMETER A (S) (I NCHES) (DE 1. 10 18. 00 1. 10 18. 00 0. 00 0. 00 0. 00 0. 00 0. 00===Q5 EQUALS B | NGLE FLOWLINE CRI GREES) ELEVATION DEPT 60.00 173.44 0 - 173.11 0 0.00 0.00 0 0.00 0.00 0 | TI CAL VELOCITY (FT/SEC) (). 39 |
| UPSTREAM: MANNIN DOWNSTREAM: MANNIN AVERAGED FRICTION S JUNCTION LENGTH = | S(DELTA1) - Q3*V3*C0 A4))/((A1+A2)*16.1 IG'S N = 0.01300; IG'S N = 0.01300; SLOPE IN JUNCTION 4.00 FEET 0.001 FEET (DY+HV1-HV2)+(ENTR | S(DELTA3) -) + FRICTION LOSSES FRICTION SLOPE = 0.00 FRICTION SLOPE = 0.00 ASSUMED AS 0.00014 ENTRANCE LOSSES = 0 ANCE LOSSES) | 0010 |
| NODE 920. 00 : HGL | _ = < 174. 437>; EG | L= < 174.449>; FLOWLIN | NE= < 173.440> |
| FLOW PROCESS FROM N | IODE 920.00 TO N | ************************************** | ■ 1 |
| CALCULATE FRICTION PIPE FLOW = PIPE LENGTH = | LOSSES(LACFCD): 1.10 CFS PIP 17.89 FEET | E DIAMETER = 18.00 IN MANNING'S N = 0.0 | NCHES 01300 |
| HYDRAULIC JUMP: DOV | VNSTREAM RUN ANALY | SIS RESULTS | |
| | | CRITICAL DEPTH(FT) | |
| UPSTREAM CONTROL AS | SSUMED FLOWDEPTH(F | | |
| GRADUALLY VARIED FL | | | |
| DISTANCE FROM CONTROL(FT) | FLOW DEPTH VELOC (FT) (FT/S | ITY SPECIFIC EC) ENERGY(FT) Page 2 | PRESSURE+ MOMENTUM(POUNDS) |

| | | 925. RI | ES | |
|------------------|------------------|--------------------|------------------|------------------|
| 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. 682 | 0. 155 0. 154 | 11. 419 11. 537 | 2. 181 2. 222 | 24. 72 24. 97 |
| 0. 878 | 0. 154 | 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 2. 700 | 0. 146 0. 145 | 12. 429 12. 566 | 2. 546 2. 598 | 26. 83 27. 11 |
| 3. 054 | 0. 143 | 12. 706 | 2. 652 | 27. 11 |
| 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 7. 133 | 0. 137 0. 136 | 13. 601 13. 760 | 3. 012 3. 078 | 29. 28 29. 62 |
| 8. 216 | 0. 135 | 13. 700 | 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:

| DI STANCE FROM CONTROL (FT) 0. 000 0. 053 0. 105 0. 158 0. 210 0. 262 0. 313 0. 365 0. 416 0. 467 0. 517 0. 566 0. 615 0. 664 0. 711 0. 758 0. 803 0. 847 0. 889 | FLOW DEPTH (FT) 0. 997 0. 973 0. 949 0. 924 0. 900 0. 876 0. 852 0. 828 0. 803 0. 779 0. 755 0. 731 0. 706 0. 682 0. 658 0. 634 0. 610 0. 585 0. 561 | VELOCITY (FT/SEC) 0. 882 0. 907 0. 934 0. 962 0. 993 1. 026 1. 100 1. 141 1. 186 1. 234 1. 287 1. 344 1. 287 1. 344 1. 406 1. 474 1. 549 1. 631 1. 722 1. 823 | SPECIFIC ENERGY (FT) 1.009 0.986 0.962 0.939 0.916 0.892 0.869 0.846 0.824 0.801 0.779 0.756 0.773 0.756 0.734 0.713 0.692 0.671 0.651 0.631 0.613 | PRESSURE+ MOMENTUM(POUNDS) 35.88 34.08 32.33 30.63 29.00 27.42 25.91 24.45 23.06 21.72 20.45 19.24 18.10 17.03 16.02 15.08 14.21 13.41 12.68 |
|---|--|--|---|--|
| 0. 664 | 0. 682 | 1. 406 | 0. 713 | 17. 03 |
| 0. 758 | 0. 634 | 1. 549 | 0. 671 | 15. 08 |
| 0. 847 0. 889 | 0. 585 0. 561 | 1. 722 1. 823 | 0. 631 0. 613 | 13. 41 12. 68 |
| 0. 928 0. 965 0. 999 | 0. 537 0. 513 0. 488 | 1. 935 2. 061 2. 202 | 0. 595 0. 579 0. 564 | 12. 04 11. 47 10. 99 |
| 1. 028 1. 051 | 0. 464 0. 440 | 2. 362 2. 544 | 0. 551 0. 541 | 10. 61 10. 32 |
| 1. 067 1. 073 117. 890 | 0. 416 0. 392 0. 392 | 2. 753 2. 995 2. 995 | 0. 534 0. 531 0. 531 | 10. 13 10. 07 10. 07 |
| | END OF H | HYDRAULI C JUMP | | |

Page 3

| PRESSURE+MOMENTUM BALANCE OCCURS AT | | | | | | |
|---|--|--|--|--|--|--|
| 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 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.00 Q5 0.00==Q5 EQUALS BASIN INPUT=== LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED: | | | | | | |
| 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 0.00 Q5 0.00==Q5 EQUALS BASIN INPUT=== LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED: | | | | | | |
| CALCULATE JUNCTION LOSSES: PI PE FLOW DI AMETER 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 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.00 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> | | | | | | |
| ************************************** | | | | | | |
| 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: | | | | | | |
| DI STANCE FROM 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 | | | | | | |

```
925. RES
                                   7. 017
         0.663
                        0. 216
                                                  0. 981
                                                                   15.82
         0.839
                        0.205
                                                  1.095
                                  7. 569
                                                                   16.89
                                                                   18.14
         1.066
                        0.194
                                  8. 200
                                                  1. 239
                                  8. 927
9. 770
         1. 364
1. 765
                        0.183
                                                  1.421
                                                                   19.60
                                                                   21. 32
23. 36
                        0.172
                                                  1.655
         2.322
                                  10.759
                        0. 161
                                                  1. 960
         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:
                                   FLOWLINE ELEVATION = 258.07
 NODE NUMBER = 910.00
 ASSUMED UPSTREAM CONTROL HGL = 258.46 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 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.)

IIPSTRFAM RIIN DOWNSTRE

| NODE MODEL D | UPSTREAM RUN | | DOWNSTREAM RUN | |
|--|--------------------|-----------------------------|--------------------|------------------------|
| NODE MODEL P NUMBER PROCESS H 1045.00- | EAD(FT) 1.50* | MOMENTUM (POUNDS) 105.91 | DEPTH(FT) 0.66 | MOMENTUM(POUNDS) 68.00 |
| } FRICTION 1040.00- | 1. 32* | 88. 10 | 0. 61 | 71. 29 |
| } JUNCTION 1040.00- } FRICTION | 1. 11 | 72. 57 | 0. 33* | 146. 60 |
| 1035.00- } JUNCTION | 0.82 Dc | 63. 12 | 0. 31* | 156. 94 |
| 1035.00- } FRICTION | 0.82 Dc | 63. 12 | 0. 28* | 182. 92 |
| 1030.00- } JUNCTION 1030.00- | 0.82 Dc 0.82 Dc | 63. 12 63. 12 | 0. 29* 0. 26* | 174. 25 202. 64 |
| } FRICTION 1025.00- | 0.82 Dc | 63. 12 | 0. 75* | 63. 91 |
| } JUNCTI ON 1025. 00- | 0.82 Dc | 63. 12 | 0. 70* | 65. 44 |
| } FRICTION 1020.00- } JUNCTION | 0.82*Dc | 63. 12 | 0.82*Dc | 63. 12 |
| 1020.00- } FRICTION | 0. 88 | 63. 55 | 0. 68* | 66. 46 |
| 1015.00- } JUNCTI ON | 0.82 Dc | 63. 12 | 0. 61* | 71. 51 |
| 1015.00- } FRICTION 1010.00- | 0.82 Dc 0.82*Dc | 63. 12 63. 12 | 0. 72* 0. 82*Dc | 64. 93 63. 12 |
| } CATCH BASI 1010. 00- | N 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

```
CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
 DESIGN MANUALS.
          DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER = 1045.00
PIPE FLOW = 4.60 CFS
                                  FLOWLINE ELEVATION = 166.71
                                  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
  -----
DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 1.50
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
 ______
                  FLOW DEPTH VELOCITY
                                           SPECIFIC PRESSURE+
 DISTANCE FROM
                   (FT)
                              (FT/SEC)
                                           ENERGY(FT)
  CONTROL(FT)
                                                         MOMENTUM (POUNDS)
                       1.500
                               2. 602
                                                1.605
                                                                105.91
         0.000
         3. 195
                       1.473
                                                                103.02
                                  2.613
                                                1.579
                                 2. 633
         6. 262
                       1. 446
                                                                100.24
                                                1.554
                       1. 419
1. 392
         9. 257
                                  2.658
                                                                 97.53
                                                1.529
                                 2. 689
2. 689
                                                                 94. 90
        12. 195
                                                1.504
                       1. 365
1. 338
        15.086
                                  2.724
                                                                 92.34
                                                1.480
        17.934
                                  2.764
                                                                 89.87
                                                1. 456
                              2. 796
                                            1. 439
        20.000
                      1. 318
 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:
                       DIAMETER ANGLE
      PI PE
                 FLOW
                                          FLOWLI NE
                                                    CRI TI CAL
                                                                 VELOCITY
                        (INCHES) (DEGREES) ELEVATION
                 (CFS)
                                                     DEPTH(FT.)
                                                                 (FT/SEC)
                                    60. 00<sup>°</sup>
                                                        0.82
    UPSTREAM
                  4.60
                          18.00
                                            167. 24
                                                                  16. 180
                                             166. 91
                                                                   2. 797
   DOWNSTREAM
                  4.60
                          18.00
                                                        0.82
   LATERAL #1
                  0.00
                           0.00
                                     0.00
                                              0.00
                                                        0.00
                                                                   0.000
   LATERAL #2
                                                        0.00
                                                                   0.000
                  0.00
                           0.00
                                     0.00
                                              0.00
                  O. OO===Q5 EQUALS BASIN INPUT===
      05
 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>
                                     Page 2
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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+
                    (FT)
                                 (FT/SEC)
   CONTROL(FT)
                                              ENERGY(FT)
                                                             MOMENTUM (POUNDS)
                                                    4. 996
                         0.311
          0.000
                                   17. 365
                                                                    156. 94
                                   17. 303
17. 312
17. 260
17. 208
17. 156
17. 105
          0.695
                         0.312
                                                    4. 968
                                                                    156.48
                                                                    156.03
          1.417
                         0.312
                                                    4. 941
                         0. 313
0. 314
0. 314
          2. 170
                                                    4.914
                                                                    155.57

    955
    775

                                                    4.887
                                                                    155.12
                                                   4.860
                                                                    154.68
                                                4. 834
4. 807
4. 781
4. 755
                                   17. 054
                         0.315
                                                                    154.23
          4.636
                        0. 316
                                   17.003
          5.540
                                                                    153.79
          6.493
                        0. 316
                                   16. 952
                                                                    153.35
                                   16. 902
          7.502
                        0. 317
                                                                    152. 91
          8. 572
                                   16.851
                                                  4. 730
                                                                    152.47
                         0. 318
                                   16.802
          9.712
                         0. 318
                                                   4.704
                                                                    152.04
                                   16. 752
16. 703
         10. 933
                         0.319
                                                   4.679
                                                                    151.61
                         0. 320
         12. 249
                                                   4.654
                                                                    151.18
                         0.320
                                   16.654
                                                   4. 629
         13.675
                                                                    150.75
         15. 232
                         0.321
                                   16.605
                                                   4.605
                                                                    150.33
         16. 948
                         0.322
                                   16. 556
                                                                    149.91
                                                  4. 580
                                                 4. 556
         18.861
                         0.322
                                   16. 508
                                                                    149.49
         21.023
                         0.323
                                   16. 460
                                                  4. 532
                                                                    149.07
                         0.323
                                   16. 412
                                                   4. 508
         23. 512
                                                                    148.65
                                   16. 364
16. 317
16. 270
                                                 4. 485
4. 461
4. 438
4. 415
                         0.324
         26. 446
                                                                    148. 24
                         0.325
         30.028
                                                                    147.83
                         0.325
                                                                    147.42
         34.632
         41. 102
                         0.326
                                   16. 223
                                                                    147.02
                                   16. 176
16. 175
                         0.327
                                                  4. 392
         52. 148
                                                                    146.61
         66,000
                        0. 327
                                                  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:
                  FLOW
                          DI AMETER ANGLE
                                             FLOWLI NE
                                                          CRI TI CAL
                                                                     VELOCITY
                          (INCHES) (DEGREES) ELEVATION
                  (CFS)
                                                         DEPTH(FT.)
                                                                     (FT/SEC)
                            18. 00<sup>°</sup>
                                      12. 00<sup>°</sup>
                                              179. 16
     UPSTREAM
                    4.60
                                                            0.82
                                                                       20.340
    DOWNSTREAM
                                                178.83
                                                            0.82
                                                                       17. 370
0. 000
                    4.60
                            18.00
    LATERAL #1
                                        0.00
                                               0.00
                                                            0.00
                    0.00
                             0.00
    LATERAL #2
                    0.00
                             0.00
                                        0.00
                                                  0.00
                                                            0.00
                                                                        0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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
REAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.33831
  UPSTREAM:
                                        Page 3
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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 ENTRANCE LOSSES | 1.109 FEET ENTRANCE LOSSES | JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) JUNCTION LOSSES = (2.036)+(0.000) = 2.036
                                          ENTRANCE LOSSES = 0.000 FEET
 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+
                                   (FT/SEC)
                                                 ENERGY(FT)
                                                                MOMENTUM (POUNDS)
  CONTROL(FT)
                     (FT)
                                                 6. 104
                          0. 288
                                    19. 346
                                                                        174. 25
          0.000
                          0. 288
                                    19. 386
          0.511
                                                      6. 127
                                                                        174.60
                                    19. 425
                          0. 288
          1.045
                                                      6. 150
                                                                        174.94
          1.604
                                     19.464
                                                                        175. 29
                          0. 287
                                                      6. 174
                          0. 287
                                     19.504
          2. 190
                                                      6. 197
                                                                        175.64
                          0. 286
                                     19.544
                                                                        175.99
          2.806
                                                      6. 221
                          0.286
                                     19. 584
                                                      6. 245
          3.455
                                                                        176.34
                                                      6. 269
          4. 141
                          0. 285
                                     19. 624
                                                                        176.69
                                                  6. 269
6. 293
6. 317
6. 342
6. 366
6. 491
6. 441
6. 466
6. 491
6. 542
6. 568
6. 594
6. 620
6. 646
6. 673
6. 699
                          0. 285
                                    19. 664
                                                                        177.04
          4.867
                                                                        177.39
                          0. 285
                                    19. 705
          5. 639
                                    19. 745
                          0. 284
          6. 462
                                                                        177. 75
          7. 344
8. 294
                                    19. 786
19. 827
                          0. 284
                                                                        178.11
                          0. 283
                                                                        178.47
                          0. 283
0. 283
                                    19. 867
19. 909
          9. 321
                                                                        178.82
                                                                        179.18
         10.440
                          0. 282
                                     19. 950
                                                                        179.55
         11.669
                                    19, 991
                                                                        179.91
         13.030
                         0. 282
                                     20.033
         14. 555
                         0. 281
                                                                        180.27
         16. 287
                         0. 281
                                     20.074
                                                                        180.64
         18, 290
                         0. 281
                                     20. 116
                                                                        181. 01
                                    20. 158
20. 200
20. 243
20. 285
                          0. 280
         20.665
                                                                        181. 38
         23. 577
27. 340
                          0. 280
                                                                        181.75
                          0.279
                                                                        182.12
                          0. 279
                                                                        182.49
         32. 656
         41.778
                          0. 279
                                     20. 328
                                                      6. 699
                                                                        182.87
                                 20. 326 6. 703
        108. 000 0. 278
                                                                        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:
       PI PE
                 FLOW DIAMETER
                                       ANGLE
                                                 FLOWLI NE
                                                            CRI TI CAL
                                                                         VELOCITY
                           (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
                                         0.00 216.21 0.82
     UPSTREAM
                     4.60
                             18. 00
                                                                        22. 582
    DOWNSTREAM
                     4.60
                             18.00
                                                  215.88
                                                               0.82
                                                                           19.352
                                         Page 4
```

```
1045. RES
    LATERAL #1 0.00 0.00
LATERAL #2 0.00 0.00
                                                        0.00
                                                                                   0.000
                                            0.00
                                                                                  0.000
                       O. OO===Q5 EQUALS BASIN INPUT===
        05
  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 LOSSE
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (2.404)+(0.000) = 2.404
                                          ENTRANCE LOSSES = 0.000 FEET
  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(POUN
   CONTROL(FT)
                             (FT)
                                      (FT/SEC)
                                                     ENERGY(FT)
                                                                     MOMENTUM (POUNDS)
                                        5. 187
                            0. 752
                                                          1. 170
                                                                               63. 91
           0.000
           0.017
                            0.732
                                          5. 373
                                                           1. 180
                                                                              64.46
                                     5. 373
5. 572
5. 787
6. 018
6. 267
6. 537
6. 830
7. 149
7. 496
7. 877
8. 294
8. 754
9. 263
9. 827
           0.039
                            0.711
                                                           1. 194
                                                                               65. 17
           0.068
                            0. 691
                                                                               66.04
                                                           1. 211
                                                          1. 233
1. 260
1. 293
                                                                               67. 11
68. 38
           0. 105
                            0. 670
           0. 151
                            0.650
           0.206
                            0.629
                                                                               69.87
                            0.609
                                                           1. 334
                                                                               71.61
           0.275
                                                       1. 334
1. 383
1. 441
1. 512
1. 596
1. 698
1. 819
1. 966
2. 145
2. 361
2. 627
2. 954
3. 362
           0.357
                            0. 589
                                                                               73.61
           0.457
                            0. 568
                                                                               75. 91
           0.577
                            0. 548
                                                                               78.54
                            0. 527
                                                                               81.53
           0. 722
                            0.507
                                                                               84.95
           0.897
                            0.486
           1. 109
                                                                               88.83
                                         9. 827
                                                                               93. 25
98. 29
           1. 368
                            0.466
                            0. 446
                                        10. 457
           1. 685
                            0.425
                                        11. 163
           2.078
                                                                              104.04
           2.570
                                        11. 959
                            0.405
                                                                              110.63
           3. 195
                            0.384
                                        12.861
                                                                              118.20
           4.003
                            0.364
                                        13.891
                                                          3.362
                                                                              126.95
                                                                              137. 10
           5.074
                            0.343
                                        15. 075
                                                          3. 875
                                                          4. 527
                            0.323
                                        16. 449
                                                                              148.98
           6.546
                            0. 303
           8.679
                                        18.057
                                                          5.369
                                                                              162.97
                                        19. 959
22. 238
                            0. 282
          12.061
                                                           6.472
                                                                              179.63
                                        22. 238
22. 575
                            0. 262
                                                           7.945
                                                                              199.67
          18.592
                            0. 259
          72.000
                                                          8. 177
                                                                              202.64
  NODE 1025.00: HGL = < 260.782>; EGL= < 261.200>; FLOWLINE = < 260.030>
```

Page 5

| FLOW PROCESS FROM I UPSTREAM NODE 1029 | NODE 1025.00 5.00 ELEV | 1045.RE D TO NODE 10 /ATION = 26 | 25.00 IS CODE 0.36 (FLOW I | = 5 S SUPERCRI TI CAL) |
|--|---|--|---|--|
| (C) | LOSSES: OW DIAMETE | ER ANGLE S) (DEGREES) 0 47.00 0 - 0 0.00 0 0.00 JALS BASIN IN | FLOWLINE C | RITICAL VELOCITY PTH(FT.) (FT/SEC) 0.82 5.643 0.82 5.189 0.00 0.000 0.00 0.000 |
| LACFCD AND OCEMA FI DY=(Q2*V2-Q1*V1*CO: Q4*V4*COS(DELTA UPSTREAM: MANNII DOWNSTREAM: MANNII AVERAGED FRICTION: JUNCTION LENGTH = FRICTION LOSSES = JUNCTION LOSSES = | S(DELTA1) - Q3° A4)) / ((A1+A2) NG' S N = 0.0° NG' S N = 0.0° SLOPE IN JUNO 4.00 FEET 0.034 FEET (DY+HV1-HV2) | *V3*COS(DELTA)*16.1)+FRICT 300; FRICTI 300; FRICTI CTION ASSUMED ENTRA -(ENTRANCE LO | 3) - I ON LOSSES ON SLOPE = 0.0 ON SLOPE = 0.0 AS 0.00856 NCE LOSSES = | |
| NODE 1025.00 : HG | | , | , | |
| FLOW PROCESS FROM I UPSTREAM NODE 1020 | NODE 1025.00 | TO NODE 10 | 20.00 IS CODE | = 1 |
| CALCULATE FRICTION PIPE FLOW = PIPE LENGTH = NORMAL DEPTH(FT) = | LOSSES (LACE) | י (חי | | |
| NORMAL DEPTH(FT) = | 0. 70 | CRI T | ICAL DEPTH(FT |) = 0.82 |
| UPSTREAM CONTROL A | SSUMED FLOWDE | EPTH(FT) = | 0. 82 | |
| GRADUALLY VARIED F | | | | ======================================= |
| DI STANCE FROM CONTROL (FT) 0. 000 0. 014 0. 059 0. 138 0. 253 0. 408 0. 608 0. 857 1. 161 1. 526 1. 962 2. 478 3. 085 3. 799 4. 638 5. 626 6. 796 8. 189 9. 867 | FLOW DEPTH (FT) 0. 823 0. 818 0. 813 0. 808 0. 803 0. 798 0. 793 0. 788 0. 783 0. 777 0. 772 0. 767 0. 762 0. 762 0. 757 0. 752 0. 747 0. 742 0. 736 0. 736 | VELOCITY (FT/SEC) 4. 628 4. 664 4. 700 4. 737 4. 775 4. 813 4. 852 4. 892 4. 932 4. 932 5. 015 5. 057 5. 100 5. 144 5. 188 5. 234 5. 280 5. 327 5. 375 | SPECI FI C ENERGY (FT) 1. 156 1. 157 1. 157 1. 157 1. 158 1. 159 1. 159 1. 161 1. 162 1. 163 1. 165 1. 166 1. 168 1. 170 1. 172 1. 175 1. 177 | PRESSURE+ MOMENTUM (POUNDS) 63. 12 63. 13 63. 14 63. 16 63. 18 63. 22 63. 26 63. 31 63. 37 63. 44 63. 52 63. 60 63. 70 63. 80 63. 70 63. 80 63. 92 64. 04 64. 17 64. 31 64. 46 |

5. 574 1. 194 5. 627 1. 198 5. 642 1. 199 22. 242 0. 711 28. 843 0. 706 32. 170 0. 704 65. 17 65. 38 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: PI PF FLOW DIAMETER ANGLE FLOWLINE CRI TI CAL (INCHES) (DEGREES) ELEVATION (CFS) DEPTH(FT.) (FT/SEC) UPSTREAM 4. 60 60. 50´ 0. 82 18. 00[°] 261. 01 5.882 DOWNSTREAM 4.60 18.00 260.68 0.82 4. 629 0.00 0.00 0.00 0.00 0.00 0.00 LATERAL #1 0.00 0.00 0.00 0.000 0.00 LATERAL #2 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== 05 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(POUN MOMENTUM (POUNDS) 0. 610 **7**1. 51 0.000 6.814 1. 331 1. 238 0.613 6.765 1.324 71.21 2.508 70.93 0.617 6. 717 1.318 3.812 1. 311 0.620 6. 670 70.65 5. 153 0.623 6. 624 1. 305 70.37 6. 578 6. 532 6. 487 6. 443 6. 399 1. 299 0.626 70.10 6. 536 7.964 0.630 1. 293 69.84 69.59 1.287 9.443 0.633 1. 281 69.34 10.979 0.636 12.578 0.640 1. 276 69.10 14. 248 0.643 6. 356 1. 271 68.86 6. 314 6. 272 15. 999 0.646 1. 266 68. 63 17.845 0.649 1. 261 68. 40 19. 799 0. 653 6. 230 1. 256 68. 18 Page 7

```
1045. RES
                           1045. RES

0. 656 6. 189

0. 659 6. 149

0. 663 6. 109

0. 666 6. 069

0. 669 6. 030

0. 672 5. 992

0. 676 5. 954

0. 679 5. 916

0. 682 5. 880
          21.880
                                                          1. 251
                                                                              67.97
                                                                              67.76
                                                          1. 247
          24. 114
                                                          1. 242
1. 238
1. 234
          26. 533
                                                                              67.56
          29. 179
                                                                              67.36
          32. 114
                                                                              67.17
                                                          1. 230
                                                                              66.99
          35. 429
          39. 260
                                                          1. 227
                                                                              66.80
                                                          1. 223
          43.843
                                                                              66.63
          49. 420
  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:
                    FLOW DIAMETER ANGLE FLOWLINE
                                                               CRI TI CAL
                                                                              VELOCI TY
                             (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                    (CFS)
                                18.00 24.30 261.84
                                                                              5. 512
     UPSTREAM
                      4. 60
                                                                    0.82
                      4.60
                                18.00
    DOWNSTREAM
                                                      261. 51
                                                                    0.82
                                                                                  6.816

      4. 60
      18. 00
      -
      261. 51

      0. 00
      0. 00
      0. 00
      0. 00

      0. 00
      0. 00
      0. 00
      0. 00

    LATERAL #1
                      0.00
                                                                    0.00
                                                                                 0.000
    LATERAL #2
                                                                    0.00
                                                                                 0.000
                      O. OO===Q5 EQUALS BASIN INPUT===
        Q5
  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)
                            0.823
                                      4. 628
           0.000
                                                          1. 156
                                                                              63. 12
                                       4. 663
4. 699
4. 735
                            0.818
                                                           1. 156
           0.014
                                                                              63.13
                                                          1. 157
1. 157
           0.059
                            0.813
                                                                              63.14
                                                                              63.16
           0.136
                            0.808
           0.250
                            0.803
                                       4. 772
                                                          1. 157
                                                                              63.18
           0.404
                            0. 798
                                       4. 810
                                                          1. 158
                                                                              63.22
                            0. 793
                                       4.848
                                                          1. 159
                                                                              63. 26
           0.601
                                     4. 886
                           0. 788
           0.847
                                                          1. 159
                                                                              63. 31
                                       4. 926
           1. 148
                            0. 783
                                                          1. 160
                                                                              63.36
                                            Page 8
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1045. RES
         1.510
                       0.778
                                 4.966
                                               1. 161
                                                               63.43
         1.941
                       0. 773
                                 5.006
                                               1. 163
                                                               63.50
         2.450
                                               1. 164
                       0.768
                                 5.048
                                                               63.59
                       0. 763
0. 758
         3.051
                                 5.090
                                               1. 166
1. 168
                                                               63.68
                                 5.132
                                                               63.78
         3.757
                       0.753
                                 5. 176
                                               1.170
         4.586
                                                               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
                                                               64.56
                                               1. 182
        14. 312
17. 572
                                               1. 185
                       0. 723
                                 5. 453
                                                               64.73
                       0.718
                                 5.502
                                               1. 188
                                                               64.90
                              5. 510
        18. 330
                      0. 717
                                               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:
                                 FLOWLINE ELEVATION = 262.02
 NODE NUMBER = 1010.00
                                262.84 FOR DOWNSTREAM RUN ANALYSIS
 ASSUMED UPSTREAM CONTROL HGL =
______
 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 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 **PRESSURE** PRESSURE+ PRESSURE+ MODEL FLOW NUMBER **PROCESS** HEAD(FT) MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) 1.50* 1125.00-86. 26 0.41 20. 15 FRI CTI ON 1120.00-1.32* 67.44 21.09 0.38 JUNCTI ON 1120.00-39. 91 0.18*51.20 1.01 } 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 PIPE FLOW = 1.80 FLOWLINE ELEVATION = 154.55 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 MANNING'S N = 0.01300PIPE LENGTH = 18.00 FEET NORMAL DEPTH(FT) = 0.42 CRITICAL DEPTH(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) 1. 516 0.000 1.500 1. 018 86. 26 1.026 4.068 1.460 1.477 81.90 8. 108 1.420 1.040 1.437 77.62 12. 132 1. 381 1.058 1.398 73.42 1.080 1. 359 16. 143 1. 341 69.31 1.341 18.000 1. 322 1.091 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: FLOW DIAMETER ANGLE FLOWLINE CRITICAL VELOCITY (CFS) (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) PI PE UPSTREAM 1. 80 18. 00[°] ` 60. 00´ 155.06 0.50 14. 513 0.50 DOWNSTREAM 1.80 18.00 154. 73 1.091 0.00 0. 00 0. 00 0. 00 0 00 LATERAL #1 0.00 0.00 0.000 0.00 LATERAL #2 0.00 0.00 0.000 O. OO===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 MANNING'S N = 0.01300; FRICTION SLOPE = 0.00026 DOWNSTRFAM: 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: FLOW DEPTH VELOCITY SPECIFIC PRESSURE+ DISTANCE FROM CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM (POUNDS) Ò. 5Ó5 3. 444 0.689 0.000 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 19. 21 0.452 0.038 4.006 0.702 Page 2

```
0.063
                        0.439
                                   4. 173
                                                   0.710
                                                                    19.43
         0.096
                        0.426
                                   4. 352
                                                                    19.71
                                                   0. 721
                                                                    20.06
         0.138
                        0.413
                                   4. 546
                                                   0.734
         0.192
                        0.400
                                   4.756
                                                  0.752
                                                                    20.48
                        0.387
                                   4.984
         0.258
                                                                    20.97
                                                  0.773
                                                  0. 799
         0.340
                        0.374
                                   5.232
                                                                    21.55
         0.441
                        0.361
                                   5.502
                                                  0.831
                                                                    22.21
         0.564
                                   5. 798
                        0.348
                                                  0.870
                                                                    22.99
         0.715
                        0.334
                                   6. 124
                                                  0.917
                                                                    23.87
                        0.321
                                                  0.974
                                                                    24.89
         0. 901
                                   6. 482
         1.129
                        0.308
                                   6.879
                                                  1.043
                                                                    26.05
         1.413
                                   7. 320
                        0. 295
                                                   1. 128
                                                                    27.39
                        0. 282
         1.767
                                   7.812
                                                   1.230
                                                                    28.91
         2. 216
2. 794
                        0.269
                                   8.365
                                                   1.356
                                                                    30.66
                        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
                                                   2.251
         6.092
                        0. 217
                                  11. 443
                                                                    40.79
                        0.203
                                  12.530
                                                   2.643
                                                                    44.46
         8. 438
        12.917
                        0.190
                                  13.806
                                                                    48.80
                                                   3. 152
       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 = \langle 202.906 \rangle; EGL = \langle 202.906 \rangle; FLOWLINE = \langle 202.180 \rangle
*******************
 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
```

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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

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

"*" indicates nodal point data used.)

| | (| UPSTREAL | M RUN | DOWNSTREA | AM RUN |
|-----------|------------|----------|-------------------|-----------|-------------------|
| | | | PRESSURE+ | | |
| NUMBER | PROCESS | HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| | | | `112. 36´ | 0. 59 | 90. 71 |
| } | FRI CTI ON | | YDRAULIC JUMP | | |
| | | 1. 36 | 98. 79 | 0. 53* | 101. 26 |
| | JUNCTI ON | | | | |
| 1225. 00- | | 1. 18 | 85. 08 | 0. 27* | 238. 15 |
| | FRI CTI ON | | | | |
| 1220. 00- | | 0.88 Dc | 74. 13 | 0. 32* | 191. 12 |
| | JUNCTI ON | | | | |
| 1220. 00- | | 0.88 Dc | 74. 13 | 0. 29* | 225. 48 |
| | FRI CTI ON | | | | |
| 1215. 00- | | 0.88*Dc | 74. 13 | 0.88*Dc | 74. 13 |
| | JUNCTI ON | | | | |
| 1215. 00- | | 1. 19 | 85. 40 | 0. 36* | 163. 80 |
| | FRI CTI ON | | | | |
| | | 0.88*Dc | 74. 13 | 0.88*Dc | 74. 13 |
| } | CATCH BAS | | 44.40 | | 05.07 |
| 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 PIPE FLOW = 5.20 FLOWLINE ELEVATION = 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 Page 1

| UPSTREAM NODE 1225.0 | 0 ELEVATION | 230. RES = 138. 70 | | P OCCURS) |
|---|--|---|--|--|
| CALCULATE FRICTION LO PIPE FLOW = 5 PIPE LENGTH = 16 | SSES(LACFCD): . 20 CFS PIPE . 00 FEET | | | |
| HYDRAULIC JUMP: DOWNS | | | | |
| NORMAL DEPTH(FT) = | 0. 75 | CRITICAL D | EPTH(FT) = | 0. 88 |
| UPSTREAM CONTROL ASSU | MED FLOWDEPTH(F) | 0.53 | | |
| GRADUALLY VARIED FLOW | | | | |
| DI STANCE FROM FL CONTROL (FT) 0. 000 2. 115 4. 260 6. 438 8. 653 10. 909 13. 209 15. 558 16. 000 | OW DEPTH VELOCI (FT) (FT/SE 0. 531 9. 2 0. 540 9. 0 0. 548 8. 8 0. 557 8. 7 0. 566 8. 5 0. 574 8. 3 0. 583 8. 1 0. 591 8. 0 | EC) ENERG' 280 280 388 704 526 355 90 | IFIC PR Y(FT) MOMEN 1.869 1.821 1.776 1.734 1.695 1.659 1.625 1.593 1.588 | ESSURE+ TUM (POUNDS) 101. 26 99. 55 97. 92 96. 38 94. 91 93. 51 92. 19 90. 93 90. 71 |
| HYDRAULIC JUMP: UPSTR | | | | |
| DOWNSTREAM CONTROL AS | SUMED PRESSURE H | IEAD(FT) = | 1. 50 | |
| GRADUALLY VARIED FLOW | PROFILE COMPUTE | D INFORMATION | N: | |
| PRESSURF+MOMENTUM BAI | ANCE OCCURS AT | 14.50 FFFT | UPSTREAM OF N | ODF 1230.00 |
| | H = 1.375 FEET, | | | |
| NODE 1225.00 : HGL = | | | | |
| FLOW PROCESS FROM NOD UPSTREAM NODE 1225.0 | E 1225.00 TO NO O ELEVATION | DE 1225.00 | IS CODE = 5 (FLOW IS SUPER | |
| LATERAL #1 0.0 LATERAL #2 0.0 | SSES: DI AMETER AN (I NCHES) (DEC (DEC | IGLE FLOWL GREES) ELEVAT 50.00 139.0 - 138. 0.00 0.0 0.00 0.0 SIN INPUT=== AE USED: 6(DELTA3)- +FRICTION LOS | I NE |) (FT/SEC) 23. 480 9. 283 |
| | | Page 2 | | |

```
MANNI NG' S N = 0.01300; FRI CTI ON SLOPE = 0.45880
MANNI NG' S N = 0.01300; FRI CTI ON SLOPE = 0.03390
 UPSTREAM:
 DOWNSTREAM:
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.24635
 JUNCTION LENGTH = 4.00 FEET
 FRICTION LOSSES = 0.985 FEET ENTRANCE LOSSES)
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (7.296)+(0.000) = 7.296
                                       ENTRANCE LOSSES = 0.000 FEET
 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
                                 MANNI NG' 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:
 ______
                   FLOW DEPTH VELOCITY
                                              SPECIFIC PRESSURE+
 DISTANCE FROM
                                (FT/SEC)
                                             ENERGY(FT)
  CONTROL(FT)
                    (FT)
                                                           MOMENTUM (POUNDS)

 321

                                  18. 735
                                                  5.775
         0.000
                                                                  191.12
                                                                  192. 72
                                  18.896
         0.414
                        0.319
                                                  5.867
                                  19.061
                                                  5.962
                                                                  194.34
         0.850
                        0.317
                                  19. 228
19. 397
                        0.315
                                                  6.060
                                                                  195.99
         1. 310
                        0.314
         1.796
                                                  6. 159
                                                                  197.66
                        0.312
                                  19.569
                                                                  199.37
                                                  6. 262
         2. 311
         2.857
                        0.310
                                  19. 744
                                                 6. 366
                                                                  201.09
                                                6. 366
6. 474
6. 584
6. 697
                        0.308
                                  19. 921
         3.439
                                                                  202.85
         4.061
                        0.306
                                  20. 101
                                                                  204.64
                        0.304
                                  20. 284
         4. 726
                                                                  206.45
                        0. 302
                                  20.470
                                                6.813
         5.442
                                                                  208.29
                                  20. 659
         6. 215
                        0.300
                                                 6. 931
                                                                  210.17
                                  20. 851
21. 046
21. 244
                                                 7. 053
7. 178
7. 307
         7.053
                                                                  212.07
                        0. 296
         7.967
                                                                  214.01
                        0. 294
         8.971
                                                                  215.98
                        0. 292
                                  21. 446
                                                 7. 439
        10.082
                                                                  217.98
        11. 322
                        0. 290
                                  21. 651
                                                 7. 574
                                                                  220.02
        12. 722
                        0. 288
                                  21.859
                                                  7. 713
                                                                  222.09
                                  22. 071
        14.325
                        0. 286
                                                  7.855
                                                                  224.20
                                  22. 287
22. 506
        16. 193
                        0.285
                                                  8.002
                                                                  226.34
        18. 426
                        0. 283
                                                  8. 152
                                                                  228.52
                                  22. 728
22. 955
        21. 185
24. 779
                        0. 281
                                                  8.307
                                                                  230.74
                        0.279
                                                  8. 466
                                                                  233.00
                        0.277
                                  23. 186
        29.895
                                                                  235.29
                                                  8.630
                                                  8.798
        38.745
                        0.275
                                  23.420
                                                                  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:
                 FLOW DIAMETER
                                    ANGLE
                                             FLOWLI NE
                                                        CRI TI CAL
                                                                   VELOCITY
      PI PE
                         (INCHES) (DEGREES) ELEVATION
                  (CFS)
                                                       DEPTH(FT.)
                                                                   (FT/SEC)
                                     15. 00´
    UPSTREAM
                   5. 20
                                                          0.88
                           18. 00
                                              205.04
                                                                     22. 207
                                      Page 3
```

```
1230. RES
                                   5. 20 18. 00
0. 00 0. 00
0. 00 0. 00
                                                                                                       DOWNSTREAM
                                                                                        0.00
         LATERAL #1
         LATERAL #2
                                                                                        0.00
                                             O. OO===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
   ENTRANCE LOSSES = 0.000 FEET
    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:
   DI STANCE 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
   ______

      0. 025
      0. 804
      5. 389
      1. 255

      0. 047
      0. 779
      5. 604
      1. 267

      0. 077
      0. 755
      5. 837
      1. 284

      0. 118
      0. 730
      6. 090
      1. 306

      0. 170
      0. 705
      6. 365
      1. 335

      0. 236
      0. 681
      6. 666
      1. 371

      0. 320
      0. 656
      6. 996
      1. 417

      0. 423
      0. 631
      7. 359
      1. 473

      0. 552
      0. 607
      7. 759
      1. 542

      0. 711
      0. 582
      8. 201
      1. 627

      0. 907
      0. 557
      8. 694
      1. 732

      1. 151
      0. 533
      9. 244
      1. 860

      1. 455
      0. 508
      9. 862
      2. 019

      1. 836
      0. 483
      10. 559
      2. 216

      2. 321
      0. 459
      11. 350
      2. 460

      2. 945
      0. 434
      12. 255
      2. 768

      3. 763
      0. 409
      13. 298
      3. 157

      4. 862
      0. 385
      14. 509
      3. 656

      6. 392
      0. 360
      15. 930
      4. 303
    <
                                                                                                                                                         96. 30
100. 95
                                                                                                                                                         106.33
                                                                                                                                                         112.58
                                                                                                                                                         119.82
                                                                                                                                                         128. 27
                                                                                                                                                         138. 15
                                                                                                                                                         149.79
                                                                                                                                                         163.58
                                                                                                                                                          180.09
                                                                                                                                                         200.07
                                                                                                                                                         224.55
                                                                                                                                                       225. 48
```

Page 4

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:
        PI PE
                    FLOW DIAMETER
                                              ANGLE FLOWLINE CRITICAL
                               (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                      (CFS)

      5. 20
      18. 00
      90. 00
      225. 49
      0. 88
      15. 958

      5. 20
      18. 00
      -
      225. 16
      0. 88
      4. 839

      0. 00
      0. 00
      0. 00
      0. 00
      0. 00
      0. 00

      0. 00
      0. 00
      0. 00
      0. 00
      0. 00
      0. 00

      0. 00
      0. 00
      0. 00
      0. 00
      0. 00
      0. 00

      UPSTREAM
     DOWNSTREAM
     LATERAL #1
     LATERAL #2
                        O. OO===Q5 EQUALS BASIN INPUT===
        05
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
       \overline{04}*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
                  MANNI NG'S N = 0.01300; FRI CTI ON SLOPE = 0.15397
MANNI NG'S N = 0.01300; FRI CTI ON SLOPE = 0.00586
  DOWNSTREAM:
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.07992
  JUNCTI ON LENGTH = 4.00 FEET
FRI CTI ON LOSSES = 0.320 FEET ENTRANCE LOSSES)
JUNCTI ON LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTI ON LOSSES = (3.402)+(0.000) = 3.402
                                                ENTRANCE LOSSES = 0.000 FEET
  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(POUN
                                                                          MOMENTUM (POUNDS)
            0.000
                              0.878
                                         4. 837
                                                               1. 242
                                                                                    74. 13
            0.003
                              0.853
                                            5.008
                                                               1.243
                                                                                     74.22
                                           5. 191
5. 389
                                                                                    74.51
                              0.829
                                                               1. 247
            0.011
                              0.804
                                                                                     74.99
            0.025
                                                               1. 255
            0.047
                              0.779
                                            5.604
                                                               1.267
                                                                                     75.70
                                           5.837
                              0.755
            0.077
                                                               1. 284
                                                                                     76.65
                                         5.837
6.090
6.365
6.666
6.996
7.359
7.759
8.202
                              0.730
                                                               1.306
                                                                                     77.85
            0. 117
            0.170
                              0.705
                                                               1.335
                                                                                     79.35
                              0.681
                                                               1. 371
                                                                                     81.15
            0.236
            0.320
                              0.656
                                                              1. 417
                                                                                     83.31
                              0.631
            0. 423
                                                               1. 473
                                                                                     85.85
                              0.607
            0.552
                                                               1. 542
                                                                                    88.82
                                                               1. 627
                              0.582
                                                                                    92.28
            0.710
                                                           1. 732
1. 861
2. 019
2. 216
                                           8. 694
9. 244
            0.907
                              0.557
                                                                                    96.30
                                                                                   100.95
            1.150
                              0.533
                                           9.862
                              0.508
            1.454
                                                                                   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
                                           13. 299
            3.762
                              0. 409
                                                               3. 157
                                                                                   138. 16
                                                Page 5
```

| 4. 860 6. 390 6. 420 | 0. 385 0. 360 0. 360 | | 3. 656 4. 304 | 149. 80 163. 60 163. 80 |
|--|-----------------------------|----------------------|---|-------------------------------|
| NODE 1210.00 : | HGL = < 229.95 | 8>; EGL= < 2 | 30. 322>; FLOWLI NE= | < 229. 080> |
| ************************************** | M NODE 1210.00 | TO NODE 12 | | 8 |
| | 5. 20 CFS 4. 84 FEET/SEC | PI PE DI VELOCI T | CD): AMETER = 18.00 I Y HEAD = 0.364 F D) = .2*(0.364) | EET |
| NODE 1210.00 : | HGL = < 230.39 | 4>; EGL= < 2 | 30. 394>; FLOWLI NE= | < 229. 080> |
| ************************************** | OW CONTROL DATA 210.00 | : FLOWLINE | ************************************** | . 08 |
| END OF GRADUALLY | VARIED FLOW AN | ======= ALYSI S | | ========= |

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

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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 | 1 RUN . | DOWNSTRÉA | M RUN |
|-----------|------------|----------|-----------------------------|-----------|-------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FI) | MOMENTUM(POUNDS) 1142.93 | DEPIH(FI) | MOMENTUM (POUNDS) |
| 1350.00- | FRI CTI ON | 3.00 | 1142. 93 | 0. 78 | 2357.83 |
| 1345. 00- | TRICITON | 2. 89 | 1100. 75 | 0. 72* | 2615. 56 |
| | JUNCTI ON | | | | |
| 1345. 00- | | 2. 84 | 970. 88 | 0. 58* | 2770. 06 |
| 1342. 50- | FRI CTI ON | 1. 97 Dc | 797. 87 | 0. 65* | 2352. 18 |
| } | JUNCTI ON | | ,,,,, | 0.00 | 2002. 10 |
| 1342. 50- | | 1.97 Dc | 797. 87 | 0.62* | 2503. 68 |
| | FRI CTI ON | 1. 97 Dc | 797. 87 | 1. 54* | 868. 19 |
| 1340.00- | JUNCTI ON | 1.97 DC | 191.01 | 1. 34 | 000. 19 |
| 1340.00- | | 1. 97*Dc | 797. 87 | 1. 97*Dc | 797. 87 |
| } | FRI CTI ON | | | | |
| 1335. 00- | | 2. 03* | 798. 73 | 1.97 Dc | 797. 87 |
| 1335. 00- | JUNCTI ON | 2. 80* | 697. 80 | 1. 40 | 383. 38 |
| | FRI CTI ON | 2.00 | 077.00 | 1. 10 | 000.00 |
| 1332.00- | | 2. 24* | 503. 91 | 1.47 Dc | 381. 99 |
| | JUNCTI ON | 2 22 | 455 44 | 0.7/* | /01 45 |
| 1332.00- | FRI CTI ON | 2. 22 | 455. 41 | 0. 76* | 601. 45 |
| 1330.00- | | 1. 49*Dc | 359. 10 | 1. 49*Dc | 359. 10 |
| } | CATCH BAS | IN | | | |
| 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:

```
FLOWLINE ELEVATION = 138.62
  NODE NUMBER = 1350.00
 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 CONTROL(FT) FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM(POUI
0.000 0.723 31.904 16.538 2615.50
10.507 0.763 29.569 14.348 2429.35
                                                                MOMENTUM (POUNDS)
                                                                       2615.56
                                                                       2429.35
         15.000
                                     28. 670
                          0. 780
                                                     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:
                          DI AMETER
                                      ANGLE
                                                FLOWLI NE
       PI PF
                   FLOW
                                                             CRITICAL
                                                                         VFI OCLTY
                            (INCHES) (DEGREES) ELEVATION
                   (CFS)
                                                                         (FT/SEC)
                                                            DEPTH(FT.)
     UPSTREAM
                    36.80
                              36. 00<sup>°</sup>
                                      7. 82
                                                 139. 10
                                                               1. 97
                                                                            38.647
                    41. 90
5. 10
                              36.00
                                                                           31. 913
                                                  138.77
                                                                2. 11
    DOWNSTREAM
                                                                            4.804
                              0.00
5.50
                                         90.00
    LATERAL #1
                              18.00
                                                  140.60
                                                               0.87
                                       90.00 130.20
                     0.00
                                                               0.00
                                                                            0.000
    LATERAL #2
                     O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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
                                         CRITICAL DEPTH(FT) = 1.97
  NORMAL DEPTH(FT) = 0.57
                                          Page 2
```

```
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.65
______
  GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
                    FLOW DEPTH VELOCITY
                                                  SPECIFIC PRESSURE+
  DISTANCE FROM
  CONTROL(FT)
                          (FT)
                                   (FT/SEC)
                                                 ENERGY(FT)
                                                                MOMENTUM (POUNDS)
                                                                      2352. 18
          0.000
                          0.649
                                     32. 712
                                                     17. 275
          1.187
                          0.646
                                     32.928
                                                     17.492
                                                                      2367.36
          2.434
                          0.643
                                     33. 146
                                                                      2382.72
                                                     17. 714
          3.746
                                                                      2398.27
                          0.640
                                     33. 367
                                                     17. 939
                                     33. 591
33. 817
          5.129
                          0.637
                                                     18. 168
                                                                      2414.00
          6.589
                          0.634
                                                     18.402
                                                                      2429.92
                                     34. 045
34. 277
          8. 136
9. 778
                                                     18.640
                          0.631
                                                                      2446.03
                          0.628
                                                     18.883
                                                                      2462.33
         11.527
                          0.625
                                     34. 511
                                                    19. 130
                                                                      2478.83
         13.395
                          0.622
                                     34. 748
                                                    19. 382
                                                                      2495.54
                                     34. 987
                                                    19. 639
         15. 398
                          0.619
                                                                      2512.44
                                     35. 230
         17.555
                          0.616
                                                    19. 900
                                                                      2529.56
                                     35. 230
35. 476
35. 724
35. 976
36. 231
36. 489
         19.888
                          0.613
                                                     20. 167
                                                                      2546.89
                                                    20. 439
20. 717
20. 999
21. 288
         22. 427
25. 207
                          0.610
                                                                      2564.43
                                                                      2582.19
                          0.607
         28.274
                          0.604
                                                                      2600.17
         31. 689
                          0.601
                                                                      2618.38
         35.534
                          0.598
                                     36.750
                                                    21. 582
                                                                      2636.82
         39.925
                          0.595
                                     37.014
                                                    21.882
                                                                      2655.49
                                     37. 282
                          0.592
                                                    22. 188
         45.031
                                                                      2674.40
                                     37. 553
37. 827
                                                     22. 500
22. 819
                          0.589
         51. 113
                                                                      2693.56
         58.612
                          0.586
                                                                      2712.96
                                     38. 105
38. 387
                          0.583
                                                     23. 144
         68. 351
                                                                      2732.61
         82.179
                          0.580
                                                     23.475
                                                                      2752.52
                          0. 577
                                                     23.770
        102. 940
                                     38. 635
                                                                      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:
                   FLOW
                           DI AMETER
                                      ANGLE
                                                FLOWLI NE
                                                             CRI TI CAL
                                                                        VELOCITY
       PI PE
                           (INCHES) (DEGREES) ELEVATION
                   (CFS)
                                                           DEPTH(FT.)
                                                                        (FT/SEC)
                                     8. 50<sup>´</sup>
                                                  188. 38
                                                               1. 97
     UPSTREAM
                    36.80
                             36.00
                                                                          34.874
    DOWNSTREAM
                    36.80
                              36.00
                                                  188.05
                                                               1.97
                                                                          32.723
                     0.00
                              0.00
                                         0.00
                                                    0.00
                                                               0.00
                                                                           0.000
    LATERAL #1
                     0.00
                                         0.00
                                                    0.00
                                                               0.00
    LATERAL #2
                              0.00
                                                                           0.000
                     O. OO===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
REAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.34719
  UPSTREAM:
               MANNING'S N = 0.01300;
  DOWNSTREAM:
                                        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: DI STANCE FROM FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM (POUI
0.000 1.538 10.082 3.118 868.19 (FT) 1. 538 MOMENTUM (POUNDS) Ò. 0Ó0 10. 082 3. 118 868.19 1. 499 0.130 10. 418 3. 185 883.35 0. 283 1.460 10. 777 3. 264 900.45 1. 421 3.356 919.65 0.460 11. 161 1. 381 0.666 11. 573 3.462 941.11 1. 342 1. 303 1. 264 1. 225 0.905 12. 015 3. 585 965.04 12. 491 1. 183 3. 727 3. 892 991.67 3. 892 4. 082 4. 302 4. 557 4. 853 5. 199 13. 005 1.505 1021.26 13. 560 1054.10 1.879 2. 315 1. 185 14. 162 1090.53 1. 146 14. 816 1130.95 2.823 3.420 1. 107 15. 528 1175.81 1.068 16. 306 1225.65 4. 121 17. 158 18. 096 1. 029 5.603 4. 951 1281.09 6. 077 6. 637 7. 300 8. 091 9. 039 10. 187 11. 586 13. 308 15. 451 0. 990 5. 940 6. 077 1342.86 19. 131 20. 278 7. 126 0.950 1411.85 0. 911 8.563 1489. 10 21. 554 22. 982 10. 326 0.872 1575.87 1673.69 12.519 0.833 24. 588 26. 403 28. 469 30. 837 33. 572 34. 863 15. 299 0.794 1784.42 18. 913 0. 754 1910.39 23. 780 0. 715 2054.49 0. 676 0. 637 2220.37 30.688 15. 451 18. 149 41. 423 2412.72 50.030 0.620 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: DIAMETER ANGLE FLOWLINE (INCHES) (DEGREES) ELEVATION FLOW CRI TI CAL **VELOCITY** DEPTH(FT.) (CFS) (FT/SEC) 36. 00[°] 0.00 1. 9̀7 7. 466 UPSTREAM 36.80 215. 29 **DOWNSTREAM** 36.80 36.00 214.96 1.97 7.466 0.00 0.00 0.00 0.00 0.00 0.000 LATERAL #1 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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 Page 4

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+ (FT) 1. 973 (FT/SEC) ENERGY(FT) CONTROL(FT) MOMENTUM (POUNDS) 2.838 7. 464 0.000 797.87 1.975 7.454 797.87 2.838 0.013 0.054 1. 977 7.445 797.88 2.838 1. 980 7. 435 0.126 2.838 797.88 2.838 0.230 1. 982 7. 425 797.89 1. 984 0.371 7. 416 2.839 797.91 1. 986 0. 552 7. 406 2.839 797.92 1. 989 797. 94 7. 397 2.839 0.778 7. 387 7. 378 1. 991 2.839 797.97 1.054 1.993 2.839 797.99 1.385 1.779 1. 995 7.369 2.839 798.02 7. 359 7. 350 7. 341 7. 331 7. 322 7. 313 7. 304 7. 295 7. 285 7. 276 7. 267 7. 258 7. 249 7. 359 1. 997 2. 245 2.839 798.05 798.09 2.793 2.000 2.839 3. 436 2.002 2.839 798.12 2.004 4. 191 2.839 798.16 2. 006 2. 009 2.839 798. 21 5.080 2. 840 6. 131 7. 382 798.25 2. 011 2. 013 798. 30 798. 36 2.840 2.840 8.886 2.015 2.840 798.41 10.722 13.011 2.018 2.840 798.47 15.958 2.841 2.020 798.53 19.944 2.022 2.841 798.59 2.024 7. 249 2.841 798.66 25.828 7. 240 7. 240 2. 027 2.841 798.73 36. 364 2.841 798.73 84.000 2.027 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: FLOW DIAMETER ANGLE FLOWLI NE CRI TI CAL PI PE **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 3. 060 7. 242 **UPSTREAM** 21. Ó0 90.00 36. 00[°] 216. 06 1. 47 DOWNSTREAM 36.80 1. 97 1. 36 1. 97 7.242 36.00 215. 69 48. 30 14. 30 24. 00 1. 50 18. 00 14.80 LATERAL #1 14. 30 24.00 216. 69 5. 317 LATERAL #2 217. 19 1.083 O. OO===Q5 EQUALS BASIN INPUT=== **Q5**

```
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+
                    (FT) (FT/SEC)
2.797 3.059
2.744 3.097
                                                               MOMENTUM (POUNDS)
  CONTROL(FT)
                                               ENERGY(FT)
                                                     2. 943
          0.000
                                                                      697.80
                                                     2.893
         11.856
                                                                      676.79
                                3. 097
3. 140
3. 188
3. 241
3. 298
3. 360
3. 428
3. 500
3. 579
3. 663
3. 714
                          2.691
                                                     2.845
                                                                      656.27
         23. 612
         35. 283
                          2.638
                                                     2.796
                                                                      636.27
                                                     2.748
         46.878
                         2. 585
                                                                      616.80
         58. 403
                         2.532
                                                     2. 701
                                                                      597.89
         69.863
                         2. 479
                                                     2.655
                                                                      579.57
                         2. 426
                                                     2.609
         81. 262
                                                                      561.85
                         2. 373
                                                     2.564
                                                                      544.76
         92.600
                      2. 320
2. 267
2. 237
        103.877
                                                     2.519
                                                                      528.32
        115.091
                                                     2.476
                                                                      512.57
        121. 440
                                                    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:
       PI PE
                  FLOW
                          DI AMETER
                                     ANGLE
                                               FLOWLI NE
                                                           CRI TI CAL
                                                                       VELOCITY
                           (INCHES) (DEGREES) ELEVATION
                                                           DEPTH(FT.)
                   (CFS)
                                                                       (FT/SEC)
     UPSTREAM
                   19.30
                             30.00
                                       90. 00 217. 17
                                                             1. 49
                                                                        15. 431
                   21.00
   DOWNSTREAM
                             36.00
                                                 216. 67
                                                              1. 47
                                                                          3. 715
                    1. 70
                             36.00
                                                              0.40
                                       58. 70
                                                                          0. 518
   LATERAL #1
                                    58. 70 217. 00
0. 00 0. 00
                                                 217.00
   LATERAL #2
                    0.00
                             0.00
                                                              0.00
                                                                          0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       Q5
 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
               MANNING'S N = 0.01300;
                                       FRICTION SLOPE = 0.00121
 DOWNSTREAM:
                                         Page 6
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1350. RES
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.02869
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.115 FEET ENTRANCE LIJUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (2.501)+(0.000) = 2.501
```

ENTRANCE LOSSES = 0.000 FEET

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 DIAMETER = 30.00 INCHES PIPE FLOW = PIPE LENGTH = 19.30 CFS 19.54 FEET MANNI NG' 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 CONTROL(FT) | FLOW DEPTH (FT) | VELOCITY (FT/SEC) | SPECIFIC ENERGY(FT) | PRESSURE+ 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 |
| 17. 340 | 0.733 | 13.420 | 4.433 | 00 I. 4 3 |

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:

1350. RES NODE NUMBER = 1330.00 FLOWLINE ELEVATION = 221.10 ASSUMED UPSTREAM CONTROL HGL = 222.59 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS $^{\circ}$

1335NE. RES

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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

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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
                  PRESSURE
                              PRESSURE+
                                                          PRESSURE+
          MODEL
                                              FLOW
  NUMBER
         PROCESS
                 HEAD(FT)
                           MOMENTUM (POUNDS)
                                            DEPTH(FT)
                                                       MOMENTUM (POUNDS)
                                                0.55*
                                    363. 34<sup>°</sup>
 1335.00-
                                                                574.33
        } FRICTION
 1310.00-
                                    259.08
                                                1. 36*Dc
                                                               259.08
                    1. 36*Dc
        } CATCH BASIN
                    2. 10*
                                    214.82
 1310.00-
                                                1.36 Dc
 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:
                                FLOWLINE ELEVATION =
 NODE NUMBER = 1335.00
 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):
               14. 30 CFS PIPE DIAMETER = 24. 00 INCHES 57. 77 FEET MANNING'S N = 0. 01300
 PIPE FLOW =
                             MANNI NG' S N = 0.01300
 PIPE LENGTH =
 NORMAL DEPTH(FT) = 0.52 CRITICAL DEPTH(FT) =
 ______
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.36
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
```

```
FLOW DEPTH VELOCITY
                                                    SPECI FIC
 DISTANCE FROM
                                                                      PRESSURE+
                                                                   MOMENTUM (POUNDS)
  CONTROL(FT)
                           (FT)
                                    (FT/SEC)
                                                   ENERGY(FT)
                                                       1. 974
          0.000
                           1. 362
                                                                           259.08
                                     6. 272
                           1. 328
1. 295
          0.009
                                        6.452
                                                         1.975
                                                                           259.32
                                                         1. 981
          0.039
                                        6.645
                                                                           260.05
                           1. 261
                                                         1.990
          0.092
                                       6. 852
                                                                           261.32
          0.172
                           1. 227
                                       7.075
                                                         2.005
                                                                           263.15
                                      7. 314
          0.282
                           1. 193
                                                         2.024
                                                                           265.60
                                       7. 573
          0.427
                          1. 159
                                                        2.050
                                                                           268.70
                          1. 125
                                       7. 851
                                                                           272.50
          0.613
                                                        2. 083
                          1.091
                                                        2. 124
                                                                           277.08
          0.846
                                      8. 153
          1.134

    2. 175
    2. 236

                           1.058
                                      8. 479
                                                                           282.50
           1.487
                           1.024
                                      8. 833
                                                     2. 236
2. 310
2. 400
2. 507
2. 636
2. 790
2. 975
3. 197
3. 466
3. 791
4. 189
4. 677
5. 281
6. 037
                                                                           288.83
           1. 919
                           0. 990
                                       9. 219
                                                                           296.17
                                      9. 639
          2.444
                          0. 956
                                                                           304.63
          3.083
                          0. 922
                                   10. 100
10. 604
                                     10. 100
                                                                           314.32
          3.861
                          0.888
                                                                           325.40
          4.813
                          0. 855
                                     11. 160
                                                                           338.02
          5. 984
                          0. 821
                                      11. 774
                                                                           352.41
          7. 437
                          0. 787
                                      12. 455
                                                                           368.78
                                     13. 213
14. 062
15. 016
          9. 262
                          0. 753
0. 719
                                                                           387.45
          11. 594
                                                                           408.76
                                                                           433.13
                           0. 685
         14.642
         18. 761
                          0. 651
                                      16. 096
                                                                           461.12
                                     17. 325
         24.622
                          0. 618
                                                                           493.38
                          0.584
                                     18. 733
                                                       6. 037
         33. 738
                                                                          530.75
                          0. 550 20. 361
0. 550 20. 361
                                                    6. 992
6. 992
         50. 976
                                                                          574.33
         57. 770
                                                                          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
```

1335NE. RES

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1335SE. RES

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 Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 Fax 619-291-4165 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 PRESSURE PRESSURE+ PRESSURE+ MODEL FLOW NUMBER PROCESS HEAD(FT) MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) 1.71* 1335.00-110.69 0.21 57.48 } HYDRAULIC JUMP } FRICTION 1311.00-0.55*Dc 22.94 0.55*Dc 22.94 } CATCH BASIN 0.79* 1311. 00-0.55 Dc MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

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

Page 1

1335SE.RES GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

| | (FT) 0. 547 0. 533 0. 519 0. 505 0. 491 0. 477 0. 463 0. 449 0. 435 0. 421 0. 407 0. 393 0. 379 0. 365 0. 351 0. 337 0. 323 0. 399 0. 295 0. 281 0. 268 0. 254 0. 240 0. 226 0. 212 0. 210 | (FT/SEC) 3. 603 3. 732 3. 870 4. 017 4. 174 4. 344 4. 526 4. 722 4. 934 5. 163 5. 413 5. 684 5. 981 6. 306 6. 664 7. 059 7. 496 7. 984 8. 529 9. 142 9. 836 10. 626 11. 533 12. 581 13. 804 13. 922 | ENERGY (FT) 0. 749 0. 749 0. 752 0. 756 0. 762 0. 770 0. 781 0. 795 0. 813 0. 835 0. 862 0. 895 0. 935 0. 983 1. 041 1. 111 1. 196 1. 300 1. 426 1. 580 1. 771 2. 008 2. 306 2. 685 3. 172 3. 222 | PRESSURE+ MOMENTUM(POUNDS) 22. 94 22. 96 23. 04 23. 18 23. 37 23. 63 23. 96 24. 36 24. 84 25. 42 26. 09 26. 86 27. 75 28. 78 29. 95 31. 29 32. 82 34. 57 36. 57 38. 86 41. 49 44. 53 48. 05 52. 17 57. 01 57. 48 |
|--|--|---|---|--|
| DOWNSTREAM CONTR ==================================== | ========= | ======== | | ========== |
| DI STANCE FROM CONTROL (FT) 0.000 0.727 | PRESSURE HEAD(FT) 1.710 1.500 | VELOCITY (FT/SEC) 1. 188 1. 188 | SPECIFIC ENERGY(FT) 1. 732 1. 522 | |
| ASSUMED DOWNSTRE | AM PRESSURE HE | AD(FT) = | 1. 50 | ======================================= |
| GRADUALLY VARIED | FLOW PROFILE | COMPUTED IN | FORMATION: | |
| DI STANCE FROM CONTROL (FT) 0. 727 0. 858 0. 988 1. 118 1. 246 1. 375 1. 502 1. 629 1. 755 1. 880 2. 004 2. 128 2. 249 2. 369 2. 488 | FLOW DEPTH (FT) 1.500 1.462 1.424 1.386 1.347 1.309 1.271 1.233 1.195 1.157 1.119 1.081 1.042 1.004 0.966 | VELOCITY (FT/SEC) 1. 188 1. 196 1. 211 1. 231 1. 255 1. 283 1. 315 1. 351 1. 351 1. 435 1. 485 1. 540 1. 601 1. 669 1. 745 Page | ENERGY (FT) 1. 522 1. 484 1. 447 1. 409 1. 372 1. 335 1. 298 1. 261 1. 225 1. 189 1. 153 1. 117 1. 082 1. 048 1. 014 | PRESSURE+ MOMENTUM (POUNDS) 87. 54 83. 38 79. 29 75. 28 71. 36 67. 53 63. 82 60. 21 56. 73 53. 38 50. 16 47. 08 44. 15 41. 37 38. 75 |

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```
1335SE. RES
         2.604
                      0.928
                                1.828
                                              0.980
                                                              36.29
                      0.890
                                              0.947
         2.717
                                1.922
                                                              34.01
         2.827
                                              0.916
                      0.852
                                 2.027
                                                              31.90
         2.933
                      0.814
                                 2.144
                                              0.885
                                                              29.98
                      0.776
                                 2.277
                                                              28. 26
         3.034
                                              0.856
                      0.737
         3.128
                                 2.428
                                              0.829
                                                              26.75
         3. 214
                      0.699
                                 2.599
                                              0.804
                                                              25.46
         3.289
                                              0.783
                                2.796
                                                              24.41
                      0.661
         3.350
                      0.623
                                3.024
                                              0.765
                                                              23.62
         3.393
                                 3. 290
                                                              23.11
                      0.585
                                              0.753
         3.409
                                                              22.94
                      0.547
                                              0.749
                                 3.603
                                 3.603
        42. 980
                      0.547
                                              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 DIAMETER = 18.00 INCHES
 PIPE FLOW =
              2. 10 CFS
                  3.60 FEET/SEC.
 FLOW VELOCITY =
                                  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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1332. RES ****************** PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (Reference: LACFCD, LACRD, AND OCEMA HYDRAULICS CRITERION)
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Ver. 21.0 Release Date: 06/01/2014 License ID 1261 Analysis prepared by: RICK ENGINEERING COMPANY 5620 Friars Road San Di ego, Cal i forni a 92110 619-291-0707 Fax 619-291-410 Fax 619-291-4165 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 PRESSURE PRESSURE+ PRESSURE+ MODEL FLOW NUMBER PROCESS HEAD(FT) MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) 1. 90* 1332.00-244.69 0.18 32.61 } HYDRAULIC JUMP } FRICTION 1331.00-0. 40*Dc 15.66 0. 40*Dc 15.66 } CATCH BASIN 0.57* 1331.00-0.40 Dc 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 PLPE FLOW - 1 70 FLOWLINE ELEVATION = 1.70 CFS PIPE FLOW = 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

1332. RES GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

| DISTANCE FROM | FLOW DEPTH | VELOCI TY | SPECI FI C | PRESSURE+ |
|---------------|------------|-----------|------------|------------------|
| CONTROL(FT) | (FT) | (FT/SEC) | ENERGY(FT) | MOMENTUM(POUNDS) |
| 0.000 | Ò. 4Ó4 | 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 | VELOCI TY | SPECI FI C | PRESSURE+ |
|---------------|------------|-----------|------------|-------------------|
| CONTROL(FT) | (FT) | (FT/SEC) | ENERGY(FT) | MOMENTUM (POUNDS) |
| Ò. 0Ó0 | ì. 9Ó0 | 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 |
| | | Page | 2 | |
| | | | | |

1332. RES 2.446 8.808 0.464 0. 557 16. 22 2.989 8. 901 0.404 0.543 15.66 2.989 23. 540 0.404 0.543 15.66 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) = 0.028NODE 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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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 | A RUN | DOWNSTREA | M RUN |
|-----------------------------|----------------------|-------------------------------|--|---------------------------|-----------------------------------|
| NODE NUMBER 1570 00- | MODEL I PROCESS I | PRESSURE HEAD(FT) 3 OO* | PRESSURE+ MOMENTUM(POUNDS) 1034.91 | FLOW DEPTH(FT) 1 50 | PRESSURE+ MOMENTUM(POUNDS) 888 73 |
| } 1565. 00- | FRICTION JUNCTION | 2. 87* | 984. 18 | 1. 47 | 897. 98 |
| 1565.00- | | 2. 96 | 1017. 89 | 0. 81* | 1745. 62 |
| 1560. 00- | JUNCTI ON | 2. 73 | 935. 57 | 0. 71* | 2076. 68 |
| 1560. 00- } 1555. 00- | FRI CTI ON | 2. 42 1. 98 Dc | 851. 28 800. 77 | 0. 64* 0. 69* | 2395. 34 2159. 48 |
| 1555.00- | JUNCTI ON | 1. 98 DC | 800. 77 | 0. 65* | 2340. 69 |
| 1535. 00- | | 1.98 Dc | 800. 77 | 1. 93* | 801. 51 |
| 1535. 00- | JUNCTI ON FRI CTI ON | 1.98 Dc | 800. 77 | 1. 87* | 804. 38 |
| 1530. 00 - } | JUNCTI ON | 1. 98*Dc | | 1. 97*Dc | 800. 77 |
| | FRI CTI ON | } H' | 894.13 YDRAULIC JUMP | 1. 64 | 839. 60 |
| 1525. 00- } 1525. 00- | JUNCTI ON | 1. 98 DC | 800. 77 800. 77 | 1. 81* 1. 73* | 809. 96 820. 91 |
| } 1520. 00- | FRI CTI ON | 1. 98*Dc | 800. 77 | 1. 98*Dc | 800. 77 |
| 1520. 00- | CATCH BAS | 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 Page 1

```
CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
 DESIGN MANUALS.
         DOWNSTREAM PIPE FLOW CONTROL DATA:
                               FLOWLINE ELEVATION =
 NODE NUMBER = 1570.00
 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
                             MANNI NG' S N = 0.01300
 PIPE LENGTH =
                  16.00 FEET
 -----
DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 3.00
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
______
                FLOW DEPTH VELOCITY
                                        SPECIFIC PRESSURE+
 DISTANCE FROM
                  (FT)
                            (FT/SEC)
                                        ENERGY(FT)
  CONTROL(FT)
                                                    MOMENTUM (POUNDS)
                     3.000
                             5. 219
                                            3.423
        0.000
                                                          1034.91
                     2. 959
                              5. 233
5. 259
5. 292
                                            3. 384
        5. 448
                                                          1017.87
                                                          1001.73
                     2.918
       10.513
                                            3.348
                     2.877
       15. 359
                                            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:
               FLOW
                      DI AMETER
                               ANGLE
                                       FLOWLI NE
                                                           VELOCITY
     PI PE
                                                 CRI TI CAL
               (CFS)
                      (INCHES) (DEGREES) ELEVATION
                                                 DEPTH(FT.) (FT/SEC)
                                       100. 28
                                                   1. 98 ´
    UPSTREAM
                36. 90
                        36.00 60.00
                                                            23. 964
                36.90
   DOWNSTREAM
                        36.00
                                          99. 91
                                                   1. 98
                                                              5.299
                       0.00
                                       0.00
                 0.00
                             0. 00
                                  0.00
                                                   0.00
                                                             0.000
   LATERAL #1
   LATERAL #2
                 0.00
                                          0.00
                                                   0.00
                         0.00
                                                              0.000
                 O. OO===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
REAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.12039
 UPSTREAM:
            MANNING'S N = 0.01300;
 DOWNSTREAM:
                                 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)
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (6.790)+(0.000) = 6.790
                                  ENTRANCE LOSSES = 0.000 FEET
 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
                                  Page 2
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```
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:
 DI STANCE FROM FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM (POUI
0.000 0.712 28.705 13.515 2076.66
9.294 0.748 26.812 11.918 1944.20
                                                           MOMENTUM (POUNDS)
                                                                 2076.68
                                28. 700
26. 812
                                                 11. 918
                                                                 1944. 21
         9. 294
                        0.748
                               25. 129
23. 957
                        0.783
        18.691
                                                 10. 594
                                                                 1826, 92
                                                9. 727
        26, 000
                        0.810
                                                                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:
                 FLOW
                       DIAMETER ANGLE FLOWLINE
                                                      CRI TI CAL
                                                                   VELOCITY
      PI PE
                         (INCHES) (DEGREES) ELEVATION
                 (CFS)
                                                       DEPTH(FT.)
                                                                   (FT/SEC)
                  36. 90
                           36.00
                                                                     33. 243
    UPSTREAM
                                     25. 00<sup>°</sup>
                                              100.87
                                                          1. 98
   DOWNSTREAM
                  36.90
                           36.00
                                              100.54
                                                          1. 98
                                                                     28.714
                                      0.00
                   0.00
                                                          0.00
                                                                     0.000
   LATERAL #1
                            0.00
                                                0.00
                                                          0.00
                                                                      0.000
   LATERAL #2
                   0.00
                            0.00
                                     0.00
                                                0.00
      05
                   O. OO===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)
                                      Page 3
```

```
1570. RES
                                         29.885
           0.000
                             0.692
                                                          14. 569
                                                                              2159.48
           1. 428
                             0.690
                                         30.018
                                                          14. 691
                                                                             2168.83
           2. 924
                                         30. 152
30. 287
                             0.688
                                                          14.814
                                                                             2178. 25
                                                                             2187. 74
2197. 31
           4.494
                             0.686
                                                          14. 938
                                                          15.065
                            0.684
                                         30. 423
           6.145
                                                          15. 192
           7.884
                                         30. 560
                                                                             2206.97
                            0.682
           9.722
                            0.679
                                         30. 698
                                                          15. 322
                                                                             2216.69
                            0.677
                                         30.838
                                                          15. 453
                                                                             2226, 50
          11.669
                                         30. 978
          13. 736
                            0.675
                                                          15. 586
                                                                             2236. 39
                                        31. 120
31. 263
                                                         15. 720
15. 856
          15. 939
                            0.673
                                                                             2246. 36
                                                                             2256. 41
          18. 296
                            0.671
                                                         15. 994
16. 134
16. 276
                                        31. 406
31. 551
31. 698
31. 845
          20.828
                            0.669
                                                                             2266.54
          23. 560
                            0.666
                                                                             2276.76
          26. 525
29. 764
                            0.664
                                                                              2287.07
                                                      16. 2/6
16. 419
16. 564
16. 711
16. 861
17. 012
17. 165
17. 320
17. 477
17. 636
17. 798
                                                                             2297.45
                            0.662
                                                                             2307.93
          33. 329
                            0.660
                                        31. 994
          37. 288
                            0. 658
                                        32. 144
                                                                             2318. 49
                                        32. 295
                                                                             2329. 15
          41. 736
                            0. 656
                                        32. 447
          46.802
                            0. 653
                                                                             2339.89
                                        32.601
          52.679
                            0.651
                                                                             2350. 72
                                       32. 755
32. 912
33. 069
33. 228
33. 233
          59. 662
                            0.649
                                                                             2361.64
          68. 251
79. 377
                                                                             2372.66
                            0.647
                            0.645
                                                                             2383.77
          95. 137
                            0.643
                                                                             2394.98
                                                         17.803
          96.000
                            0.643
                                                                             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:
                    FLOW DIAMETER ANGLE
                                                    FLOWLI NE
        PI PF
                                                                 CRI TI CAL
                                                                                VFI OCI TY
                             (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                     (CFS)
                     36. 90
     UPSTREAM
                                36. 00 15. 10 131. 03
                                                                  1. 98
                                                                                  32. 469
                                36.00
                      36. 90
                                                       130. 70
                                                                     1. 98
    DOWNSTREAM
                                                                                  29.894
                      0. 00
0. 00
0. 00
                                 0.00 0.00 0.00
0.00 0.00 0.00
                      0.00
                                                                     0.00
                                                                                  0.000
    LATERAL #1
                                                        0.00
                                                                     0.00
                                                                                   0.000
    LATERAL #2
                       O. OO===Q5 EQUALS BASIN INPUT===
        Q5
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
 O4*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
                                             Page 4
```

______ UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.93 ______ GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION: FLOW DEPTH VELOCITY SPECIFIC PRESSURE+ DISTANCE FROM CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM (POUNDS) 0.000 1. 926 7. 692 2.846 801.51 1.873 2.854 0.022 7.946 804.07 0.062 1.820 8.220 808.56 2.870 2.894 1. 767 0.124 8.516 815.14 0.209 1.714 8.836 2.927 823.98 0.322 1.661 9. 183 2.972 835.27 849.22 1.608 9. 561 3.028 0.468 9. 971 1.555 0.653 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. 396 1.516 11. 448 3. 432 937. 32 1.343 969. 28 1.943 12.040 3.595 1. 290 1006.21 2.467 12.694 3.794 1. 237 13. 420 14. 228 4.035 1048. 75 1097. 72 3.109 3.899 1.184 4.329 1. 131 15. 132 1154.07 4.878 4. 689 6.098 1.078 16. 149 5. 130 1218. 98 17. 299 1293.91 7.636 1.025 5.674 0.972 6. 351 18.607 1380.69 9.602 0.919 20. 106 12. 161 7. 200 1481.62 21. 838 23. 855 15. 575 0.866 8. 275 1599.64 9.654 20. 292 0.812 1738.57 0. 759 0. 706 26. 228 29. 053 11.448 1903.45 27. 165 38. 129 13.821 2101.05 32.458 59.429 0.653 17.023 2340.68 32. 458 17.023 109. 110 0.653 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: FLOW DI AMETER PI PE ANGLE FLOWLI NE CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION (CFS) DEPTH(FT.) (FT/SEC) **UPSTREAM** 36. 90 36.00 30.00 174. 78 1. 98 7.971 36. 90 DOWNSTREAM 36.00 174. 49 1. 98 7.694 0.00 0.00 0.00 0.00 LATERAL #1 0.00 0.000 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED: DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)- $\overline{Q4*V4*COS(DELTA4)})/((A1+A2)*16.1)+FRICTIÓN LOSSES$ MANNING'S $\hat{N} = 0.01300$; FRICTION SLOPE = 0.00606 MANNING'S N = 0.01300; FRICTION SLOPE = 0.00554 DOWNSTREAM: AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00580 JUNCTION LENGTH = 4.00 FEET FRICTION LOSSES = 0.023 FEET ENTRANCE L' JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) ENTRANCE LOSSES = 0.000 FEET JUNCTION LOSSES = (0.300) + (0.000) = 0.300NODE 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)
 NORMAL DEPTH(FT) = 1.69 CRITICAL DEPTH(FT) = 1.98
_________________
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.97
GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

        DI STANCE FROM CONTROL (FT)
        FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
        SPECIFIC PRESSURE+

        0.000
        1.975
        7.475
        2.843
        800.77

                                                              MOMENTUM (POUNDS)
                                  7. 47Ś
                                                                     800.77
                                                     2.843
          0.047
                         1. 963
                                     7. 525
                                                                     800.81
                        800.94
          0. 185
                                                     2.844
          0.421
                                                     2.844
                                                                     801.15
          0.765
                                                                     801.44
                                                     2.845
                                                                     801.82
          1. 228
                                                     2.847
          1.822
                                                     2.848
                                                                     802.29
                                                                     802.84
          2. 560
                                                     2.850
          3. 461
                                                    2.852
                                                                     803.49
          4.544
                                                    2.855
                                                                     804.22
          4.810
                                                    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:
                         DIAMETER ANGLE FLOWLINE CRITICAL (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                  FLOW
                                                                      VELOCITY
                  (CFS)
                                                                       (FT/SEC)
                                                          1. 98
                             36.00
                   36. 90
                                       61. 50 175. 19
                                                                         5. 684
     UPSTREAM
                   36.90
                                                174.82
                                                             1. 98
    DOWNSTREAM
                             36.00
                                                                         7. 475
                                       0.00
0.00
                   0.00
                             0.00
                                                             0.00
                                                                         0.000
    LATERAL #1
    LATERAL #2
                    0.00
                             0.00
                                                             0.00
                                                                         0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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
                     4.00 FEET
  JUNCTION LENGTH =
                                        ENTRANCE LOSSES = 0.000 FEET
 FRICTION LOSSES = 0.016 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
```

1570. RES 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: -----DI STANCE FROM FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM(POUN
0.000 1.807 8.289 2.875 809.96
1.108 1.799 8.337 2.879 810.96 (FT) 1.807 1.799 1.790 1.782 MOMENTUM (POUNDS) 809.96 2. 879 2. 883 8. 337 8. 384 810.96 1. 108 2. 322 812.02 2. 891 2. 896 2. 900 2. 905 2. 911 2. 916 2. 922 2. 928 2. 935 2. 941 2. 948 2. 956 2. 963 2. 971 2. 980 2. 988 2. 989 2.887 813.14 8.433 3.652 5. 108 1. 773 8. 482 814.31 8. 532 8. 582 8. 633 8. 685 8. 737 8. 790 8. 844 8. 899 8. 954 9. 010 9. 066 9. 124 9. 182 9. 241 9. 301 9. 306 6.703 1. 764 8. 532 815.55 8. 451 1. 756 816.84 1. 730 1. 747 1. 739 1. 730 1. 722 1. 713 1. 704 10.369 818.19 12. 477 819.61 14. 798 17. 359 20. 194 821.08 822.62 824.22 23. 345 825.89 26.861 1. 696 827.62 1. 687 829.42 30.807 1. 679 1. 670 1. 661 1. 653 1. 644 831.28 35. 264 40.343 833. 21 46. 189 835. 21 837. 28 53.008 61. 102 839.43 1.644 HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS ______ DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.59 ______ GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION: DISTANCE FROM CONTROL(FT) (FT) (FT/SEC) SPECIFIC PRESSURE+ MOMENTUM(POUNDS)
0.000 2.592 5.682 3.094 894.13
2.317 2.568 5.727 3.077 887.42 2.568 3.077 2. 317 5.727 5. 727 5. 774 5. 823 5. 874 3.061 4.591 2.543 880.92 6.822 2. 518 3.045 874.63 2.494 9.007 5. 874 5. 927 5. 982 6. 038 6. 097 6. 158 6. 221 6. 287 6. 354 6. 424 6. 496 6. 571 6. 648 6. 728 6. 810 6. 896 3.030 868.56 862. 72 857. 10 2.469 11. 146 3.015 13. 237 15. 278 17. 265 3.000 2.444 851.71 2.420 2.986 2. 395 2.973 846. 56 19.197 2.370 2.959 841.65 2.346 21.070 2. 947 836.99 22.880 2. 321 2. 935 832.57 2. 296 2. 924 24.624 828.42 2. 296 2. 272 2. 247 2. 222 2. 198 2. 173 2. 913 26. 298 824.52 2. 913 2. 903 2. 893 2. 884 2. 876 2. 869 27.895 820.90 29.410 817.54 30.838 814.47 32.169 811.69 2. 148 33.396 809.21 2. 124 2. 099 34.509 6. 896 2.862 807.02 6. 984 35. 497 2.857 805.15 7.075 36. 347 2.074 2.852 803.60 2.050 7. 169 2.848 37.044 802.37 Page 7

```
1570. RES
                                 7. 267
7. 368
                                                                 801.49
        37. 570
                        2.025
                                                 2.845
                                                 2.844
        37. 904
                        2.000
                                                                 800.95
                                  7. 472
                        1. 976
                                                 2.843
        38. 022
                                                                 800.77
 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:
      PI PF
                 FLOW
                        DIAMETER ANGLE
                                           FLOWLI NE
                                                       CRI TI CAL
                                                                  VELOCITY
                         (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                 (CFS)
                                                                  (FT/SEC)
                  36. 90
    UPSTREAM
                           36. 00 30. 00
                                            176. 14
                                                         1. 98
                                                                     8.734
                                                         1. 98
                  36.90
                                             175.81
   DOWNSTREAM
                           36.00
                                                                     8.292
                   0.00
0.00
0.00
                                            0.00
   LATERAL #1
                  0.00
                                     0.00
                                                         0.00
                                                                    0.000
                                     0.00
                                               0.00
                                                         0.00
                                                                    0.000
   LATERAL #2
                   O. OO===Q5 EQUALS BASIN INPUT===
      05
 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:
                     SPECIFIC PRESSURE+
 DISTANCE FROM
                   FLOW DEPTH VELOCITY
                                (FT/SEC)
  CONTROL(FT)
                                            ENERGY(FT)
                                                          MOMENTUM (POUNDS)
                        (FT)
                        1. 976
         0.000
                                  7. 472
                                                 2.843
                                                                 800.77
                                  7. 541
                                                 2.843
         0.049
                        1.960
                                                                 800.84
                                 7. 611
                        1.944
                                                                 801.07
         0.202
                                                 2.844
                                 7. 682
         0.470
                        1.928
                                                 2.845
                                                                 801.45
                                 7. 755
7. 830
                        1.913
         0.861
                                                 2.847
                                                                 801.99
                        1.897
         1.390
                                                 2.850
                                                                 802.69
                       1.881
                                  7. 906
                                                                 803.56
         2.071
                                                 2.853
                                 7. 984
         2. 920
                       1.866
                                                 2.856
                                                                 804.59
         3. 958
                       1.850
                                 8.064
                                                 2.860
                                                                 805.80
         5. 207
                       1.834
                                 8. 145
                                                 2.865
                                                                 807.18
                                 8. 229
         6. 696
                       1. 819
                                                 2.871
                                                                 808.74
                                     Page 8
```

| 10. 536 12. 980 15. 854 | 1. 771 1. 756 1. 740 | 8. 402 8. 491 8. 583 | 2. 877 2. 884 2. 892 2. 900 2. 910 2. 916 | 812. 42 814. 54 816. 86 | | | |
|--|---|--------------------------------|--|---------------------------------------|--|--|--|
| NODE 1520.00 : HGL | = < 178.336 | 5>; EGL= < 17 | 79. 203>; FLOWLI NE= | < 176. 360> | | | |
| ************************************** | DDE 1520.00 00 ELEVA N ENTRANCE L 90 CFS 47 FEET/SEC. | TO NODE 152 ATION = 176 | 20.00 IS CODE = 6.36 (FLOW UNSEA 0): AMETER = 36.00 I / HEAD = 0.868 F | 8 LS IN REACH) NCHES EET | | | |
| NODE 1520.00 : HGL | = < 179.377 | 7>; EGL= < 17 | 79. 377>; FLOWLI NE= | < 176. 360> | | | |
| ************************************** | | | | | | | |
| END OF GRADUALLY VAR | RIED FLOW ANA | LYSIS | | ============ | | | |

1610. RES ****************** 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 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 PRESSURE PRESSURE+ PRESSURE+ MODEL FLOW NUMBER **PROCESS** HEAD(FT) MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) 10.21* 1620.00-1049. 47 0.19 83. 53 } HYDRAULIC JUMP } FRICTION 1610.00-0. 59*Dc 27. 21 0.59*Dc 27.21 } CATCH BASIN 0.59*Dc 1610.00-0. 52 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 PI PE FLOW = 2.40 FLOWLINE ELEVATION = 70.69 PIPE DIAMETER = 18.00 INCHES 2.40 CFS 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): 2. 40 CFS PIPE DIAMETER = 18.00 INCHES 151. 64 FEET MANNING'S N = 0.01300 PIPE FLOW = PIPE LENGTH = HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.59

1610. RES GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

```
1610. RES
                                    2.029
        22.954
                        0.952
                                                   1.016
                                                                    40.00
                        0.915
        23.029
                                    2. 125
                                                   0.985
                                                                    37.81
        23. 103
                        0.879
                                    2. 231
                                                   0.956
                                                                    35.79
        23. 173
23. 239
                        0.842
                                    2.349
                                                   0.928
                                                                    33.95
                                                   0.901
                        0.805
                                    2.482
                                                                    32.30
        23. 301
                        0.769
                                    2.631
                                                   0.876
                                                                    30.85
        23.357
                        0.732
                                    2.799
                                                   0.854
                                                                    29.61
                        0.696
                                                                    28.61
                                    2.990
        23, 405
                                                   0.835
        23.444
                        0.659
                                    3. 209
                                                   0.819
                                                                    27.86
        23.470
                        0.623
                                    3. 459
                                                   0.809
                                                                    27.38
                                    3.750
        23.480
                        0.586
                                                   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
                   5.99 FEET/SEC.
 FLOW VELOCITY =
                                      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
                                  132.62 FOR DOWNSTREAM RUN ANALYSIS
 ASSUMED UPSTREAM CONTROL HGL =
______
 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:

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

18022-F Maple Canyon

* System 0 0100 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 | /I RUN | DOWNSTREA | M RUN |
|-------------|------------|---------------|----------------------------|-----------|-------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 1. 00- | | 3. 00*Dc | 1Ò213. 72´ | 2. 99*Dc | 10212. 41 |
| } | FRI CTI ON | | | | |
| | | 10. 23* | 13403. 57 | 2. 99 Dc | 10212. 41 |
| | JUNCTI ON | | | | |
| | | 25. 68* | 23945. 30 | 2. 56 | 8552. 22 |
| | FRI CTI ON | | | | |
| | | 19. 86* | 19379. 20 | 2. 26 | 9649. 55 |
| | JUNCTI ON | 00 04 # | 10107 10 | 0.44 | 10045 47 |
| 10.00- | EDI OTI ON | 20. 01* | 19497. 40 | 2. 14 | 10245. 46 |
| | FRI CTI ON | 12 00* | 14050 (0 | 0.10 | 10047 70 |
| | HINGTLON | 13. 08* | 14058. 69 | 2. 18 | 10047. 70 |
| | JUNCTI ON | 12. 99* | 12000 F0 | 2 12 | 10217 21 |
| | FRI CTI ON | 12. 99" | 13990. 59 | 2. 13 | 10317. 31 |
| | FRICTION | 6. 83* | 9161. 86 | 2. 80 | 7916. 98 |
| | JUNCTI ON | 0. 63 | 9101.00 | 2. 00 | 7910.96 |
| 30 00- | JUNCTION | 7 /0* | 9675. 91 | 2. 43 | 8975. 12 |
| 30.00- | EDICTION. | 7.47 \ LI\ | ADDVIII I CHIMD | 2.43 | 0773. 12 |
| 40 00- | TRICTION | 3 80*00 | /DRAULI C JUMP 6888. 04 | 3.80*Dc | 6888. 04 |
| 40.00- } | CATCH BAS | 3.00 DC | 0000.04 | 3. 00 DC | 0000.04 |
| 40 00- | OATON DAG | 8 07* | 4758. 94 | 3.80 Dc | 1414. 30 |
| | | | 4750.74 | | |

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:

FLOWLINE ELEVATION = NODE NUMBER = 1.00 186.66 CFS PIPE FLOW = PIPE DIAMETER = 36.00 INCHES

ASSUMED DOWNSTREAM CONTROL HGL = 46. 270 FEET

```
1.00 : HGL = < 46.270>; EGL= < 57.098>; FLOWLINE= < 43.270>
 NODE
******************
 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
                                                         CRI TI CAL
                                                                      VELOCITY
                          (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                  (CFS)
                                                             3. 80
    UPSTREAM
                  186. 66
                          48. 00 90. 00 44. 20
                                                                         14.854
   DOWNSTREAM
                                                             2. 99
                  186.66
                             36.00
                                                 43.87
                                                                         26. 407
                    0.00
                                                                         0.000
   LATERAL #1
   LATERAL #2
                                                                         0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
      Q5
 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)
                                       ENTRANCE LOSSES = 0.000 FEET
 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:
                  FLOW DIAMETER ANGLE FLOWLINE
      PI PE
                                                          CRI TI CAL
                                                                       VELOCITY
                  (CFS)
                          (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                                   20. 00<sup>°</sup>
    UPSTREAM
                  186.66
                            48.00
                                                 57.85
                                                             3. 80 14. 854
                                                             3.80
   DOWNSTREAM
                             48.00
                                                  57.52
                                                                         14.854
                  186. 66
                                                          0.00
                                              0.00
                                        0.00
   LATERAL #1
                  0.00
                             0.00
                                                                         0.000
   LATERAL #2
                    0.00
                             0.00
                                       0.00
                                                  0.00
                                                             0.00
                                                                         0.000
                                        Page 2
```

```
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
           10.00 : HGL = < 77.862>; EGL= < 81.289>; FLOWLINE= < 57.850>
  NODE
*******************
 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:
        PI PE
                       FLOW
                                 DIAMETER ANGLE FLOWLINE
                                                                         CRI TI CAL
                                                                                        VELOCITY
                                 (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                                                                                         (FT/SEC)
                       (CFS)
                                                              68. 19
      UPSTREAM
                       186.66
                                    48. 00 13. 00
                                                                             3.80
                                                                                           14.854
    DOWNSTREAM
                       186.66
                                    48.00
                                                              67.86
                                                                             3.80
                                                                                           14.854
                         0.00
                                     0.00
                                                  0.00
                                                              0.00
                                                                             0.00
                                                                                            0.000
    LATERAL #1
    LATERAL #2
                         0.00
                                     0.00
                                                  0.00
                                                               0.00
                                                                             0.00
                                                                                            0.000
                         O. OO===Q5 EQUALS BASIN INPUT===
        05
  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
                  MANNI NG'S N = 0.01300; FRI CTI ON SLOPE = 0.01688 MANNI NG'S N = 0.01300; FRI CTI ON SLOPE = 0.01688
  UPSTREAM:
  DOWNSTREAM:
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01688
  JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.068 FEET ENTRANCE LOSSES)

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                                   ENTRANCE LOSSES = 0.000 FEET
  JUNCTION LOSSES = (0.243)+(0.000) = 0.243
            20.00 : HGL = < 81.180>; EGL= < 84.606>; FLOWLINE= < 68.190>
  NODE
         ********************
  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
```

```
30.00 : HGL = < 82.092>; EGL= < 85.518>; FLOWLINE= < 75.260>
 NODE
*****
 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:
                  FLOW DIAMETER ANGLE FLOWLINE CRITICAL VELOCITY (CFS) (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                           48.00 30.00 75.59
48.00 - 75.26
    UPSTREAM
                  186.66
                                                               3. 80 14. 854
                  186.66
    DOWNSTREAM
                                                               3.80
                                                                          14.854
                 0.00
                            0.00
                                                0. 00
0. 00
                                                              0. 00
0. 00
                                                                          0.000
    LATERAL #1
    LATERAL #2
                    0.00
                                                                           0.000
                     O. OO===Q5 EQUALS BASIN INPUT===
       Q5
 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)+FRICTIÓN LOSSES
 U4^V4^CUS(DELIA4))/((A1+A2)^16.1)+FRICTION LUSSES

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 = 0.008 FEET ENTRANCE LOSSES = 0.000

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.098) + (0.000)
                                         ENTRANCE LOSSES = 0.000 FEET
 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(POUN
                    (FT)
3. 802
                                                               MOMENTUM (POUNDS)
                                                      7. 358
7. 368
7. 397
                                   15. 128
15. 330
15. 571
                                                                      6888.04
          0.000
          0.086
                                                                      6895. 73
6918. 00
                          3.716
                          3.630
          0.340
          0.760
                                    15.847
                                                      7.446
                          3.545
                                                                      6954.25
          1.353
                          3.459
                                    16. 158
                                                      7.515
                                                                      7004.35
                          3.373
                                    16. 505
                                                                      7068.54
          2. 133
                                                     7. 605
          3. 115
                         3. 287
                                    16.888
                                                     7. 718
                                                                      7147.27
                                    17. 309
17. 771
18. 275
                         3. 201
                                                                      7241. 19
          4. 324
                                                     7. 856
                         3. 115
3. 029
2. 943
2. 858
                                                   8. 022
8. 219
8. 450
8. 722
          5. 787
                                                     8. 022
                                                                      7351. 17
          7.542
                                                                      7478.24
                                     18.826
          9.633
                                                                      7623.64
                                     19. 427
         12. 115
                                                                      7788.83
         15.060
                         2.772
                                    20.083
                                                     9. 038
                                                                      7975.50
                         2. 686
2. 600
                                                    9. 407
         18. 556
                                     20. 799
                                                                      8185, 62
         22.718
                                    21. 581
                                                     9.837
                                                                     8421, 49
                                    22. 437
23. 355
                                                   10. 336
         27. 697
                         2. 514
                                    22. 437
                                                                     8685.76
                                                     10. 905
         33. 570
                         2. 430
                                                                      8975.12
```

```
HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
______
 DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 7.49
 ______
 PRESSURE FLOW PROFILE COMPUTED INFORMATION:
   -----
                             VELOCITY SPECIFIC PRESSURE+
(FT/SEC) ENERGY(FT) MOMENTUM(POU
 DISTANCE FROM
                  PRESSURE
                    HEAD(FT)
                                                         MOMENTUM (POUNDS)
  CONTROL(FT)
                             14. 854
14. 05
                  7. 487
                                               10. 913
         0.000
                                                              9675.91
                                               7. 426
                                                              6941.34
        30. 462
                      4.000
______
 ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 4.00
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
 DISTANCE FROM
                  FLOW DEPTH VELOCITY SPECIFIC
                                                           PRESSURE+
  CONTROL(FT)
                                           ENERGY(FT)
                                                         MOMENTUM (POUNDS)
                       (FT)
                               (FT/SEC)
                                 14. 849
        30.462
                       4.000
                                                7.426
                                                              6941.34
        30. 522
                       3.992
                                 14.852
                                                7.419
                                                              6935.94
                       3. 984
3. 976
                                 14.856
                                                7. 413
7. 408
                                                              6931.20
        30.575
        30.622
                                 14.861
                                                              6926.90
                       3.968
                                                7.403
                                 14.867
                                                              6922.94
        30.666
                                                7. 398
        30. 706
                       3.960
                                 14.874
                                                              6919.30
        30. 744
                       3.953
                                 14.882
                                                7.394
                                                              6915.92
        30.778
                       3.945
                                 14.890
                                                7.390
                                                              6912.80
                       3.937
                                 14.899
                                                7. 386
        30.810
                                                              6909.90
                                                7. 383
7. 379
7. 376
7. 374
7. 371
7. 369
                                 14. 909
14. 919
14. 930
14. 941
                       3.929
                                                              6907. 22
        30.839
                       3. 921
        30.867
                                                              6904.75
        30.892
                       3.913
                                                              6902. 48
6900. 39
                       3.905
        30. 915
                                 14.953
        30. 936
                       3.897
                                                              6898.49
        30. 955
                       3.889
                                 14. 965
                                                              6896.76
        30. 972
                       3.881
                                 14. 978
                                                7. 367
                                                              6895, 20
                                14. 991
        30.988
                       3.873
                                                7.365
                                                              6893.80
        31.001
                       3.865
                                15.005
                                                7.364
                                                              6892.56
                                                7. 362
7. 361
7. 360
7. 359
7. 359
                       3.858
                                 15. 019
        31.013
                                                              6891.48
                                15. 033
15. 048
15. 063
                       3.850
        31.023
                                                              6890.55
                       3. 842
3. 834
        31.032
                                                              6889.77
                                                              6889.14
        31.039
                       3.826
                                 15. 079
        31.044
                                                              6888.66
                       3.818
                                 15.095
                                                7.358
        31.048
                                                              6888.31
                       3.810
        31.051
                                 15. 111
                                                7.358
                                                              6888.10
        31.051
                       3.802
                                 15. 128
                                                7.358
                                                              6888.04
                       3.802
                                 15. 128
                                                              6888.04
                                                7. 358
 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 DIAMETER = 48.00 INCHES
VELOCITY HEAD = 3.556 FEET
 PIPE FLOW = 186.66 CFS
FLOW VELOCITY = 15.13 FEET/SEC.
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(3.556) = 0.711
         40.00 : HGL = < 88.069>; EGL= < 88.069>; FLOWLINE= < 80.000>
 NODE
```

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 $^{\circ}$

0000 ULT. RES

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

* 18022-F Maple Canyon

* System 0 0100 Proposed

* UĬtimate 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

"*" indicates nodal point data used.)

| | ` | UPSTREAM | DOWNSTRÉ <i>A</i> | AM RUN | |
|--------|------------|----------|-------------------------------|-----------|-------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FT) | MOMENTUM (POUNDS) 16586.28 | DEPTH(FT) | MOMENTUM (POUNDS) |
| 2.00- | | 16. 30* | 16586. 28 | 2. 60 | 8408. 75 |
| | FRI CTI ON | | | | |
| | | 14. 93* | 15508. 25 | 2. 54 | 8609. 40 |
| | JUNCTI ON | | | | |
| | | 14. 66* | 15302. 43 | 2. 56 | 8552. 22 |
| | FRI CTI ON | | | | |
| | IIINOTI ON | 8.84* | 10736. 30 | 2. 26 | 9649. 55 |
| | JUNCTI ON | 0 004 | 40054.50 | 0.44 | 10045 47 |
| | EDI CTI ON | | 10854.53 | 2. 14 | 10245. 46 |
| | | | DRAULIC JUMP | 2 10* | 10047 70 |
| | HINCTLON | 3.80 DC | 6888. 04 | 2. 18* | 10047. 70 |
| | JUNCTI ON | 3.80 Dc | 4000 04 | 2. 13* | 10317. 31 |
| | FRI CTI ON | 3. 60 DC | 6888. 04 | 2. 13 | 10317.31 |
| | FRICTION | 3.80 Dc | 6888. 04 | 2. 80* | 7916. 98 |
| | JUNCTI ON | 3.00 DC | 0000.04 | 2.00 | 7710. 70 |
| | JUNCTION | 4. 59 | 7405. 01 | 2. 43* | 8975. 12 |
| | FRI CTI ON | 4. 57 | 7403.01 | 2. 40 | 0773.12 |
| 40 00- | TRIGITOR | 3.80*Dc | 6888. 04 | 3.80*Dc | 6888. 04 |
| | CATCH BAS | | 0000.01 | 0.00 00 | 0000.01 |
| | | 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:

FLOWLINE ELEVATION = NODE NUMBER = 2.00 186, 66 CFS PIPE FLOW = PIPE DIAMETER = 48.00 INCHES

ASSUMED DOWNSTREAM CONTROL HGL = 56.600 FEET

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               2. 00 : HGL = < 56. 600>; EGL= < 60. 026>; FLOWLINE= < 40. 300>
  NODE
*****
  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 = \langle 58.795 \rangle; EGL = \langle 62.221 \rangle; FLOWLINE = \langle 43.870 \rangle
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)

        PSTREAM
        186.66
        48.00
        0.00
        44.20
        3.80
        14.854

        WNSTREAM
        186.66
        48.00
        -
        43.87
        3.80
        14.854

        TERAL #1
        0.00
        0.00
        0.00
        0.00
        0.00
        0.00

        TERAL #2
        0.00
        0.00
        0.00
        0.00
        0.00
        0.00
        0.00

      UPSTREAM
     DOWNSTREAM
     LATERAL #1
     LATERAL #2
                             O. OO===Q5 EQUALS BASIN INPUT===
         Q5
  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 = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                                       ENTRANCE LOSSES = 0.000 FEET
  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:
                          FLOW DIAMETER ANGLE FLOWLINE
         PI PE
                                                                                  CRI TI CAL
                                                                                                     VELOCITY
                                     (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                          (CFS)
                                     48.00 20.00 57.85 3.80 14.854
      UPSTREAM
                          186.66
     DOWNSTREAM
                                         48.00
                                                                       57. 52
                                                                                        3.80
                          186. 66
                                                                                                        14.854
                                        48.00 - 57.52 3.80
0.00 0.00 0.00 0.00
0.00 0.00 0.00
     LATERAL #1
                          0.00
                                                                                                        0.000
     LATERAL #2
                            0.00
                                                                                                         0.000
                                                         Page 2
```

```
05
                           O. OO===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)

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.481)+(0.000) = 0.481
                                                ENTRANCE LOSSES = 0.000 FEET
           10.00 : HGL = < 66.840>; EGL= < 70.266>; FLOWLINE= < 57.850>
  NODE
*******************
  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:
 DI STANCE FROM FLOW DEPTH VELOCI TY SPECIFIC PRESSURE+
CONTROL (FT) (FT) (FT/SEC) ENERGY (FT) MOMENTUM (POUN
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
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
                                                                                 MOMENTUM (POUNDS)
                                                                                        10047.70
                                                                                         10058.56
                                                                                        10069.44
                                                                                        10080.37
                                                                                        10000.37
10091.32
10102.30
10113.31
                                                                                         10124.36
                                                                                        10135.44
                                                                                        10146.54
                                                                                        10157.69
                                                                                        10168, 86
                                              27. 003
27. 039
27. 072
27. 106
27. 140
27. 174
27. 208
                                                                                        10180.07
                                                                                        10191.31
                                                                                         10202.58
                                                                                        10213.88
                                                                  13. 619
13. 646
                                                                                        10225. 22
                                 2. 144
          166.640
                                                                                        10236, 58
                                           27. 234
                                                               13. 666
                                2. 142
          182.050
  HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS
______
  DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 8.99
______
  PRESSURE FLOW PROFILE COMPUTED INFORMATION:
      ______
                                          VELOCITY SPECIFIC PRESSURE+
(FT/SEC) ENERGY(FT) MOMENTUM(POUNDS)
14.854 12.416 10854.53
                         PRESSURE
  DISTANCE FROM
                           HEAD(FT)
8. 990
   CONTROL(FT)
             0.000
                                  4.000
                                                                     7. 426
          130. 986
                                               14.854
                                                                                         6941.34
                                                     Page 3
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| ASSUMED DOWNSTREAM PRES | SSURE HEAD(FT) = | 4. 00 | |
|--|---|---|--|
| GRADUALLY VARIED FLOW I | ========================== PROFILE COMPUTED IN | :======== IFORMATI ON: | ======================================= |
| CONTROL (FT) 130. 986 131. 166 131. 322 131. 462 131. 591 131. 709 131. 819 131. 920 132. 013 132. 099 132. 179 132. 252 132. 319 132. 380 132. 435 132. 435 132. 485 132. 530 132. 570 132. 570 132. 605 132. 659 132. 669 132. 680 132. 695 132. 706 132. 715 182. 050 | | 7. 413 7. 408 7. 403 7. 398 7. 394 7. 390 7. 386 7. 383 7. 379 7. 376 7. 374 7. 371 7. 369 7. 367 7. 365 7. 364 7. 362 7. 361 7. 360 7. 359 7. 359 7. 358 7. 358 7. 358 7. 358 | 6922. 94 6919. 30 6915. 92 6912. 80 6909. 90 6907. 22 6904. 75 6902. 48 6900. 39 6898. 49 6896. 76 6895. 20 6893. 80 6892. 56 6891. 48 6890. 55 6889. 77 6889. 14 6888. 66 6888. 31 6888. 10 6888. 04 6888. 04 |
| NODE 20.00 : HGL = - | < 70. 040>; EGL= < | 81. 069>; FLOWLII | NE= < 67.860> |
| FLOW PROCESS FROM NODE UPSTREAM NODE 20.00 | 20.00 TO NODE ELEVATION = | | |
| CALCULATE JUNCTION LOSS PIPE FLOW (CFS) UPSTREAM 186.66 DOWNSTREAM 186.66 LATERAL #1 0.00 LATERAL #2 0.00 | SES: DI AMETER | 6) ELEVATION DEP 68.19 67.86 0.00 0.00 | TTI CAL VELOCITY TH(FT.) (FT/SEC) 3.80 27.457 3.80 26.650 0.00 0.000 0.000 |
| UPSTREAM: MANNING'S DOWNSTREAM: MANNING'S AVERAGED FRICTION SLOPI JUNCTION LENGTH = 4.0 | LTA1)-Q3*V3*COS(DEL /((A1+A2)*16.1)+FRI N = 0.01300; FRIC N = 0.01300; FRIC E IN JUNCTION ASSUN OO FEET 11 FEET ENT HV1-HV2)+(ENTRANCE | TA3) - CTION LOSSES CTION SLOPE = 0.09 CTION SLOPE | 5067 |

0000_ULT. RES 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) PSTREAM 186.66 48.00 30.00 75.59 3.80 23.362 WNSTREAM 186.66 48.00 - 75.26 3.80 19.886 3. 80 23. 362 3. 80 19. 886 0. 00 0. 000 0. 00 0. 000 UPSTREAM DOWNSTREAM 0.00 LATERAL #1 LATERAL #2 O. OO===Q5 EQUALS BASIN INPUT=== 05 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>

Page 5

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| ************************************** | | | | | | | |
|---|--|--|--|--|--|--|--|
| 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: | | | | | | | |
| DI STANCE FROM 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 | | | | | | | |
| NODE 40.00 . HGL = < 63.602>, EGL= < 67.556>, FLOWEI NE= < 60.000> | | | | | | | |
| ************************************** | | | | | | | |
| 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> | | | | | | | |
| ************************************** | | | | | | | |
| END OF GRADUALLY VARIED FLOW ANALYSIS | | | | | | | |

APPENDIX E

Energy Dissipater Design

RIP RAP PAD AT NODE 145 SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

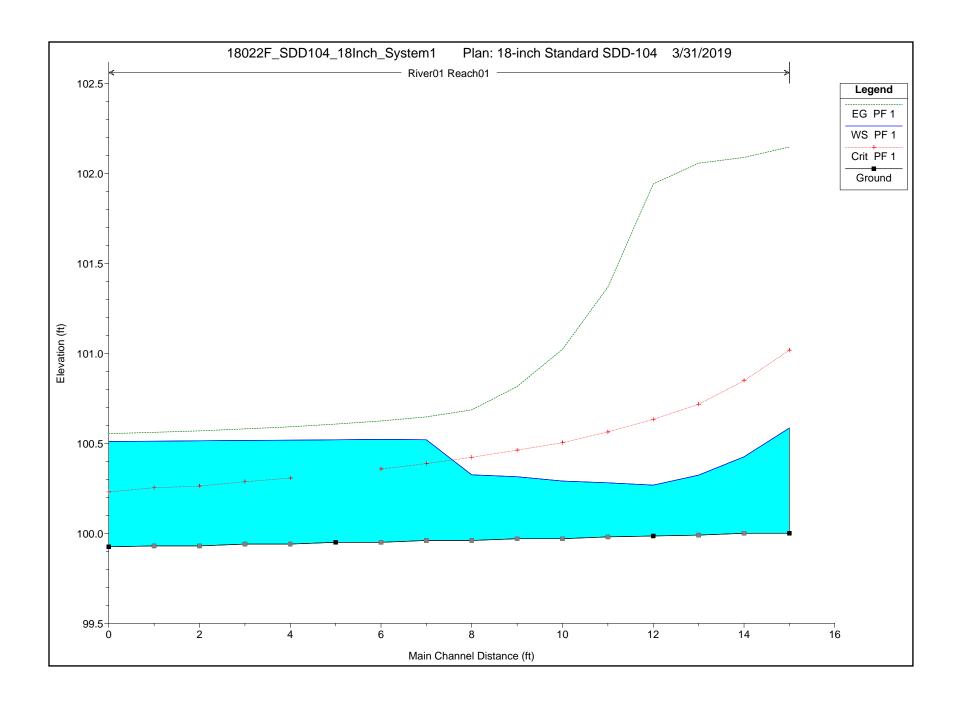
HEC-RAS Plan: 18-inch_SDD104 River: River01 Reach: Reach01 Profile: PF 1

| 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 |
| Reach01 | 96.* | PF 1 | 8.80 | 99.98 | 100.28 | 100.56 | 101.37 | 0.305081 | 8.37 | 1.05 | 6.93 | 2.69 |
| 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 |
| 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 |
| 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 |

End of Wing Wall Start of 1/4 Ton

Hydraulic Jump

End of 1/4 Ton



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Analysis prepared by:

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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

"*" indicates nodal point data used.)

| • | UPSTREA | DOWNSTRÉ | AM RUN | |
|-----------------------|-----------|-------------------|-----------|-------------------|
| NODE MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER PROCESS | HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 145. 00- | 1.`15´ Dc | | 0.`88* | `165. 07´ |
| } FRICTION | | | | |
| 140. 00- | 1.15 Dc | 150. 14 | 0.82* | 174. 11 |
| <pre>} JUNCTION</pre> | | | | |
| 140. 00- | 1. 79 | 199. 06 | 0. 40* | 404. 13 |
| } FRICTION | | | | |
| 135. 00- | 1. 15*Dc | 150. 14 | 1. 15*Dc | 150. 14 |
| <pre>} JUNCTION</pre> | | | | |
| 135. 00- | 1. 81* | 149. 52 | 0. 78 | 82. 53 |
| } FRICTION | | | | |
| 115. 00- | 1. 55* | 121. 33 | 0.90 Dc | 79. 82 |
| } CATCH BA | | | | |
| 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 = 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

145.00 : HGL = < 102.038>; EGL= < 103.080>; FLOWLINE= < 101.160> NODE

FLOW PROCESS FROM NODE 145.00 TO NODE 140.00 IS CODE = 1Page 1

| 145_V.RES 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 | | | | | | |
| NORMAL DEPTH(FT) = 1.05 CRITICAL DEPTH(FT) = 1.15 | | | | | | |
| UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.82 | | | | | | |
| GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION: | | | | | | |
| DI STANCE FROM CONTROL (FT) FLOW DEPTH VELOCITY SPECIFIC ENERGY (FT) PRESSURE+ MOMENTUM (POUNDS ENERGY) 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 | 5) | | | | | |
| NODE 140.00 : HGL = < 102.136>; EGL= < 103.381>; FLOWLINE= < 101.320> | | | | | | |
| ************************************** | | | | | | |
| CALCULATE JUNCTION LOSSES: PI PE FLOW DI AMETER ANGLE FLOWLINE CRITICAL VELOCITOR (CFS) (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SECONDE PER PER PER PER PER PER PER PER PER PE | ΓΥ 74 54 00 00 | | | | | |
| 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 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 | ==== | | | | | |
| Page 2 | | | | | | |

| GRADUALLI VARIEL | FLOW PROFILE | COMPUTED THE | ORIVIATION. | |
|--|---|---|--|--|
| 3. 881 4. 889 6. 199 7. 942 10. 345 13. 837 19. 390 30. 145 201. 420 | 0. 616 0. 585 0. 554 0. 523 0. 491 0. 460 0. 429 0. 397 0. 397 HGL = < 185. 2 | 12. 858 13. 784 14. 843 16. 063 17. 479 19. 139 21. 107 23. 466 23. 466 | 3. 185 3. 537 3. 977 4. 531 5. 238 6. 152 7. 350 8. 953 8. 954 | NE= < 184. 150> |
| CALCULATE JUNCTI PI PE | ON LOSSES: FLOW DIAMET (CFS) (INCHE | ER ANGLE | FLOWLINE CR | RITICAL VELOCITY TH(FT.) (FT/SEC) 0. 90 3. 112 1. 15 6. 063 0. 00 0. 000 |
| LATERAL #1 LATERAL #2 Q5 | 0.00 0.0 0.00 0.0 3.30===Q5 EQ | 0 0.00 0 0.00 UALS BASIN I | 0. 00 0. 00 NPUT=== | 0.00 0.000 |
| LACFCD AND OCEMADY=(Q2*V2-Q1*V1* | A FLOW JUNCTION COS(DELTA1) - 03 ELTA4))/((A1+A2 NNING'S N = 0.0 NNING'S N = 0.0 NNING'S N = 0.0 N SLOPE IN JUN = 4.00 FEET = 0.022 FEET = (DY+HV1-HV2) | FORMULAE US *V3*COS(DELT)*16.1)+FRIC 1300; FRICT 1300; FRICT CTION ASSUME ENTR | ED: (A3) - (TION LOSSES) (ION SLOPE = 0.0) | |
| NODE 135.00 : | | • | • | NE= < 184. 480> |
| | | | | = 1 5 UNDER PRESSURE) |
| | · | | | _ |

145_V. RES

```
CALCULATE FRICTION LOSSES(LACFCD):
                             PIPE DIAMETER = 18.00 INCHES
 PIPE FLOW
          =
                  5. 50 CFS
                                  MANNING'S N = 0.01300
 PIPE LENGTH =
                 34.41 FEET
 SF = (Q/K)^{**2} = ((5.50)/(105.046))^{**2} = 0.00274

HF = L^*SF = (34.41)^*(0.00274) = 0.094
      115.00 : HGL = < 186.379>; EGL= < 186.530>; FLOWLINE= < 184.830>
 NODE
********************
 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 = FLOW VELOCITY =
                                PIPE DIAMETER = 18.00 INCHES
                5. 50 CFS
                                VELOCITY HEAD = 0.150 FEET
                3. 11 FEET/SEC.
 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

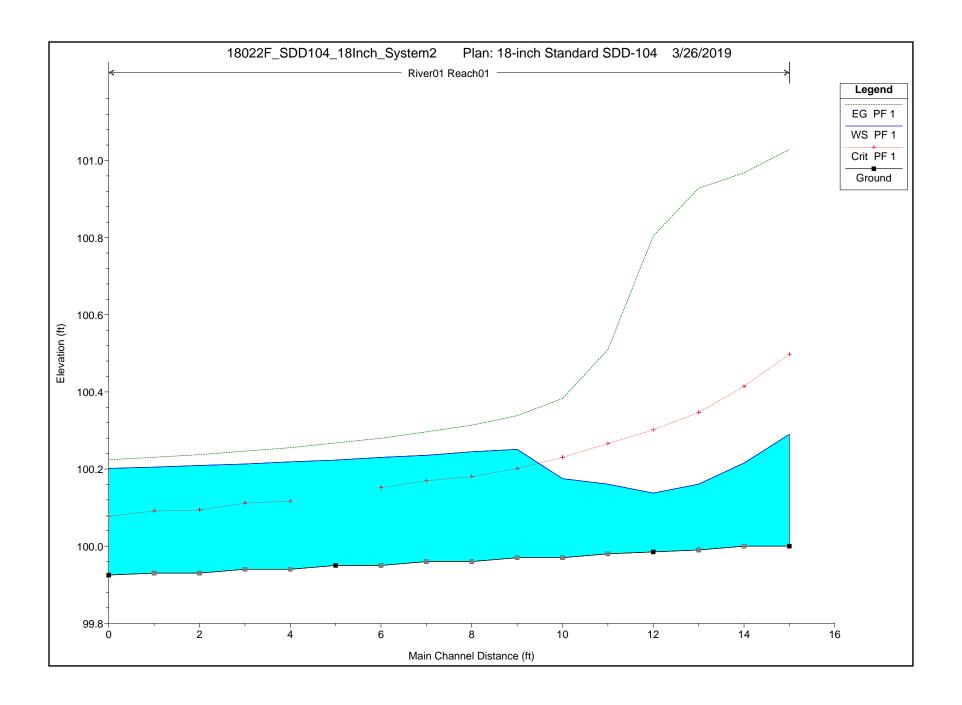
HEC-RAS Plan: 18-inch SDD104 River: River01 Reach: Reach01 Profile: PF 1

| 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 |
| Reach01 | 97 | PF 1 | 3.00 | 99.99 | 100.14 | 100.30 | 100.80 | 0.326543 | 6.55 | 0.46 | 5.42 | 2.96 |
| 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 |
| 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 |
| 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 |

End of Wing Wall Start of No.2 Backing

Hydraulic Jump

End of No.2 Backing



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Analysis prepared by:

RICK ENGINEERING COMPANY 5620 Friars Road San Diego, California 92110 619-291-0707 Fax 619-291-410 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

"*" indicates nodal point data used.)

| | • | UPSTREAM | DOWNSTRÉ | AM RUN | |
|----------|-------------|-----------|-------------------|-----------|-------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 225. 00- | | 0.`66´ Dc | | 0.`49* | ` 41. 07´ |
| } | FRI CTI ON | | | | |
| 220. 00- | | 0.66 Dc | 36. 26 | 0.44* | 45. 00 |
| | JUNCTI ON | | | | |
| 220. 00- | | 0.66 Dc | 36. 26 | 0. 22* | 109. 76 |
| | FRI CTI ON | | | | |
| 215. 00- | | 0.66 Dc | 36. 26 | 0. 25* | 93. 80 |
| | JUNCTI ON | | | | |
| 215. 00- | ED1 071 011 | 0.66 Dc | 36. 26 | 0. 22* | 112. 18 |
| , | FRI CTI ON | 0 ((1) | 0, 0, | 0 ((1) | 0,4 |
| 210.00- | 047011 040 | 0. 66*Dc | 36. 26 | 0.66*Dc | 36. 26 |
| | CATCH BAS | | 10.17 | 0 // 5 | 10.00 |
| 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 = 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

Page 1

225_V. RES

```
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(POUL
0 000 0 443 6 884 1 179
                                                               MOMENTUM (POUNDS)
                                                     1. 179
          Ò. 0Ó0
                          ò. 443
                                                                       45. 00
                                     6. 884
          1. 224
                         0.447
                                     6.794
                                                     1. 164
                                                                       44.58
          2.473
                         0. 451
                                     6. 705
                                                     1. 150
                                                                       44. 19
          3.750
                                                                       43.80
                         0. 455
                                    6. 619
                                                     1. 136
                                   6. 619
6. 534
6. 452
6. 371
6. 292
6. 215
6. 139
          5.057
                         0.460
                                                     1. 123
                                                                       43.43
          6. 397
                         0.464
                                                     1. 110
                                                                       43.07
                                                     1. 099
          7. 774
9. 191
                         0.468
                                                                       42.73
                         0.472
                                                     1.087
                                                                       42.39
                                                     1.077
         10.653
                                                                       42.07
                         0.476
         12. 167
                         0. 481
                                                    1.066
                                                                       41.76
         13.738
                                    6.065
                         0.485
                                                     1.057
                                                                       41.46
         15.374
                         0. 489
                                    5. 993
                                                     1.047
                                                                       41.17
                                     5. 967
         16.000
                         0. 491
                                                     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:
                  FLOW DIAMETER ANGLE FLOWLINE
       PI PE
                                                         CRI TI CAL
                                                                       VELOCITY
                          (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                  (CFS)
                                                           0. 66
                    3. 00
                             18. 00<sup>°</sup>
                                       60. 00 126. 51
     UPSTREAM
                                                                         18. 726
                                               126. 18
0. 00
0. 00
   DOWNSTREAM
                    3.00
                             18.00
                                                              0.66
                                                                          6.887
                                                                          0.000
                    0.00
                                         0.00
                                                              0.00
    LATERAL #1
                              0.00
                            0. 00
0. 00
                                       0.00
   LATERAL #2
                    0.00
                                                              0.00
                                                                          0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       05
 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 DIAMETER = 18.00 INCHES
 PIPE FLOW = 3.00 CFS
 PIPE LENGTH =
                                          MANNING'S N = 0.01300
                     78.00 FEET
                                         Page 2
```

```
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(POUN
                      (FT)
                                                                  MOMENTUM (POUNDS)
                                     15. 929
                                                        4. 188
                           0. 245
           0.000
                                                                            93.80
                                                        4. 237
                                                                           94.38
                           0. 244
                                      16.030
          0.337
                           0. 243
0. 242
                                      16. 132
16. 236
                                                        4.287
                                                                            94.96
           0.691
                                                        4.338
           1.063
                                                                            95.55
                                      16. 340
                           0. 241
                                                        4.390
                                                                            96.15
           1.456
           1.870
                           0. 240
                                      16. 446
                                                   4. 442
4. 496
4. 551
4. 606
4. 663
4. 721
4. 780
4. 840
4. 901
4. 963
5. 026
5. 091
5. 157
5. 224
                                                       4.442
                                                                            96.75
           2. 309
                           0. 239
                                      16. 553
                                                                            97.36
           2.774
                           0. 238
                                      16. 661
                                                                           97.98
                           0. 237
                                      16. 770
                                                                           98.60
           3. 270
           3. 799
                           0. 236
                                      16. 881
                                                                           99. 23
                                     16. 993
17. 106
17. 220
17. 336
           4. 366
                           0. 235
                                                                           99.87
                           0. 233
0. 232
0. 231
           4. 977
                                                                          100.51
           5.638
                                                                           101.17
           6.356
                                                                          101.83
           7. 143
                           0. 230
                                      17. 453
                                                                          102.50
                           0. 229
                                      17. 571
           8.010
                                                                          103.17
          8.976
                           0. 228
                                      17. 691
                                                                          103.86
                          0. 227
          10.062
                                      17. 812
                                                                          104.55
         11. 303
12. 745
                                      17. 935
18. 059
                                                       5. 224
5. 292
5. 362
                           0. 226
                                                                          105. 26
                                                                          105.97
                           0. 225
                           0. 224
0. 223
                                      18. 184
18. 312
          14.463
                                                                           106.69
                                                        5.433
                                                                           107.41
          16. 580
         19. 328
                           0. 222
0. 221
                                      18. 440
                                                        5. 505
                                                                           108.15
                                      18. 440
18. 570
18. 702
18. 720
                                                                          108.90
         23. 229
                                                        5.579
                           0. 220
         29.956
                                                        5. 654
                                                                          109.65
                          0. 219
                                                                          109.76
         78.000
                                                        5.664
  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:
                   FLOW DIAMETER ANGLE FLOWLINE
                                                              CRI TI CAL
                                                                            VELOCITY
                            (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                    (CFS)
                                                                            (FT/SEC)
                      3. 00
     UPSTREAM
                            18. 00
                                          0. 00 157. 27
                                                                 0. 66
                                                                              19. 149
    DOWNSTREAM
                      3.00
                                                    156.94
                               18.00
                                                                 0.66
                                                                              15. 934
                             <u>0</u>. 00
                                                   0.00
    LATERAL #1
                     0.00
                                           0.00
                                                                 0.00
                                                                              0.000
                                         0.00
    LATERAL #2
                      0.00
                                                                 0.00
                                                                              0.000
                               0.00
                                                      0.00
                      O. OO===Q5 EQUALS BASIN INPUT===
       05
  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>
                                           Page 3
```

```
*********************
  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(POUL
0 000 0 658 4 017 0 909 36 26
                                                ENERGY(FT)
0. 909
                                                               MOMENTUM (POUNDS)
                                   4. 017
                          0.658
          0.000
                                                                        36.26
                          0.640
          0.002
                                 4. 170
4. 335
4. 512
4. 703
4. 910
5. 135
5. 379
5. 646
5. 938
6. 258
6. 611
7. 001
7. 434
7. 918
8. 460
9. 072
9. 765
10. 558
                                      4. 170
                                                      0.910
                                                                        36.30
          0.007
                          0.622
                                                      0.914
                                                                        36.45
          0.018
                          0.603
                                                      0.919
                                                                        36.70
          0.033
                          0.585
                                                      0.928
                                                                        37.06
                          0.566
                                                     0.941
                                                                        37.55
          0.054
                          0.548
                                                     0.958
                                                                        38.17
          0.083
                         0.529
                                                    0. 979
          0.120
                                                                        38.93
                         0. 511
                                                     1.006
                                                                        39.86
          0. 167
                                                                        40.96
          0. 226
                         0. 493
                                                     1. 040
          0. 299
                         0.474
                                                     1. 083
                                                                        42.25
                                                      1. 135
          0.390
                         0. 456
                                                                        43.77
                                                      1. 199
1. 278
                          0.437
          0.503
                                                                        45.53
                                                                        47.57
          0.642
                          0. 419
                          0.400
                                                      1.374
                                                                        49.93
          0.815
          1.031
                         0.382
                                                     1. 494
                                                                        52.67
                         0.363
          1. 302
                                                     1. 642
                                                                        55.83
                                 9. 765
10. 558
11. 470
12. 529
                         0.345
                                                     1. 827
                                                                        59.50
          1.646
                      2. 059

2. 352

2. 729

0. 271 13. 769 2. 729

0. 253 15. 238 3. 861

0. 234 17. 000 4. 725

0. 216 19. 143 5. 910

0. 216 19. 143 5. 910

= < 206. 448 - 50
          2. 089
                         0. 327
                                                     2.059
                                                                        63.76
          2.669
                                                                        68.76
          3. 449
                                                                        74.62
          4.533
                                                                        81.57
                                                                        89.88
          6. 125
                                                                        99. 91
          8. 681
         13. 679
                                                                       112.18
         82.030
                                                     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 =
  ASSUMED UPSTREAM CONTROL HGL =
                                     206.45 FOR DOWNSTREAM RUN ANALYSIS
______
```

END OF GRADUALLY VARIED FLOW ANALYSIS $^{225}_\text{V. RES}$

RIP RAP PAD AT NODE 335 SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

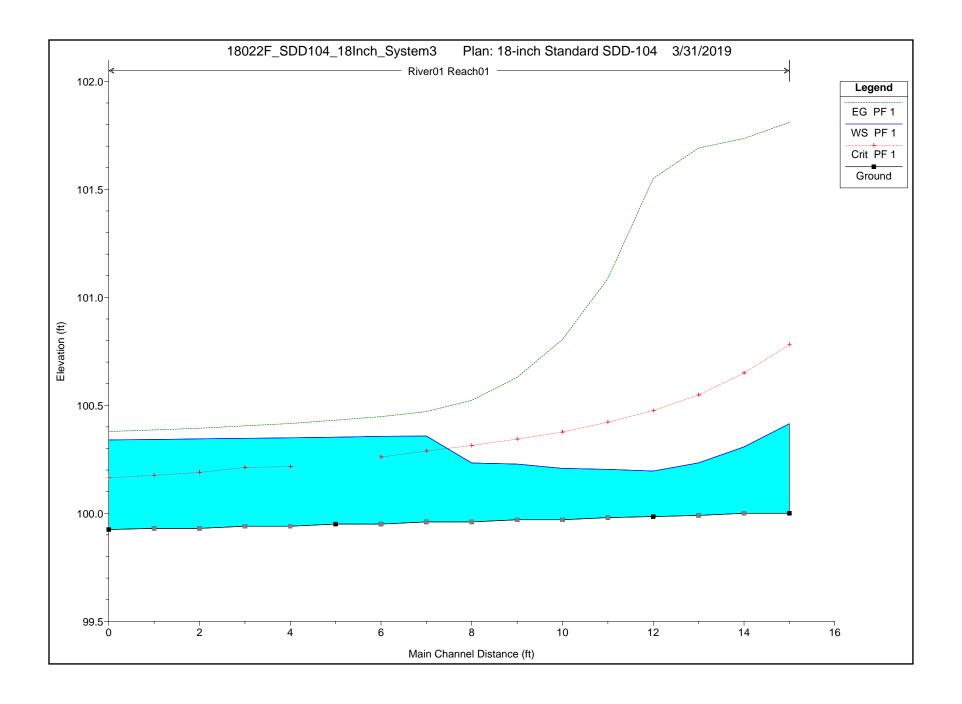
HEC-RAS Plan: 18-inch SDD104 River: River01 Reach: Reach01 Profile: PF 1

| 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 |
| Reach01 | 96.* | PF 1 | 5.90 | 99.98 | 100.20 | 100.42 | 101.09 | 0.260393 | 7.55 | 0.78 | 6.50 | 2.81 |
| 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 |
| 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 |
| 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 |

End of Wing Wall Start of Facing Class

Hydraulic Jump

End of Facing Class



PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (Reference: LACFCD, LACRD, AND OCEMA HYDRAULICS CRITERION)
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Ver. 21.0 Release Date: 06/01/2014 License ID 1261

Analysis prepared by:

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*********** 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

"*" indicates nodal point data used.)

| | • | UPSTREAM | M RUN . | DOWNSTRÉ | AM RUN |
|----------|----------------|----------|-------------------|-----------|-------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 335.00- | | 0. 94 Dc | | 0.`74* | ` 95. 02´ |
| } | FRI CTI ON | | | | |
| 330.00- | | 0.94 Dc | 87. 58 | 0. 59* | 113. 57 |
| } | JUNCTI ON | | | | |
| 330.00- | | 1. 07 | 89. 90 | 0. 31* | 254. 25 |
| } | FRI CTI ON | | | | |
| 320.00- | | 0.94 Dc | 87. 58 | 0. 32* | 246. 31 |
| | JUNCTI ON | 0. 7. 20 | 07.00 | 0.02 | |
| 320.00- | | 0.94 Dc | 87. 58 | 0. 29* | 281. 65 |
| | FRI CTI ON | 0. 7. 20 | 07.00 | 0.27 | 2011.00 |
| 315. 00- | | 0. 94*Dc | 87. 58 | 0. 94*Dc | 87. 58 |
| | | | 07.00 | 0.71 20 | 37.33 |
| | | | 49 55 | 0 94 Dc | 29 54 |
| | CATCH BAS | | 49. 55 | 0. 94 Dc | |

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 = PIPE FLOW = 5.90 CFS PIPE DIAMETER = 18.00 INCHES ASSUMED DOWNSTREAM CONTROL HGL = 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 170. 720 FEET

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 ELE | | 71.16 (FLOW IS | SUPERCRI TI CAL) |
|---|--|--|--|--|
| CALCULATE FRICT PIPE FLOW = PIPE LENGTH = | ION LOSSES(LACF 5.90 CFS 44.00 FEET | CD)· | ETER = 18.00 I NING'S N = 0. | NCHES 01300 |
| NORMAL DEPTH(FT |) = 0.80 | CRI | TICAL DEPTH(FT) | = 0.94 |
| HPSTREAM CONTRO | I ASSUMED FLOWD | FDTH/FT) - | 0.59 | ======================================= |
| CDADIIALI V MADLE | D ELOW DDOELLE | COMPLITED INFO | $\bigcap DMATI \bigcap Ni$ | |
| DI STANCE FROM CONTROL (FT) 0. 000 2. 129 4. 289 6. 483 8. 716 10. 990 13. 311 15. 684 18. 115 20. 611 23. 182 25. 837 28. 591 31. 458 34. 459 37. 620 40. 977 44. 000 | FLOW DEPTH (FT) 0. 595 0. 603 0. 611 0. 620 0. 628 0. 636 0. 645 0. 653 0. 662 0. 670 0. 678 0. 687 0. 687 0. 695 0. 703 0. 712 0. 720 0. 729 0. 736 | VELOCITY (FT/SEC) 9. 046 8. 878 8. 717 8. 560 8. 409 8. 263 8. 121 7. 984 7. 851 7. 723 7. 599 7. 478 7. 361 7. 247 7. 137 7. 030 6. 927 6. 842 | SPECIFIC ENERGY(FT) 1. 866 1. 828 1. 792 1. 758 1. 727 1. 697 1. 670 1. 644 1. 619 1. 597 1. 556 1. 556 1. 537 1. 520 1. 503 1. 488 1. 474 1. 463 | PRESSURE+ MOMENTUM (POUNDS) 113. 57 111. 99 110. 49 109. 06 107. 69 106. 39 105. 15 103. 96 102. 84 101. 76 100. 74 99. 77 98. 85 97. 98 97. 15 96. 36 95. 61 95. 02 |
| NODE 330.00 : | HGL = < 171.7 | 55>; EGL= < | 173. 026>; FLOWLI | NE= < 171. 160> |
| FLOW PROCESS FROUPSTREAM NODE | OM NODE 330.0 330.00 ELE | O TO NODE VATION = 1 | 330.00 IS CODE 71.49 (FLOW IS | ************************************** |
| CALCULATE JUNCT | LON LOSSES: | ER ANGLE S) (DEGREES) 0 60.00 0 - 0 0.00 0 0.00 | FLOWLINE CR ELEVATION DEP 171.49 171.16 0.00 0.00 | ITICAL VELOCITY TH(FT.) (FT/SEC) 0.94 22.050 0.94 9.049 0.00 0.000 0.000 0.000 |
| UPSTREAM: MA | *COS(DELTA1)-Q3 ELTA4))/((A1+A2 NNI NG'S N = 0.0 NNI NG'S N = 0.0 ON SLOPE IN JUN = 4.00 FEET = 0.749 FEET = (DY+HV1-HV2) | *V3*COS(DELTA)*16.1)+FRIC 1300; FRICT 1300; FRICT CTION ASSUME ENTRA +(ENTRANCE LO | A3) - TION LOSSES ION SLOPE = 0.3 ION SLOPE = 0.0 D AS 0.18721 ANCE LOSSES = OSSES) | 2874 |
| NODE 330.00 : | HGL = < 171.8 | 03>; EGL= < | 179. 353>; FLOWLI | NE= < 171. 490> |
| ************************************** | | | 320.00 IS CODE | ************************************** |

| 335_V. RES |
|--|
| 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 |
| 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. 452 247. 28 2. 571 0. 319 21. 455 7. 452 247. 28 2. 571 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. 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. 685 7. 604 249. 88 9. 703 0. 317 21. 685 7. 623 250. 20 10. 901 0. 317 21. 685 7. 623 250. 20 10. 901 0. 317 21. 685 7. 623 250. 20 10. 901 0. 317 21. 685 7. 623 250. 20 10. 901 0. 316 21. 743 7. 681 251. 19 15. 215 0. 316 21. 773 7. 681 251. 19 15. 215 0. 316 21. 773 7. 681 251. 19 15. 215 0. 316 21. 773 7. 681 251. 19 15. 215 0. 316 21. 802 7. 701 251. 53 16. 986 0. 315 21. 802 7. 721 251. 86 18. 997 0. 315 21. 801 7. 741 252. 19 21. 321 0. 315 21. 801 7. 741 252. 19 21. 321 0. 315 21. 801 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 86 27. 448 0. 314 21. 920 7. 780 252. 85 24. 074 0. 315 21. 802. 00 7. 801 253. 20 31. 803 0. 314 21. 980 7. 800 253. 20 31. 803 0. 314 21. 980 7. 800 253. 20 31. 803 0. 314 21. 980 7. 800 253. 20 31. 803 0. 314 21. 980 7. 800 253. 20 31. 803 0. 314 21. 980 7. 800 253. 20 31. 803 0. 314 21. 980 7. 861 254. 21 110. 000 0. 313 22. 040 7. 861 254. 21 110. 000 0. 313 22. 040 7. 861 254. 21 |
| 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 (CES) (INCHES) (DEGREES) FLEVATION DEPTH(ET.) (FL/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 LATERAL #2 0. 00 0. 00 0. 00 0. 00 0. 00 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 Page 3 |

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335 V. RES
 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
      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
                                            SPECI FI C
                                                      PRESSURE+
                                             ENERGY(FT)
  CONTROL(FT)
                     (FT)
                                (FT/SEC)
                                                           MOMENTUM (POUNDS)
                        ò. 938
                                                  1. 338
1. 339
                                                                   87.58
         0.000
                                   5.075
         0.002
                        0. 911
                                   5. 251
                                                                   87.69
                                                                   88.03
                        0.884
                                   5.442
         0.010
                                                  1.344
                                  5. 649
                                                  1.353
                                                                   88.62
                        0.857
         0.024
                                  5.873
         0.045
                        0.831
                                                 1. 367
                                                                   89.47
                        0.804
         0.074
                                  6. 117
                                                  1. 385
                                                                   90.61
                                  6. 383
                        0.777
                                                  1.410
                                                                   92.07
         0. 112
                                 6. 673
                        0. 750
0. 723
                                                  1.442
                                                                   93.88
         0. 162
                                  6. 991
7. 340
                                                                   96.07
         0. 226
                                                  1.483
                        0.697
                                                  1.534
         0.306
                                                                   98.69
                                 7. 725
                                                  1. 597
         0.406
                        0.670
                                                                  101.78
                                 8. 151
                        0.643
         0.530
                                                 1. 675
                                                                  105.40
                                 8. 623
9. 150
9. 741
                                                 1. 772
         0.683
                        0. 616
                                                                  109.63
                                                 1.890
         0.873
                        0.589
                                                                  114.55
                        0.563
                                                 2.037
         1. 110
                                                                  120.26
                               9. 741
10. 407
11. 161
                                                 2. 219
                                                                  126.90
          1.406
                        0. 536
                                  11. 161
12. 021
          1. 780
                        0.509
                                                  2.444
                                                                  134.61
                                                  2. 727
                        0.482
                                                                  143.59
          2. 256
                        0.455
                                  13. 008
                                                  3.085
                                                                  154.10
          2.871
                                  14. 152
         3.681
                        0.429
                                                 3.541
                                                                  166.45
                                                 4. 129
         4.775
                        0.402
                                  15. 489
                                                                  181.07
         6.306
                        0.375
                                  17. 067
                                                 4. 901
                                                                  198.51
                                  18. 952
                        0.348
                                                 5. 929
                                                                  219.53
         8. 568
                       0. 321
0. 295
                                 21. 236
24. 047
                                                 7. 329
9. 280
         12. 227
                                                                  245.16
        19.445
                                                                  276.87
                                             9. 595
        80.000
                        0. 291
                                  24. 470
                                                                  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 DIAMETER = 18.00 INCHES
. VELOCITY HEAD = 0.400 FEET
 PIPE FLOW = 5.90 CFS
FLOW VELOCITY = 5.08 FEET/SEC.
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.400) = 0.080
        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 $^{\circ}$

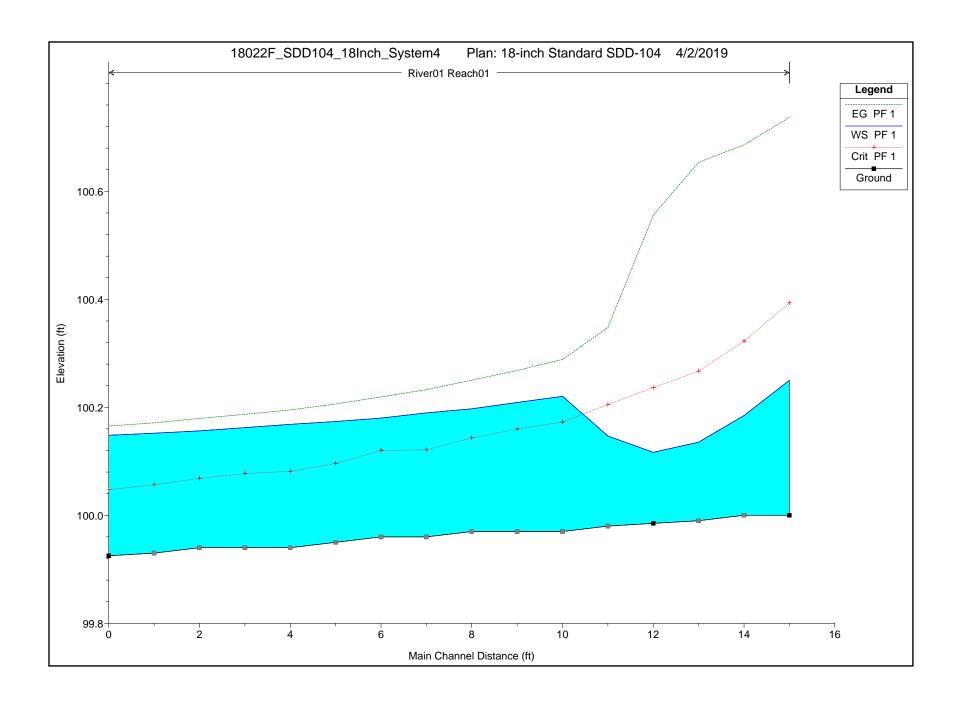
RIP RAP PAD AT NODE 430 SYSTEM 4 MAPLE CAYON RESTORATION PHASE 1

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 |
| Reach01 | 96.* | PF 1 | 2.10 | 99.98 | 100.15 | 100.21 | 100.35 | 0.087228 | 3.60 | 0.58 | 5.98 | 1.55 |
| Reach01 | 95.* | PF 1 | 2.10 | 99.97 | 100.22 | 100.17 | 100.29 | 0.017295 | 2.10 | 1.00 | 6.91 | 0.74 |
| 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 |
| 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 |

End of Wing Wall Start of No.2 Backing Hydraulic Jump

End of No.2 Backing



PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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 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

"*" indicates nodal point data used.)

| | | M RUN . | DOWNSTRÉ | AM RUN |
|----------------------|---------|-----------|----------|-------------------|
| | | PRESSURE+ | | |
| | | | | MOMENTUM (POUNDS) |
| | | 22. 94 | 0. 45* | 24. 32 |
| } FRICTIO | | 00.04 | 0 40# | 0/ 54 |
| 425. 00- | | 22. 94 | 0. 40* | 26. 51 |
| } JUNCTIO | | 22.04 | 0 10* | /F 00 |
| 425.00- } FRICTIO | | 22. 94 | 0. 19* | 65. 98 |
| 420. 00- | 0.55 Dc | 22. 94 | 0. 20* | 60. 21 |
| 420.00- } JUNCTIO | | 22. 74 | 0. 20 | 00. 21 |
| 420. 00- | | 22. 94 | 0. 17* | 76. 04 |
| } FRICTIO | | 22. 71 | 0.17 | 70.01 |
| 415. 00- | | 22. 94 | 0. 19* | 66. 49 |
| } JUNCTIO | | | | |
| 415. 00- | 0.55 Dc | 22. 94 | 0. 15* | 95. 12 |
| } FRICTIO | | | | |
| 410. 00- | | 22. 94 | 0. 55*Dc | 22. 94 |
| } CATCH B | | 10.00 | 0 == 0 | |
| 410. 00- | 0. 79* | 12. 23 | 0.55 Do | 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 PIPE FLOW = 2.10 FLOWLINE ELEVATION = PIPE DIAMETER = 18.00 INCHES 195.370 FEET

PIPE FLOW = 2.10 CFS ASSUMED DOWNSTREAM CONTROL HGL =

*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

430.00 : HGL = < 195.820>; EGL= < 196.164>; FLOWLINE = < 195.370> NODE ***************** 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) = 0.55UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.40 ______ GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION: DISTANCE FROM FLOW DEPTH VELOCITY SPECIFIC PRESSURE+ (FT/SEC) ENERGY(FT) MOMENTUM (POUNDS) CONTROL(FT) (FT) 0.000 0.399 5. 562 0.880 26. 51 0.808 0.402 5.519 0.875 26.38 0.404 5.477 0.870 1.637 26.26 2.488 0.406 5.435 0.865 26.15 3. 365 5. 393 0.408 26.03 0.860 4. 269 0.410 5. 353 25.92 0.856 0.413 5. 204 5. 312 0.851 25.81 0.847 6. 172 0. 415 5. 273 25.70 5. 233 25.60 7. 178 0. 417 0.843 0. 419 25.50 8. 226 9. 322 5. 195 0.839 0.422 5. 157 0.835 25.40 5. 119 10.471 0.424 25.30 0.831 5. 082 25.21 11.683 0. 426 0.827 12. 968 14. 337 0. 428 5.045 0.824 25.12 0.430 5.009 0.820 25.03 0.433 4. 973 24.94 15.807 0.817 17.400 0. 435 4. 938 0.814 24.85 4. 903 19.144 0.437 0. 811 24.77 0. 437 4. 903 0. 439 4. 869 0. 442 4. 835 0. 444 4. 801 0. 446 4. 768 0. 448 4. 735 0. 450 4. 703 0. 450 4. 702 0.808 21. 080 24.69 0.805 23. 268 24.61 25.800 0.802 24.54 0. 799 24.46 28.831 0. 797 24.39 32.649 0.794 37. 907 24.32 38.000 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: FLOW DI AMETER ANGLE FLOWLI NE CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION (CFS) DEPTH(FT.) (FT/SEC) 2. 10 18. 00[°] 60. 00[°] 196. 08 UPSTREAM 0. 55 16.057 DOWNSTREAM 2.10 195. 75 18.00 0.55 5. 564 LATERAL #1 0.00 0.00 0.00 0.00 0.000 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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 REAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.33515 UPSTREAM: Page 2

```
DOWNSTREAM: MANNING'S N = 0.01300; 430_{\text{L}}V. RES FRICTION SLOPE = 0.01662
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.17588
 JUNCTION LENGTH = 4.00 FEET ENTRANCE LOSSES | 0.704 FEET ENTRANCE LOSSES | JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) JUNCTION LOSSES = (3.644)+(0.000) = 3.644
                                           ENTRANCE LOSSES = 0.000 FEET
 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(POUN
                                    (FT/SEC)
                      (FT)
                                                  ENERGY(FT)
                                                                  MOMENTUM (POUNDS)
  CONTROL(FT)
                           0. 204
                                      14. 609
                                                        3.520
                                                                           60. 21
          0.000
                           0. 203
          0.304
                                      14. 664
                                                        3.544
                                                                           60.43
                           0. 202
          0. 622
                                      14. 720
                                                        3.569
                                                                           60.65
          0.956
                           0. 202
                                      14. 777
                                                        3.595
                                                                           60.88
                           0. 201
                                      14.834
                                                        3.620
           1.307
                                                                           61.11
                           0. 201
                                      14.891
           1.676
                                                        3.646
                                                                           61.33
                                                    3. 646
3. 672
3. 679
3. 725
3. 752
3. 780
3. 807
3. 835
3. 863
3. 920
3. 950
3. 979
4. 009
4. 039
4. 069
4. 100
4. 131
4. 162
                           0.200
                                      14. 948
                                                                           61.56
           2.066
                                      15.006
                           0.200
                                                                           61.79
           2. 478
                          0. 199
                                      15.064
           2. 916
                                                                           62.03
                                     15. 123
15. 182
15. 241
                          0. 199
           3. 382
                                                                           62.26
           3. 881
                          0. 198
                                                                           62.50
                                     15. 241
15. 301
15. 362
15. 422
                          0. 198
           4. 416
                                                                           62.73
          4. 992
                          0. 197
                                                                           62.97
          5. 618
                          0. 197
                                                                           63.21
                           0. 196
          6.300
                                                                           63.46
          7. 051
                           0. 196
                                      15. 483
                                                                           63.70
                          0. 195
          7.884
                                      15. 545
                                                                           63.95
          8.818
                          0. 195
                                      15. 607
                                                                           64. 19
          9.882
                          0. 194
                                      15. 669
                                                                           64.44
                          0. 193
                                      15. 732
                                                                           64.69
         11. 116
                                      15. 795
15. 858
15. 922
15. 987
                          0. 193
         12.580
                                                                           64.95
                           0. 192
         14.379
                                                                           65.20
         16.709
                           0. 192
                                                                           65.46
                           0. 191
         20.005
                                                                           65.71
                                  16. 052 4. 194
16. 052 4. 194
                          0. 191
                                                                           65.97
         25. 673
         29. 000 0. 191
                                                                          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:
       PI PE
                 FLOW DIAMETER
                                        ANGLE
                                                  FLOWLI NE
                                                              CRI TI CAL
                                                                           VELOCITY
                            (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                    (CFS)
     UPSTREAM
                    2. 10
                                                    206. 24
                              18. 00 0. 00
                                                                 0. 55 18. 563
                                                    205.91
                                                                 0.55
    DOWNSTREAM
                     2. 10
                              18.00
                                                                              14.613
                                           Page 3
```

```
430 V. RES
                 LATERAL #1
                                           0.00
                                                                                0.000
    LATERAL #2
                                                                               0.000
                                           0.00
                      O. OO===Q5 EQUALS BASIN INPUT===
       05
  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 LOSSE
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (2.334)+(0.000) = 2.334
                                         ENTRANCE LOSSES = 0.000 FEET
  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(POUN
   CONTROL(FT)
                                     (FT/SEC)
                                                   ENERGY(FT)
                                                                   MOMENTUM (POUNDS)
                            (FT)
                                      16. 180
                           0.190
                                                        4. 258
                                                                            66. 49
           0.000
           0.258
                           0.189
                                       16. 268
                                                         4.301
                                                                            66.84
           0.529
                           0.188
                                                        4. 346
                                                                            67.20
                                      16. 357
                           0. 188
                                                         4.391
                                      16. 447
                                                                            67.56
           0.813
                                                    4. 436
4. 483
4. 530
4. 578
4. 626
4. 676
4. 726
4. 776
4. 828
4. 881
4. 988
5. 043
5. 049
5. 156
                                                        4. 436
                                                                            67. 92
68. 29
                                      16. 538
           1. 112
                           0. 187
           1. 428
                           0. 186
                                       16. 629
           1.762
                           0. 186
                                       16. 721
                                                                            68.66
           2. 115
                           0. 185
                                      16.814
                                                                            69.03
                           0. 184
                                      16. 908
                                                                            69.41
           2. 491
           2.893
                           0. 183
                                      17.003
                                                                            69.79
           3. 322
                           0. 183
                                      17. 099
                                                                            70. 17
                                      17. 196
17. 294
17. 392
17. 492
17. 592
                           0. 182
                                                                            70.56
           3. 784
                           0. 181
                                                                            70.95
           4. 283
           4.825
                           0. 181
                                                                            71.35
           5. 418
                           0.180
                                                                            71.75
                           0.179
                                                                            72.16
           6.070
           6. 796
                           0.178
                                       17.694
                                                                            72.56
                                       17. 797
           7.612
                           0.178
                                                                            72.98
                                                      5. 156
5. 213
           8.542
                           0. 177
                                       17. 900
                                                                            73.39
                                      18.005
           9.623
                           0. 176
                                                                            73.81
          10.907
                           0. 176
                                      18. 111
                                                        5. 272
                                                                            74. 24
                                      18. 217
18. 325
          12.489
                                                        5. 331
5. 392
                                                                            74.67
                           0. 175
          14.540
                           0. 174
                                                                            75.10
                                     18. 434
18. 544
18. 558
                                       18. 434
          17.447
                           0.174
                                                         5.453
                                                                            75.54
                                                         5.516
                                                                            75.98
          22. 455
                           0.173
          55.000
                           0. 173
                                                        5. 524
                                                                            76.04
         415.00 : HGL = < 234.740>; EGL= < 238.808>; FLOWLINE= < 234.550>
  NODE
```

Page 4

| | | 430_V. F | RES. | | |
|---|---|--|---|---|--|
| FLOW PROCESS FROM UPSTREAM NODE 47 | NODE 415.0 15.00 ELE | O TO NODE VATION = 2 | 415.00 IS CODE 34.88 (FLOW I | = 5 S SUPERCRI | TICAL) |
| | LOW DIAMET | <pre>S) (DEGREES)</pre> | FLEVATION DE | RI TI CAL PTH (FT.) 0. 55 0. 55 0. 00 0. 00 | VELOCITY (FT/SEC) 23. 290 16. 185 0. 000 0. 000 |
| LACFCD AND OCEMA I DY=(Q2*V2-Q1*V1*C0 Q4*V4*COS(DELTOS) UPSTREAM: MANNI DOWNSTREAM: MANNI AVERAGED FRICTION JUNCTION LENGTH = FRICTION LOSSES = JUNCTION LOSSES = | OS(DELTA1) - Q3 (A4))/((A1+A2) NG'S N = 0.0 NG'S N = 0.0 SLOPE IN JUN 4.00 FEET 2.627 FEET (DY+HV1-HV2) | *V3*COS(DELT)*16.1)+FRIC 1300; FRICT 1300; FRICT CTION ASSUME ENTR +(ENTRANCE L | A3) - TION LOSSES ION SLOPE = 0. ION SLOPE = 0. D AS 0.65667 ANCE LOSSES = OSSES) | 34285 | ΞΤ |
| NODE 415.00 : HO | GL = < 235.0 | 28>; EGL= < | 243. 451>; FLOWL | I NE= < 23 | 34. 880> |
| ************************************** | | | | | |
| CALCULATE FRICTION PIPE FLOW = PIPE LENGTH = | 2. 10 CFS 25. 23 FEET | PIPE DIAM MAN | ETER = 18.00 NING'S N = 0 | I NCHES . 01300 | |
| NORMAL DEPTH(FT) = | = 0. 15 | CRI | TICAL DEPTH(FT |) = (| D. 55 |
| UPSTREAM CONTROL A | ASSUMED FLOWD | EPTH(FT) = | 0. 55 | | |
| GRADUALLY VARIED I | | | | ======= | ======= |
| DI STANCE FROM CONTROL (FT) 0.000 0.001 0.004 0.010 0.018 0.030 0.046 0.067 0.094 0.128 0.170 0.222 0.288 0.370 0.472 0.601 0.764 0.974 1.247 1.610 2.105 2.803 | FLOW DEPTH (FT) 0. 547 0. 531 0. 515 0. 499 0. 483 0. 467 0. 451 0. 435 0. 419 0. 403 0. 387 0. 371 0. 355 0. 339 0. 323 0. 308 0. 292 0. 276 0. 260 0. 244 0. 228 0. 212 | VELOCITY (FT/SEC) 3. 603 3. 751 3. 911 4. 083 4. 269 4. 472 4. 692 4. 933 5. 197 5. 487 5. 807 6. 161 6. 556 6. 997 7. 493 8. 053 8. 691 9. 422 10. 266 11. 250 12. 409 13. 788 Page | ENERGY (FT) 0. 749 0. 750 0. 753 0. 758 0. 766 0. 778 0. 813 0. 839 0. 871 0. 911 1. 023 1. 100 1. 196 1. 315 1. 465 1. 655 1. 897 2. 210 2. 620 3. 166 | PRESS | SURE+ M(POUNDS) 22. 94 22. 97 23. 07 23. 25 23. 51 23. 86 24. 30 24. 84 25. 50 26. 29 27. 22 28. 32 29. 59 31. 08 32. 81 34. 82 37. 17 39. 92 43. 14 46. 95 51. 49 56. 94 |

| 3. 844 5. 544 8. 931 25. 230 | 0. 196 0. 180 0. 164 0. 148 | 17. 492 20. 037 | S 3. 906 4. 934 6. 402 8. 571 | 63. 58 71. 75 82. 00 95. 12 |
|--|--------------------------------------|---------------------------|---|--------------------------------------|
| NODE 410.00 : HGL | = < 259.90 |)7>; EGL= < 26 | 60. 109>; FLOWLI NE= | < 259. 360> |
| ************************************** | DE 410. OC | TO NODE 41 | | 8 |
| | 10 CFS 60 FEET/SEC | PI PE DI A C. VELOCITY | ÁMETER = 18.00 I ' HEAD = 0.202 F | EET |
| NODE 410.00 : HGL | = < 260.14 | 19>; EGL= < 26 | 60. 149>; FLOWLI NE= | < 259. 360> |
| ************************************** | ONTROL DATA | A: FLOWLINE E | ELEVATION = 259 | . 36 |
| END OF GRADUALLY VAR | ======= IED FLOW AN | IALYSI S | .======== | ========= |

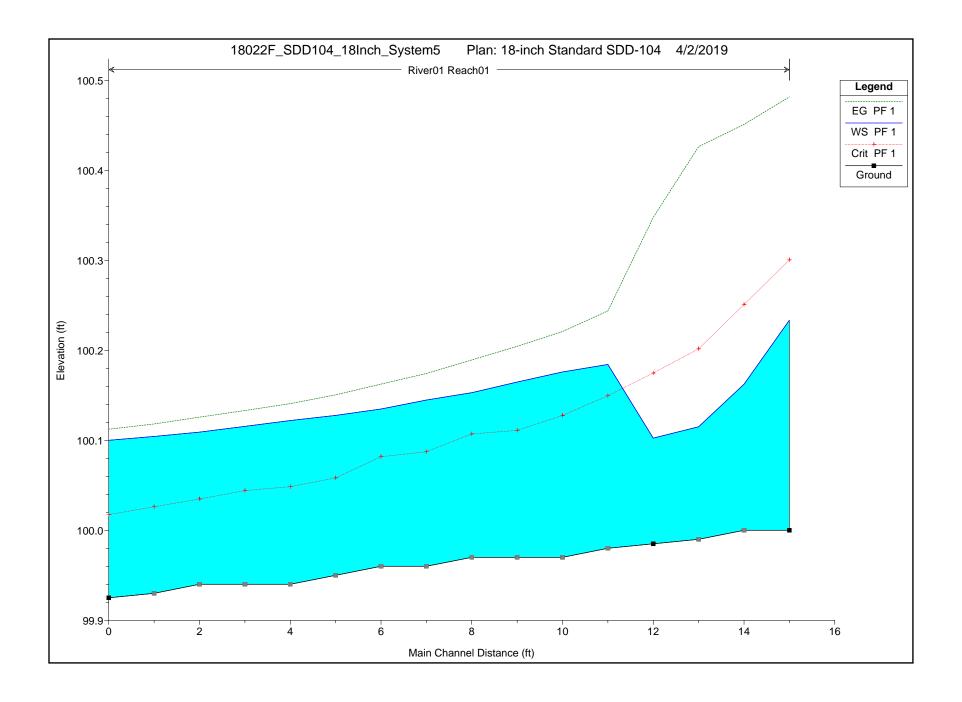
RIP RAP PAD AT NODE 525 SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

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 |
| Reach01 | 98.* | PF 1 | 1.40 | 99.99 | 100.12 | 100.20 | 100.43 | 0.024520 | 4.48 | 0.31 | 4.75 | 2.23 |
| 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 |
| 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 |
| 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 |

End of Wing Wall
Start of No.2
Backing
Hydraulic Jump

End of No.2 Backing



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 619-291-410 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

"*" indicates nodal point data used.)

| | - | UPSTREAM | M RUN | DOWNSTRE | |
|----------|------------|----------|-------------------|-----------|-------------------|
| 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 |
| } | FRI CTI ON | | | | |
| 520.00- | | 0. 44*Dc | 13. 68 | 0. 44*Dc | 13. 68 |
| } | JUNCTI ON | | | | |
| 520.00- | | 0.44 Dc | 13. 68 | 0. 15* | 42. 25 |
| } | FRI CTI ON | | | | |
| 515.00- | | 0.44 Dc | 13. 68 | 0. 31* | 16. 37 |
| } | JUNCTI ON | | | | |
| 515.00- | | 0.44 Dc | 13. 68 | 0. 37* | 14. 32 |
| } | FRI CTI ON | | | | |
| 510.00- | | 0. 44*Dc | 13. 68 | 0. 44*Dc | 13. 68 |
| } | CATCH BAS | SIN | | | |
| 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 =
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 Page 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(POUL
0 000 0 442 3 217 0 603 MOMENTUM (POUNDS) Ò. 0Ó0 0. 442 3. 217 0. 603 13.68 3. 246 0.014 0.439 0.603 13.68 0.044 0.436 3. 276 0.603 13.68 0.092 0.433 0.603 3. 307 13.69 3. 338 3. 369 3. 401 3. 434 3. 467 3. 501 0.604 0. 159 0. 431 13.70 0. 247 0.428 13.71 0.604 0.359 0.425 0.605 13.72 0.497 0. 422 0.605 13.73 13.75 0.606 0.664 0. 419 0. 416 3. 501 0.607 13.77 0.864 0. 413 0.607 1. 100 3. 535 13.79 1. 379 0.608 0.410 3.570 13.82 0.407 3.605 0.609 1.706 13.84 0.405 0. 611 2. 089 3.642 13.87 3. 678 3. 716 3. 754 2. 538 0.402 0. 612 13.90 0. 399 0.613 13.93 3.066 0.396 13.97 3.690 3. 754 3. 793 3. 832 3. 873 3. 914 3. 955 0. 615 0.393 14.01 4.431 0.616 5. 322 0.390 0. 618 14.05 0. 387 14.09 6.410 0.620 7.765 0.384 0.622 14.14 9.510 0. 381 14. 19 0. 625 3. 998 0.379 0.627 14.24 11.869 4. 000 12.000 0. 378 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: DIAMETER ANGLE FLOWLINE (INCHES) (DEGREES) ELEVATION PI PE FLOW CRI TI CAL **VELOCITY** DEPTH(FT.) (CFS) (FT/SEC) 1.40 60. 00[°] 213.48 15. 449 UPSTREAM 18.00 0. 44 213. 15 DOWNSTREAM 1.40 18.00 0.44 3. 205 0.00 0.00 0.00 0.00 0.000 LATERAL #1 0.00 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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 ENTRANCE LOSSES = 0.000 FEET FRICTION LOSSES = 0.860 FEET Page 2

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) JUNCTION LOSSES = (3.582)+(0.000) = 3.582 520.00 : 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+ (FT) (FT/SEC) ENERGY(FT) CONTROL(FT) MOMENTUM (POUNDS) 0.`741 0. 761 0.000 0. 312 5. 250 16. 37 0. 306 0.046 5. 416 16.71 0. 299 0.097 5.590 0. 785 17.08 0. 292 0.154 5. 775 0.810 17.47 0. 286 0.219 5. 971 0.839 17.90 18.37 0. 292 0. 279 6. 178 0.872 6. 398 0. 908 0.374 0. 272 18.87 6. 632 0. 265 0.949 19.42 0.467 0. 259 0. 252 6. 881 7. 147 0. 994 20.01 0.572 0.691 1.046 20.65 7. 431 0. 245 1. 103 0.827 21.34 7. 431 7. 735 8. 060 0.982 0. 239 1. 168 22.08 1. 241 0. 232 22.89 1. 160 8. 411 8. 788 9. 195 9. 636 23.77 0. 225 1. 324 1. 366 0. 218 1. 418 24.73 1.604 1. 526 0. 212 25.77 1.883 2. 213 0. 205 10. 114 10. 634 1. 648 26.90 1. 648 1. 788 1. 949 2. 134 2. 350 2. 601 2. 895 3. 242 2.606 0. 198 28.14 0. 192 29.50 3.083 0. 185 11. 201 30.98 3.670 11. 822 4. 412 0. 178 32.62 5.382 0. 172 12. 505 34.42 6.718 0. 165 13. 257 36.42 14. 089 8. 728 0. 158 3. 242 38. 63 15. 014 3. 654 15. 444 3. 855 12. 410 0. 151 100. 750 0. 148 41.10 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: FLOW DIAMETER ANGLE FLOWLI NE CRI TI CAL PI PE **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 1. 40 1. 40 UPSTREAM 35. 00[°] 18.00 261.60 0. 44 4. 063 DOWNSTREAM 261. 27 0.44 18.00 5.252 LATERAL #1 0.000 0.00 LATERAL #2 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== **Q5**

```
525 V. RES
  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
         515.00 : HGL = < 261.974>; EGL= < 262.231>; FLOWLINE= < 261.600>
 NODE
 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(POUN
                                                                MOMENTUM (POUNDS)
          0.000
                          0. 443
                                      3. 204
                                                      0.603
                                                                        13.68
                                      3. 233
          0.008
                          0.440
                                                      0.603
                                                                         13.68
                          0.438
                                      3. 263
          0.031
                                                      0.603
                                                                        13.68
                                      3. 293
          0.072
                          0. 435
                                                      0.603
                                                                        13.69
                                   3. 324
3. 355
3. 386
3. 418
3. 451
3. 484
3. 518
3. 552
3. 587
3. 623
3. 659
3. 696
3. 733
3. 772
3. 810
                                     3. 324
          0.132
                         0.432
                                                      0.604
                                                                        13.69
                                                                        13.70
                         0.429
                                                      0.604
          0. 213
                         0. 426
                                                     0.604
          0. 317
                                                                        13. 71
                                                   0. 605
0. 605
0. 606
0. 607
                         0. 423
          0.447
                                                                        13.73
                         0.420
          0.606
                                                                        13.74
                         0. 418
          0.797
                                                                        13.76
                                                                         13.78
          1.025
                         0. 415
          1. 294
                          0.412
                                                     0.608
                                                                         13.80
          1.610
                         0.409
                                                     0.609
                                                                        13.83
          1. 983
                         0. 406
                                                     0. 610
                                                                        13.85
          2. 420
                         0.403
                                                     0. 611
                                                                        13.88
          2. 936
                         0.400
                                                                        13. 92
                                                     0. 613
                          0. 397
                                                                        13.95
          3.545
                                                     0.614
                          0.395
                                                      0.616
                                                                         13.99
          4. 271
                          0. 392
          5. 145
                                     3. 810
3. 850
                                                      0. 617
                                                                         14.03
                          0.389
                                                                        14.07
          6. 213
                                                      0. 619
                                   3. 850
3. 890
3. 931
3. 973
4. 016
                          0. 386
          7.546
                                                                         14.11
                                                      0. 621
          9. 263
                          0.383
                                                     0.623
                                                                        14. 16
                          0.380
                                                                        14. 21
         11. 587
                                                      0. 625
         15.021
                          0.377
                                                      0.628
                                                                        14. 26
                                 4. 060
4. 062
         21. 174
                          0. 374
                                                      0.631
                                                                        14.32
         37.690
                         0.374
                                                     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):



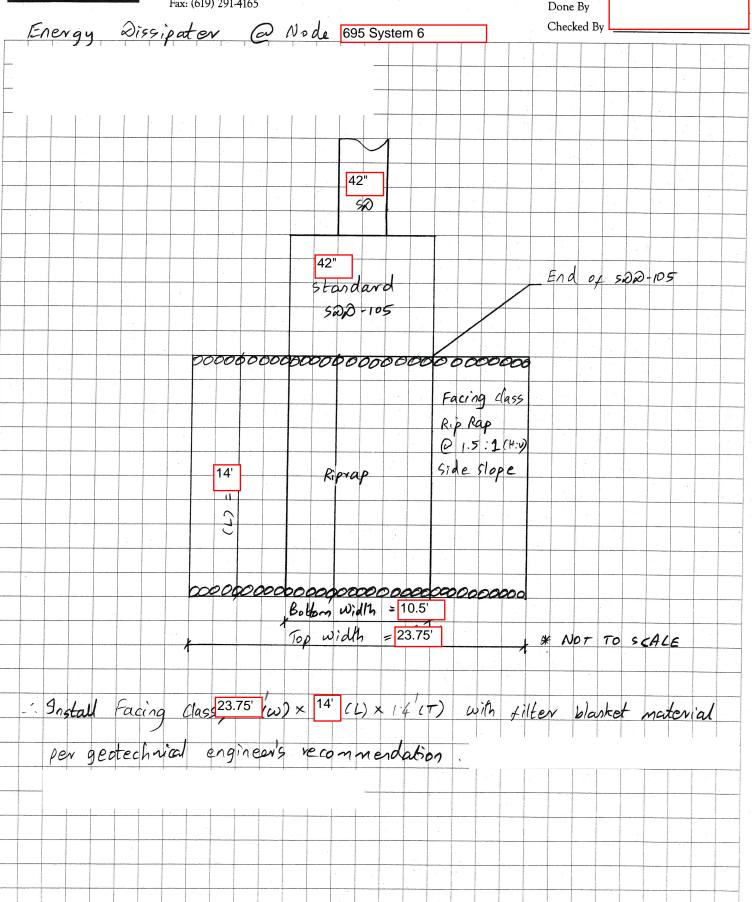
5620 Friars Road San Diego, CA 92110-2596

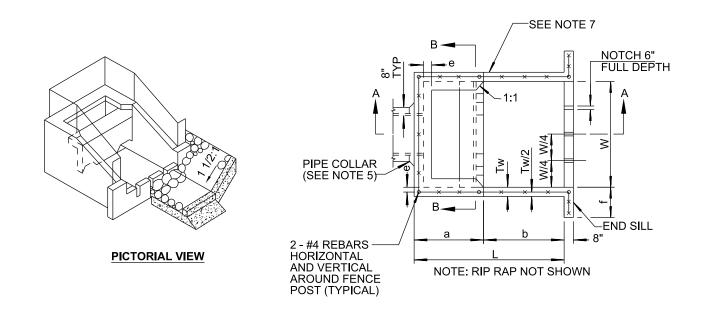
Tel: (619) 291-0707 Fax: (619) 291-4165 Date

Job No.

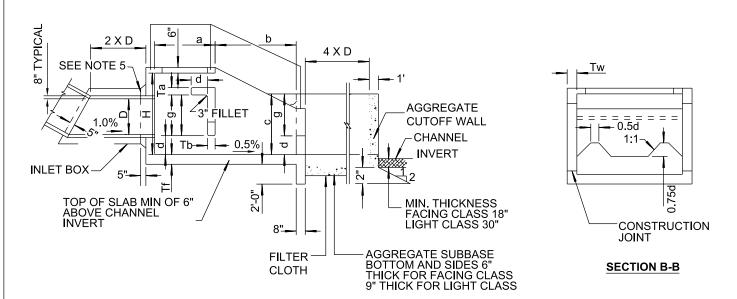
Page

04/02/2019 18022-F





PLAN



SECTION A-A

NOTES

SEE TABLE ON SHEET 2 FOR DIMENSIONS, SEE NOTES ON SHEET 2.

SHEET 1 OF 2

| UPDATED | BD | J. NAGELVOORT J. NAGELVOORT | 08/15 | CITY OF SAN DIEGO – STANDARD DRAWING | | TUNGER 9/10/18 | | |
|-----------|----|-----------------------------|-------|--------------------------------------|-------------------------------|----------------|--|--|
| UPDATED | AB | J. NAGELVOORT | 02/16 | CONCRETE ENERGY DISSIPATOR | COORDINATOR R.C.E. 56523 DATE | | | |
| REDRAFTED | CD | J. NAGELVOORT | 09/18 | JOHORETE ENERGY DIOON ATOR | | | | |
| | | | | | DRAWING | SDD-105 | | |
| | | | | | NUMBER | 3DD-103 | | |

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" |
| Н | 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" |
| а | 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" |
| С | 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" |
| е | 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' | 1 | |
| Tw | 7" | | | 9 1/2" 10 1/2" | | | | | |
| Та | | 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.
- 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 | CITY OF SAN DIEGO - STANDARD DRAWING | RECOMMENDED BY THE CITY OF SAN DIEGO STANDARDS COMMITTEE |
|-----------|----|---------------|-------|--------------------------------------|--|
| ORIGINAL* | KA | J. NAGELVOORT | 01/12 | OFFI OF ONLY BIEGO OFFICE BILLIAN | OF ONLY BIEGO OF WIND COMMITTEE |
| UPDATED | BD | J. NAGELVOORT | 08/15 | | Charge 9/10/18 |
| UPDATED | AB | J. NAGELVOORT | 02/16 | | COORDINATOR R.C.E. 56523 DATE |
| REDRAFTED | CD | J. NAGELVOORT | 09/18 | CONCRETE ENERGY DISSIPATOR | OGGNERATOR V N.O.E. 30323 DATE |
| | | | | | DRAWING SDD-105 |
| | | | | | NUMBER SBB-100 |

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, Design Discharge, Q_{design} 115 cfs From SDD-105 Standard Detail 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

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)
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Analysis prepared by:

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******* 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 | <i>I</i> I RUN | DOWNSTREA | AM RUN |
|----------------------|------------|----------|------------------------------|-----------|-------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 695.00- | | 2.31 Dc | MOMENTUM (POUNDS) 1285.72 | 0. 78* | 3628. 24 |
| } | FRI CTI ON | | | | |
| 690.00- | | 2.31 Dc | 1285. 72 | 0.74* | 3933. 09 |
| } | JUNCTI ON | | | | |
| | | 2.32 Dc | 1285. 72 | 0. 72* | 4106. 40 |
| } | FRI CTI ON | | | | |
| | | 2. 31*Dc | 1285. 72 | 2. 31*Dc | 1285. 72 |
| } | JUNCTI ON | | | | |
| | | 3. 11* | 1139. 11 | 1. 74 | 910. 27 |
| } | FRI CTI ON | | | | |
| 680.00- | | 2. 73* | 991. 82 | 2.05 Dc | 877. 18 |
| | JUNCTI ON | | | | |
| | | 3. 44* | 1249. 45 | 1. 67 | 870. 12 |
| } | FRI CTI ON | | | | |
| | | 2. 92* | 1021. 30 | 2.00 Dc | 829. 90 |
| } | JUNCTI ON | | | | |
| 675. 00 ⁻ | | 3. 56* | 978. 26 | 1. 06 | 274. 77 |
| } | FRI CTI ON | | | | |
| | | 3. 33* | 874. 31 | 1.26 Dc | 262. 39 |
| | CATCH BAS | | | | |
| | | 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 = 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.)

Page 1

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:
 DI STANCE FROM CONTROL (FT)
 FLOW DEPTH VELOCITY (FT/SEC)
 SPECIFIC PRESSURE+ MOMENTUM (POUND O. 000 0. 741 36. 828 21. 814 3933. 091 11. 941 0. 785 33. 926 18. 668 3629. 671 12. 000 0. 785 33. 913 18. 654 3628. 241 18. 654 36288. 241 18. 654 36288. 241 18. 654 36288. 241 18. 654 36288. 241 18. 654 36288. 241 18. 654 362888. 241 18. 654 362888. 241 18 MOMENTUM (POUNDS) 3933.09 3629.61 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: FLOW DI AMETER FLOWLI NE PI PF ANGLE CRITICAL VFI OCLTY (CFS) (INCHES) (DEGREES) ELEVATION (FT/SEC) DEPTH(FT.) 54. 70 54. 70 **UPSTREAM** 42. 00[°] 0. 00 224. 76 2. 31 38. 494 42.00 2. 31 **DOWNSTREAM** 224.43 36.839 0.00 0.00 0.00 0.000 LATERAL #1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.000 LATERAL #2 O. OO===Q5 EQUALS BASIN INPUT=== Q5 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED: DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-O4*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) = 2.243 690.00 : 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 CRITICAL DEPTH(FT) = 2.31NORMAL DEPTH(FT) = 0.65

Page 2

```
______
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.31
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
                  FLOW DEPTH VELOCITY SPECIFIC PRESSURE+
 DISTANCE FROM
                        (FT)
2. 315
  CONTROL(FT)
                               (FT/SEC)
                                            ENERGY(FT)
                                                          MOMENTUM (POUNDS)
         0.000
                                  8.099
                                                 3.334
                                                                1285.72
                        2.248
         0.008
                                  8.374
                                                 3.338
                                                                1287.32
         0.032
                        2.182
                                                                1292. 28
                                  8.672
                                                 3.350
         0.076
                        2.115
                                  8.995
                                                 3.372
                                                                1300.86
                        2.049
                                  9. 347
9. 729
         0.142
                                                 3.406
                                                                1313. 37
         0.234
                        1.982
                                                 3.453
                                                                1330.14
                        1.916
         0.357
                                  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
                                                3. 986
         1. 292
                                                                1494. 27
                        1.649
                                 12. 264
                        1.583
         1.687
                                 12. 937
                                                4. 184
                                                                1547.66
         2. 176
                                 13.686
                       1. 516
                                                 4. 427
                                                                1610.00
                       1. 450
1. 383
1. 317
1. 250
                                 14. 522
15. 461
                                                 4.727
         2.783
                                                                1682.57
         3.539
                                                 5.097
                                                                1766.92
                                 16. 519
                                                                1864. 95
                                                5. 557
         4.485
                                 17. 721
                                                6. 129
                                                               1979.05
         5.680
                                                6.848
                       1. 184
                                 19.093
         7. 204
                                                                2112.18
                       1. 117
                                                 7. 756
         9.176
                                 20.671
                                                                2268.13
                                 22.502
                                                8. 918
        11.777
                       1. 051
                                                                2451.78
                                 24. 647
27. 184
30. 225
33. 918
        15. 296
20. 232
                       0. 984
                                                10. 423
                                                                2669.51
                                                                2929.82
                       0.918
                                                12.400
                       0.851
                                                15.045
        27. 537
                                                                3244.26
                                                18.660
        39.384
                       0.785
                                                                3628.83
                       0.718
                                  38. 482
                                                23.727
        62.808
                                                                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:
                 FLOW DIAMETER ANGLE
      PI PE
                                           FLOWLI NE
                                                       CRI TI CAL
                                                                  VELOCITY
                        (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                 (CFS)
                                                                 (FT/SEC)
    UPSTREAM
                  39. 50
                           36.00
                                 19. 65
                                           265. 36
                                                         2.05
                                                                     5.588
                  54.70
   DOWNSTREAM
                           42.00
                                             264.86
                                                         2. 31
                                                                     8. 101
                                     0.00
                                                         0.00
                  0.00
                           0.00
   LATERAL #1
                                               0.00
                                                                    0.000
                                                         0.00
   LATERAL #2
                   0.00
                            0.00
                                     0.00
                                               0.00
                                                                    0.000
                  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
              MANNING'S \hat{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 L
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                      ENTRANCE LOSSES = 0.204 FEET
 JUNCTION LOSSES = (0.560) + (0.204) = 0.764
        685.00 : HGL = < 268.473>; EGL= < 268.958>; FLOWLINE= < 265.360>
 NODE
```

```
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:
     ______

        DI STANCE FROM CONTROL (FT)
        PRESSURE HEAD(FT)
        VELOCITY (FT/SEC)
        SPECIFIC ENERGY(FT)
        PRESSURE+ 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

      DL(FT)
      (FT)
      (FT/SEC)
      ENERGY(FT)

      17. 340
      3. 000
      5. 586
      3. 485

      22. 698
      2. 962
      5. 600
      3. 449

      27. 630
      2. 924
      5. 625
      3. 415

      32. 321
      2. 886
      5. 657
      3. 383

      36. 827
      2. 847
      5. 696
      3. 351

      41. 176
      2. 809
      5. 740
      3. 321

      45. 385
      2. 771
      5. 789
      3. 292

      49. 466
      2. 733
      5. 843
      3. 263

      49. 950
      2. 728
      5. 850
      3. 260

                                                                                               1073.59
                                                                                              1058.74
                                                                                              1044. 54
                                                                                               1030, 92
                                                                                               1017.84
                                                                                               1005.29
                                                                                              993. 25
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:
                       FLOW DIAMETER ANGLE FLOWLINE
         PI PE
                                                                               CRI TI CAL
                                                                                                  VELOCITY
                                    (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                         (CFS)
                                        36. 00 82. 70 266. 19 2. 00
       UPSTREAM
                           37. 90
                                                                                                      5. 362
                           39. 50
     DOWNSTREAM
                                        36.00
                                                                    265.86
                                                                                     2.05
                                                                                                     5.851
                                                      _
                                                                                0. 00
0. 00
                                                                 0.00
                                      0.00
                                                       0.00
                           0.00
                                                                                                     0.000
     LATERAL #1
                                                    0.00
                            0.00
     LATERAL #2
                                         0.00
                                                                      0.00
                                                                                                    0.000
                            1.60===05 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 ENTRANCE LOSSES | UNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) | JUNCTION LOSSES = (0.850)+(0.106) = 0.956
                                                        ENTRANCE LOSSES = 0.106 FEET
            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:

        DI STANCE FROM CONTROL (FT)
        PRESSURE HEAD (FT) (FT/SEC)
        SPECI FI C 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:

        DI STANCE FROM CONTROL (FT)
        FLOW DEPTH VELOCITY (FT/SEC)
        SPECIFIC ENERGY (FT)
        PRESSURE+ 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:
                        | DIAMETER | ANGLE | FLOWLINE | CRITICAL | VELOCITY | (CFS) | (INCHES) | (DEGREES) | ELEVATION | DEPTH(FT.) | (FT/SEC) | 15.70 | 36.00 | 81.90 | 267.28 | 1.26 | 2.221 | 37.90 | 36.00 | - 266.95 | 2.00 | 5.405 |
                       FLOW DIAMETER ANGLE FLOWLINE
        PI PE
                       (CFS)
      UPSTREAM
     DOWNSTREAM
                         0.00
                                                                                           0.000
                                                                            0.00
     LATERAL #1
     LATERAL #2
                                                                            0.00
                                                                                            0.000
        05
                        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

REAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00055

ISTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00285
  UPSTREAM:
  DOWNSTREAM:
  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 DIAMETER = 36.00 INCHES
  PIPE FLOW = 15.70 CFS
                                                   Page 5
```

695 V. RES PI PE LENGTH = 25.85 FEET MANNI NO SF=(Q/K)**2 = ((15.70)/(666.509))**2 = HF=L*SF = (25.85)*(0.00055) = 0.014 $\overline{\text{MANNING'S N}} = 0.01300$ 666.509))**2 = 0.00055NODE 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>; FLOWLI NE= < 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 |
| Reach01 | 96.* | PF 1 | 5.70 | 99.98 | 100.14 | 100.42 | 101.73 | 1.021041 | 10.11 | 0.56 | 6.16 | 4.44 |
| 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 |
| 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 |
| 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 |

End of Wing Wall Start of 1/4 Ton

Hydraulic Jump

End of 1/4 Ton

Decimal Slope of EGL = (107.93-104.39)/3 = 1.2 ft/ft (Used for tractive force calculations)

RICK

Tractive Force Calculations

Job Name: Maple Canyon Restoration Phase 1

Job Number: 18022 F Date: 4/1/2019

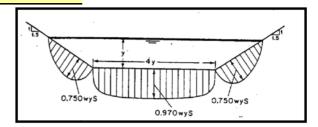
Cross Section Number:

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 - D₅₀=0.4 feet (or larger)

Tractive Force Calculations

Channel Bottom:

b/y = 40.909 $X_{bottom} = 1 \text{ from figure 1}$

 $T_{bottom} = X_{bottom} (\gamma_W) D S_{EGL}$

 $T_{permissible}$ = 0.04 (γ_S - γ_W) D_{50}

 $T_{\text{permissible}} = 0.04 (165 - 62.4 \text{ lb/ft}^3) D_{50}$

 $T_{\text{bottom}} = T_{\text{permissible}} = 4.1 D_{50}$

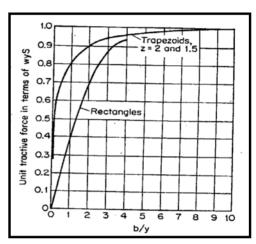


Figure 1: On bottom of Channels

$D_{50} = 1.975$ feet

Channel Sides:

b/y = $\frac{40.909}{X_{\text{side}}}$ from figure 2

 $T_{\text{side}} = X_{\text{side}} (\gamma_{\text{W}}) D S_{\text{EGL}}$

$T_{side} = 6.3176 \text{ lb/ft}^3$

 $T_{perm-side} = T_{side} [(1-(sin^2 \Phi/sin^2 \theta))^{0.5}] = 4.1 D_{50}$

Φ = **18.43** degrees

 $\theta = \frac{40}{40}$ degrees (angle of repose of rock)

 $T_{\text{perm-side}} = 7.2565 \text{ lb/ft}^3$

 $T_{\text{side}} = T_{\text{perm-side}} = 4.1 D_{50}$

1.770 feet

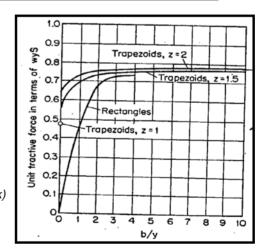


Figure 2: On sides of Channels

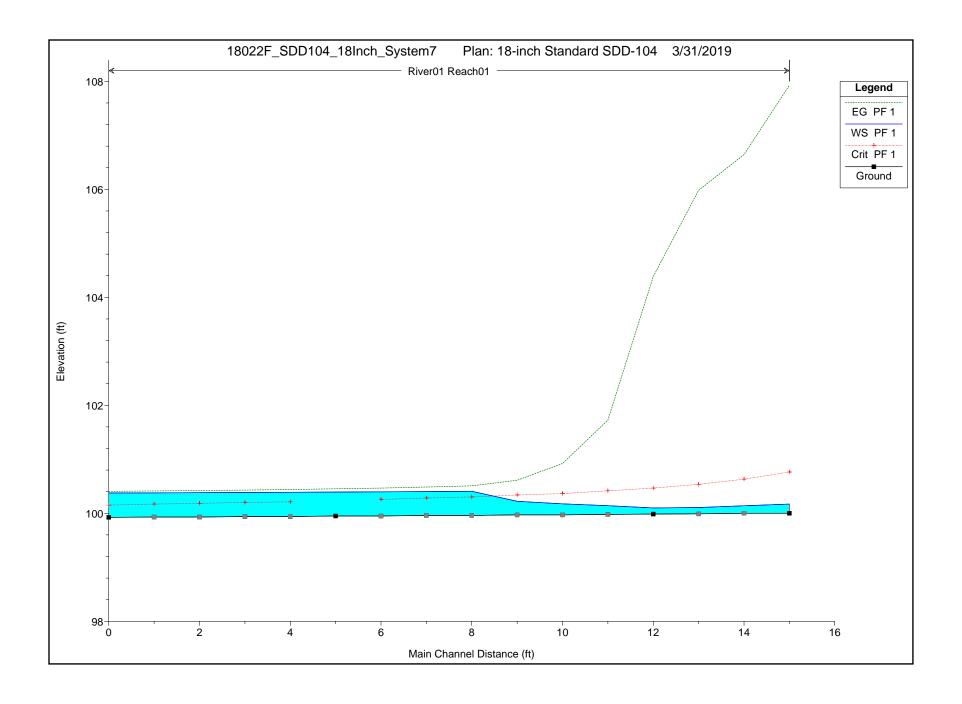
Design Specifications:

 $D_{50} =$

Required Rock Size 1/4 Ton - D₅₀=1.8 feet (or larger)

Minimum Rock Thickness: 0.6 Feet (or 1.5 x D₅₀)

Filter Material: Per Geotechnical Engineers Specifications



PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (Reference: LACFCD, LACRD, AND OCEMA HYDRAULICS CRITERION)
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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 | DOWNSTRE | AM RUN |
|----------------|------------|-------------------|-----------|-------------------|
| NODE MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER PROCESS | S HEAD(FT) | MOMENTUM (POUNDS) | DEPTH(FT) | MOMENTUM (POUNDS) |
| 755. 00- | 0. 92 Dc | 83. 68 | 0.`42* | `158. 25´ |
| } FRICTI | ON | | | |
| 750. 00- | 0.92 Dc | 83. 68 | 0.30* | 248. 21 |
| } JUNCTI | ON | | | |
| 750. 00- | 0.92 Dc | 83. 68 | 0. 27* | 287. 40 |
| } FRICTI | ON | | | |
| 745. 00- | 0.92 Dc | 83. 68 | 0. 59* | 107. 64 |
| } JUNCTI (| ON | | | |
| 745. 00- | 1. 09 | 78. 43 | 0. 45* | 119. 54 |
| } FRICTI | ON | | | |
| 730. 00- | 0.87 Dc | 72. 26 | 0.83* | 72. 52 |
| } JUNCTI | ON | | | |
| 730. 00- | 0.78 Dc | 54. 33 | 0. 67* | 56. 15 |
| } FRICTI | ON | | | |
| 710. 00- | 0. 78*Dc | 54. 33 | 0. 78*Dc | 54. 33 |
| } CATCH | | | | |
| 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 = PIPE FLOW = 755.00 FLOWLINE ELEVATION = PIPE DIAMETER = 18.00 INCHES 201.970 FEET

PIPE FLOW = 5.70 CFS ASSUMED DOWNSTREAM CONTROL HGL = *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

755.00 : HGL = < 202.393>; EGL= < 205.404>; FLOWLINE= < 201.970> NODE ***************** 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) = 0.92UPSTREAM 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(POUL
0.000 0.303 22.285 8.020 248.2 MOMENTUM (POUNDS) 22. 285 248.21 20. 371 3. 982 0.323 227.39 6. 771 18. 726 17. 300 16. 055 8.009 0. 343 0. 363 5. 791 5. 013 209. 57 194. 21 12.080 0. 382 4.387 16. 195 180.87 20. 353 0.402 14. 960 3.879 169.22 13. 991 13. 920 0.422 159.00 24. 558 3.463 0.423 3.434 158. 25 24.890 NODE 750.00 : HGL = < 202.513>; EGL= < 210.230>; FLOWLI NE= < 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: DIAMETER ANGLE FLOWLINE (INCHES) (DEGREES) ELEVATION FLOW CRI TI CAL **VELOCITY** (CFS) DEPTH(FT.) (FT/SEC) 5. 70 5. 70 18. 00 0. 00 UPSTREAM 202.54 25. 880 0. 92 202. 21 0. 92 DOWNSTREAM 18.00 22. 292 0. 00 LATERAL #1 0.00 0.00 0.00 0.00 0.000 LATERAL #2 0.00 0.00 0.00 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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 4. 00 FEET JUNCTION LENGTH = 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

755 V. RES 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 SPECIAL ENERGY (FT) SPECIFIC PRESSURE+ (FT) (FT/SEC) MOMENTUM (POUNDS) CONTROL(FT) 0. 589 8. 847 1. 805 0.000 107.64 0.099 0.576 9. 117 1.868 110.11 0.208 0.563 9.403 1.937 112.77 2.014 0.550 9. 707 0.331 115.63 0.468 0.537 10.028 2.099 118.72 10. 371 10. 735 0.524 2.195 122.04 0.622 2. 301 2. 420 2. 553 2. 701 2. 869 3. 057 3. 269 3. 510 3. 783 4. 095 4. 451 4. 860 5. 333 5. 880 6. 518 7. 267 8. 149 9. 198 10. 453 0.794 0. 511 2. 301 125.62 0. 498 0.988 11. 123 129.49 1. 207 0. 485 11. 537 133.65 0. 472 11. 980 1.454 138. 15 0. 458 1.736 12. 455 143.02 12. 964 2.057 0. 445 148.29 13. 513 14. 104 14. 743 0.432 153.99 2.425 2.849 0.419 160.19 3. 342 0.406 166.93 3.919 0.393 15. 435 174.27 0.380 16. 187 4.601 182. 28 0. 367 17.006 191.05 5. 416 0.354 17. 901 6.405 200.67 18. 882 19. 961 7. 626 0. 341 211. 25 0. 328 9. 172 222.94 11. 198 13. 997 0. 315 0. 302 21. 152 22. 474 235.88 22. 474 8. 149 23. 945 9. 198 25. 593 10. 453 25. 872 10. 674 250.27 18. 227 0. 289 266.33 25. 999 0. 275 284.34 96. 270 0. 273 287.40 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: PI PE FLOW DIAMETER ANGLE FLOWLINE CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 5. 10 5. 70 UPSTREAM 18. 00 0. 00 266. 61 0. 87 11. 584 0. 92 DOWNSTREAM 18.00 266. 28 8. 849 0.00 0.00 LATERAL #1 0.000 LATERAL #2 0.00 0.00 0.000 O. 60===Q5 EQUALS BASIN INPUT=== Q5 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

NODE 745.00 : HGL = < 267.056>; EGL= < 269.139>; FLOWLINE= < 266.610>

FRICTION LOSSES = 0.183 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.811)+(0.243) = 1.054

ENTRANCE LOSSES = 0.243 FEET

```
**********
  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)
                                                       1. 232́
                           0. 828
          0.000
                                       5.093
                                                                         72. 52
                                                       1. 235
                          0.812
          0.059
                                       5. 217
                                                                         72.76
          0.143
                          0.797
                                     5. 348
                                                       1. 241
                                                                         73.09
                                                   1. 241
1. 248
1. 257
1. 268
1. 282
1. 298
1. 316
1. 338
1. 364
1. 393
                                     5. 485
          0. 253
                          0. 781
                                                                         73.51
                                  5. 485
5. 630
5. 783
5. 944
6. 114
6. 294
6. 485
6. 688
6. 902
7. 131
7. 374
7. 634
                          0. 765
0. 749
                                                                         74.03
          0.392
          0.566
                                                                         74.65
                          0. 733
                                                                         75.38
          0.777
          1.032
                          0.717
                                                                         76.22
                          0. 701
           1.335
                                                                         77.18
                          0.685
                                                                         78. 28
           1. 696
                                                                         79.51
           2. 121
                          0. 669
           2. 623
                          0.653
                                                      1. 393
                                                                         80.89
                                                      1. 427
                          0. 637
                                                                         82.42
           3. 214
                                                      1. 466
1. 511
          3. 910
                          0.621
                                                                         84.13
                                       7.634
           4.734
                          0.605
                                                                         86.02
                                      7. 911
                                                      1. 562
                          0.589
          5. 711
                                                                         88.11
          6.878
                          0.573
                                     8. 208
                                                   1. 620
1. 687
1. 763
1. 851
1. 951
2. 066
2. 199
2. 352
                                                      1. 620
                                                                         90.41
                          0.557
                                     8. 526
                                                                         92.95
          8. 285
                                     8. 867
9. 235
          9.999
                          0. 542
                                                                         95.74
         12. 123
                          0. 526
                                                                         98.82
                                      9. 632
                          0.510
                                                                         102.20
         14.814
                                  9. 632
10. 060
10. 525
11. 030
                          0. 494
         18. 337
                                                                         105.92

    199
    352

         23.189
                          0.478
                                                                         110.02
                                    10. 525
11. 030
11. 580
11. 580
                          0.462
         30. 486
                                                                         114.54
                                                                        119.54
         43.817
                          0.446
                                                       2.529
         43.900
                          0. 446
                                                      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:
       PI PE
                  FLOW DIAMETER ANGLE
                                                FLOWLI NE
                                                             CRI TI CAL
                                                                         VELOCITY
                            (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
                     4. 10
5. 10
                                                                             5. 386
     UPSTREAM
                              18. 00 0. 00 270. 16
                                                            0. 78
    DOWNSTREAM
                              18. 00
                                         -
                                                   269.83
                                                               0. 87
                                                                            5.095
                                    66. 80 270. 12
0. 00 0. 00
                                                                            1. 440
                              18.00
                     1.00
    LATERAL #1
                                                               0.37
                     1. 00
0. 00
    LATERAL #2
                                                               0.00
                                                                            0.000
                              0.00
                     O. OO===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
                MANNING'S N = 0.01300;
  DOWNSTREAM:
                                        FRICTION SLOPE = 0.00678
                                          Page 4
```

```
755 V. RES
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00794
  JUNCTION LENGTH = 4.00 FEET
 FRICTION LOSSES = 0.032 FEET ENTRANCE LOSSES)

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.217)+(0.000) = 0.217
                                        ENTRANCE LOSSES = 0.000 FEET
       730.00 : HGL = < 270.828>; EGL= < 271.279>; FLOWLINE= < 270.160>
 NODE
**********************
 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)
                                                   1. 083
                         Ò. 775
                                   4.448
                                                                     Š4. 33
         0.000
                                                   1.083
                                                                    54.33
                        0.770
                                    4.484
         0.014
                                    4. 521
          0.057
                        0.765
                                                   1.083
                                                                     54.34
                                                                    54.36
          0.132
                        0.760
                                   4. 559
                                                   1.083
          0.242
                                                                    54.38
                        0.755
                                   4. 597
                                                   1.084
                        0. 750
0. 745
          0.391
                                                                     54.42
                                   4. 636
                                                   1.084
          0.582
                                   4. 675
                                                   1.085
                                                                     54.46
                        0. 740
0. 735
                                   4. 716
                                                   1.086
          0.820
                                                                     54.50
                                  4. 757
                                                   1.087
                                                                     54.56
          1. 111
                        0.730
                                  4. 798
          1.461
                                                  1. 088
                                                                     54.62
                                  4.841
                                                                    54.70
          1.879
                        0.725
                                                  1.090
                        0.720
                                  4.884
                                                   1. 091
                                                                    54.78
          2. 373
                                  4. 928
4. 973
          2. 954
                        0.715
                                                   1.093
                                                                     54.87
                        0. 710
0. 705
0. 700
                                                   1.095
          3.638
                                                                     54.96
                                  5. 018
5. 064
5. 112
5. 160
                                                   1.097
                                                                     55.07
          4.442
                                                   1.099
                                                                     55.18
          5.389
                        0.695
                                                   1. 101
                                                                     55.31
          6.510
          7.845
                        0.690
                                                   1. 104
                                                                     55.44
          9.453
                        0. 685
                                  5. 208
                                                   1. 107
                                                                     55.58
                                   5. 258
         11. 419
                        0. 681
                                                   1. 110
                                                                     55.74
                                   5. 309
                                                                     55.90
         13.872
                        0. 676
                                                   1. 113
                                                   1. 117
                                   5. 361
                                                                     56.07
         17.034
                        0. 671
                                   5. 361
5. 385
                                                   1. 119
        18. 980
                        0.668
                                                                     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:

END OF GRADUALLY VARIED FLOW ANALYSIS $^{\circ}$

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

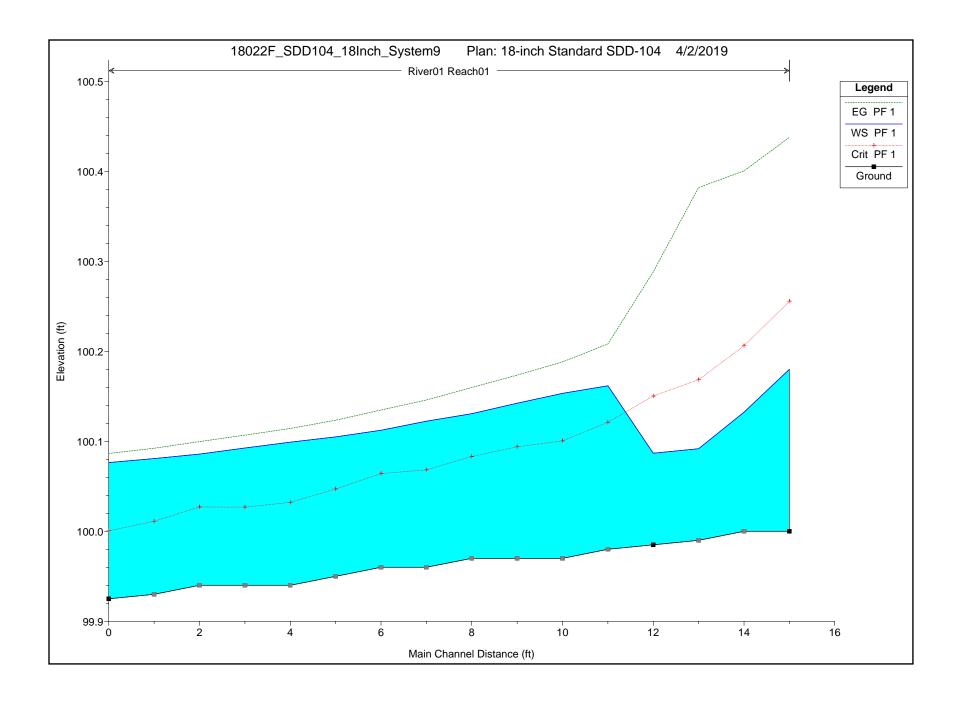
RIP RAP PAD AT NODE 925 SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

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 |
| Reach01 | 97 | PF 1 | 1.10 | 99.99 | 100.09 | 100.15 | 100.29 | 0.169442 | 3.60 | 0.31 | 5.11 | 1.99 |
| Reach01 | 96.* | PF 1 | 1.10 | 99.98 | 100.16 | 100.12 | 100.21 | 0.018020 | 1.73 | 0.64 | 6.06 | 0.71 |
| 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 |
| 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 |

End of Wing Wall Start of No.2 Backing Hydraulic Jump

End of No.2 Backing



PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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

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 | DOWNSTREA | AM 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 |
| } | FRI CTI ON | | | | |
| 920.00- | | 0. 39*Dc | 10. 07 | 0. 39*Dc | 10. 07 |
| } | JUNCTI ON | | | | |
| 920.00- | | 0.39 Dc | 10. 07 | 0. 13* | 31. 24 |
| } | FRI CTI ON | | | | |
| 915.00- | | 0.39 Dc | 10. 07 | 0. 16* | 24. 01 |
| } | JUNCTI ON | | | | |
| 915.00- | | 0.39 Dc | 10. 07 | 0. 13* | 33. 30 |
| } | FRI CTI ON | | | | |
| 910.00- | | 0. 39*Dc | 10. 07 | 0. 39*Dc | 10. 07 |
| | CATCH BAS | | | | |
| 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

DESI GN 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>

| 925_V. RES |
|--|
| 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 |
| 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 |
| NODE 920.00 : HGL = < 173.502>; EGL= < 173.641>; FLOWLINE= < 173.110> |
| ************************************** |
| 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. 00 LATERAL #2 0. 00 0. 00 0. 00 0. 00 0. 00 0. 00 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 Page 2 |

```
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
      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)
                       Ò. 158
                                                                24. 01
                                 11. 076
         0.000
                                                2.064
         0.157
                       0. 157
                                11. 188
                                                2.102
                                                                24.25
                                11. 302
                                                                24.48
         0.322
                       0. 156
                                                2. 141
         0.497
                       0.155
                                11. 419
                                                2. 181
                                                                24.72
                      0. 154
                                11. 537
                                                                24.97
         0.682
                                               2. 222
         0.878
                       0. 153
                                11. 658
                                                2. 264
                                                                25.22
         1.087
                                                2.308
                       0.152
                                11. 781
                                                                25.48
                       0.150
                                 11. 906
                                                2.353
                                                                25.74
         1.309
                       0.149
                                 12.033
                                                2.399
         1.548
                                                                26.00
                                12. 163
12. 295
                       0. 148
                                                2.447
                                                                26.27
         1.803
         2.079
                       0. 147
                                               2. 496
                                                                26.55
                                             2. 496
2. 546
2. 598
2. 652
                       0. 146
                                12. 429
         2.377
                                                                26.83
         2.700
                       0.145
                                12. 566
                                                                27.11
                                12. 706
         3.054
                       0.144
                                               2.652
                                                                27.41
                       0.143
                                12.848
                                               2. 708
                                                                27.70
         3.443
                                12. 993
13. 140
13. 291
                                               2. 765
         3.874
                       0. 142
                                                                28.01
                       0. 141
                                                2.824
                                                                28.32
         4. 357
                                                2. 884
         4.902
                       0.140
                                                                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
                                                                29.96
         8.216
                       0.135
                                13. 923
                                               3. 147
                       0.134
                                14.089
                                               3. 219
                                                                30.31
         9. 629
                                                3. 292
                       0. 133
                                14. 259
        11.644
                                                                30.66
                                14. 432
                                                3.368
        15. 135
                       0. 132
                                                                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:
                      DI AMETER ANGLE
      PI PE
                FLOW
                                          FLOWLI NE
                                                     CRI TI CAL
                                                                VELOCITY
                        (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                                                               (FT/SEC)
                 (CFS)
                                                     0. 39
    UPSTREAM
                                    0. 00
                                            226. 41
                  1. 10
                          18.00
                                                                  15. 518
                                                       0.39
   DOWNSTREAM
                  1. 10
                          18.00
                                            226.08
                                                                  11.079
                                    0.00
                  0.00
                                            0.00
                                                       0.00
                                                                  0.000
   LATERAL #1
                          0.00
   LATERAL #2
                  0.00
                           0.00
                                    0.00
                                             0.00
                                                       0.00
                                                                  0.000
                  O. OO===Q5 EQUALS BASIN INPUT===
      Q5
                                    Page 3
```

```
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 I FNGTH = 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. 381
                                         3. 117
                                                                              10.08
           0.001
                                                          0.532
           0.004
                            0.370
                                                                              10.13
                           0.359
                                                                              10.20
           0.009
           0.017
                           0. 348
                                                                              10.31
           0.027
                           0. 337
                                                                              10.45
                           0. 326
0. 315
0. 304
0. 293
           0.042
                                                                              10.64
                                                     0. 580

0. 573

0. 590

0. 611

0. 637

0. 669

0. 708

0. 756

0. 816

0. 890

0. 981

1. 095

1. 239

1. 421
           0.061
                                                                              10.86
           0.084
                                                                              11.13
           0. 114
                                                                              11.46
           0. 152
                            0. 282
                                                                              11.84
                           0. 271
           0. 198
                                                                              12. 28
           0. 255
                           0. 260
                                                                              12.80
           0.326
                           0. 249
                                                                              13.40
                           0. 238
                                                                              14.09
           0. 415
                            0. 227
                                                                              14.89
           0.525
                            0. 216
           0.663
                                                                              15.82
           0.839
                            0. 205
                                                                              16.89
                            0.194
                                                                              18.14
           1.066
                            0. 183
           1.364
                                                                              19.60
                           0. 172
           1.765
                                                                              21.32
                                                                              23.36
                           0. 161
           2. 322
           3. 141
                          0. 150
                                                                              25.79

      4. 456
      0. 139

      7. 029
      0. 128

      44. 610
      0. 126

                                                                              28.73
                                                                              32.33
                                                                              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)
```

RIP RAP PAD AT NODE 1045 SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

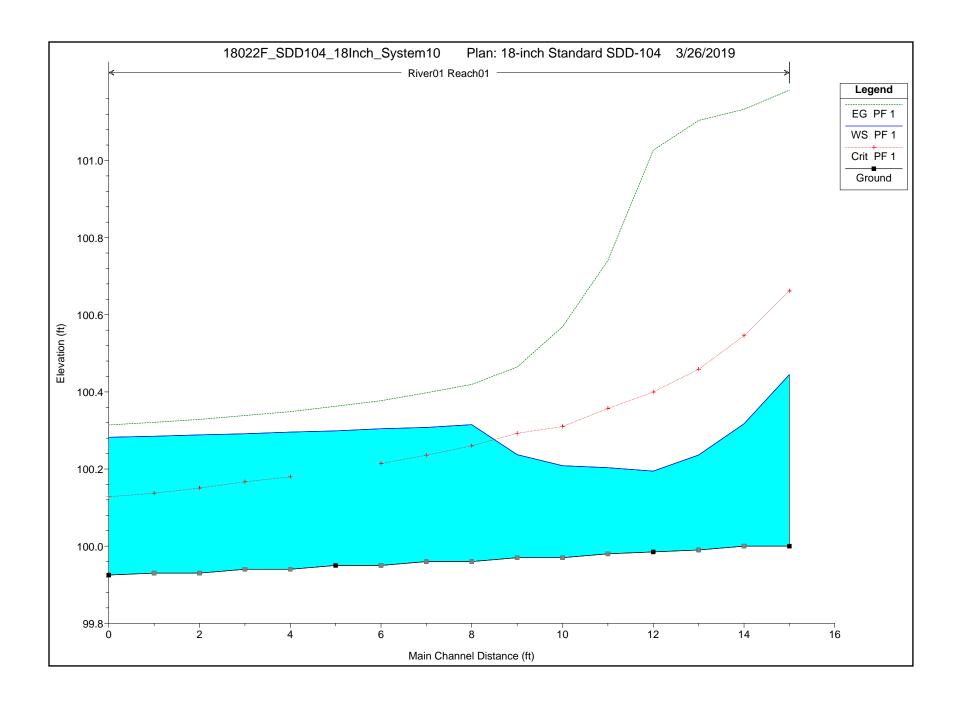
HEC-RAS Plan: 18-inch SDD104 River: River01 Reach: Reach01 Profile: PF 1

| 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 |
| Reach01 | 97 | PF 1 | 4.60 | 99.99 | 100.19 | 100.40 | 101.03 | 0.267084 | 7.32 | 0.63 | 5.76 | 2.82 |
| 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 |
| 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 |
| 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 |

End of Wing Wall Start of No.2 Backing

Hydraulic Jump

End of No.2 Backing



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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 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.)

IIPSTRFAM RIIN

DOWNSTRE

| NODE I | AODEL DI | UPSTREAN | I RUN | | DOWNSTREA | M RUN | ┍. |
|-----------------------|------------|-------------|---------------------------------|----------|-------------------------|-------------|--------------|
| NUMBER PF 1045.00- | ROCESS HI | EAD(FT) | PRESSURE+ MOMENTUM(POU 63 | NDS) DEP | _OW TH(FT) _O_66* | MOMENTUM (P | C+ OUNDS) |
| } Fh | RICTION | | | | | | |
| 1040.00- } Jl | JNCTI ON | 0.82 Dc | | . 12 | 0. 61* | | 71. 29 |
| 1040.00- } FF | RICTION | 0. 87 | 63 | . 48 | 0. 33* | 1. | 46. 60 |
| 1035. 00- } Jl | JNCTI ON | 0.82 Dc | 63 | . 12 | 0. 31* | 1! | 56. 94 |
| 1035. 00- } FF | | 0.82 Dc | 63 | . 12 | 0. 28* | 18 | 82. 92 |
| 1030. 00- } Jl | | 0.82 Dc | 63 | . 12 | 0. 29* | 1 | 74. 25 |
| 1030. 00- | | 0.82 Dc | 63 | . 12 | 0. 26* | 20 | 02. 64 |
| } FF 1025. 00- | | 0.82 Dc | 63 | . 12 | 0. 75* | (| 63. 91 |
| } Jl 1025. 00- | | 0.82 Dc | 63 | . 12 | 0. 70* | | 65. 44 |
| } FF 1020. 00- | | 0.82*Dc | 63 | . 12 | 0.82*Dc | • | 63. 12 |
| } Jl 1020. 00- | | 0.88 | 63 | . 55 | 0. 68* | , | 66. 46 |
| } FF 1015. 00- | | 0.82 Dc | 63 | . 12 | 0. 61* | | 71. 51 |
| } Jl 1015. 00- | | 0.82 Dc | 63 | . 12 | 0. 72* | , | 64. 93 |
| } FF 1010.00- | | 0.82*Dc | 63 | . 12 | 0. 82*Dc | , | 63. 12 |
|) CA 1010.00- | AICH BASII | N 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

CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA DESIGN MANUALS. DOWNSTREAM PIPE FLOW CONTROL DATA: NODE NUMBER = 1045.00 PIPE FLOW = 4.60 CFS FLOWLINE ELEVATION = 166.71 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 20.00 FEET MANNING'S N = 0.01300PIPE LENGTH = 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) (FT) (FT/SEC)
0. 612 6. 778
0. 616 6. 730
0. 619 6. 683
0. 622 6. 636
0. 626 6. 590
0. 629 6. 544
0. 632 6. 499
0. 635 6. 455
0. 639 6. 411
0. 642 6. 368
0. 645 6. 325
0. 649 6. 283
0. 652 6. 242
0. 655 6. 201
0. 656 6. 194 1. 326 0.000 71. 29 1.320 71.00 1. 233 1. 313 2.496 70.72 70.45 3. 794 1. 307 5. 129 1.300 70.18 1. 294 69.91 6. 505 1. 289 1. 283 1. 277 1. 272 7. 926 69.66 9. 397 69.41 10.924 69.16 12.513 68.92 14. 174 1. 267 68.69 15. 915 1. 262 68.47 17. 748 1. 257 68. 25 0. 655 19. 689 20. 000 1. 253 68.03 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: FLOW DIAMETER ANGLE FLOWLINE CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 18.00 60.00 167.24 16. 18Ó 4. 60 0.82 UPSTREAM DOWNSTREAM 4.60 18. 00 166. 91 0.82 6. 780 0.00 0.00 0.00 0.00 0.00 0.000 0.00 LATERAL #1 LATERAL #2 0.00 0.000 **Q**5 O. OO===Q5 EQUALS BASIN INPUT===

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED: DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-Page 2

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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:
 _____
                                              SPECIFIC PRESSURE+
 DISTANCE FROM FLOW DEPTH VELOCITY
  CONTROL(FT)
                                              ENERGY(FT)
                                                            MOMENTUM (POUNDS)
                    (FT)
                                (FT/SEC)
                                  17. 365
17. 312
17. 260
17. 208
                                                   4.996
         0.000
                        0. 311
                                                                   156.94
                                                   4.968
         0.695
                        0.312
                                                                   156.48
                        0.312
                                                   4.941
                                                                   156.03
         1.417
                        0. 313
                                                   4.914
         2. 170
                                                                   155.57
                                  17. 156
17. 105
         2. 955
                        0.314
                                                   4.887
                                                                   155.12
         3. 775
                        0.314
                                                  4.860
                                                                   154.68
                                                4. 834
4. 807
4. 781
                        0.315
                                  17.054
                                                                   154.23
         4.636
                                              4. 781
4. 755
4. 730
4. 7
         5. 540
                        0.316
                                  17.003
                                                                   153.79
         6.493
                        0.316
                                  16. 952
                                                                   153.35
                                  16. 902
         7.502
                        0. 317
                                                                   152.91
                                  16.851
                        0. 318
         8. 572
                                                                   152.47
         9.712
                        0.318
                                  16.802
                                                                   152.04
                        0.319
                                  16. 752
        10.933
                                                                   151.61
        12. 249
                        0.320
                                  16. 703
                                                 4. 654
                                                                   151.18
                        0. 320
        13.675
                                  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
                                  16. 508
        18.861
                        0.322
                                                  4. 556
                                                                   149.49
                        0.323
                                   16.460
                                                  4. 532
                                                                   149.07
        21.023
                        0.323
                                   16. 412
                                                  4.508
        23. 512
                                                                   148.65
                                  16. 364
16. 317
16. 270
                        0.324
                                                                   148.24
        26. 446
                                                  4.485
                        0.325
         30. 028
                                                  4. 461
                                                                   147.83
                        0.325
                                                  4.438
                                                                   147.42
        34.632
                                   16. 223
        41. 102
                        0.326
                                                  4.415
                                                                   147.02
                                                  4.392
                        0.327
                                   16. 176
        52. 148
                                                                   146, 61
        66.000
                        0. 327
                                  16. 175
                                                  4.392
                                                                   146.60
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:
                       DIAMETER ANGLE FLOWLINE
      PI PE
                 FLOW
                                                       CRITICAL VELOCITY
                          (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                  (CFS)
                                       Page 3
```

```
1045 V. RES
                                                    179. 16
     UPSTREAM
                     4. 60
                              18.00
                                          12.00
                                                                 0.82
                                                                              20.340
                                                    178.83
                     4.60
                               18.00
                                                                 0.82
                                                                              17.370
    DOWNSTREAM
                             0. 00
0. 00
                                                   0.00
                                           0.00
                                                                 0.00
                                                                              0.000
    LATERAL #1
                     0.00
    LATERAL #2
                      0.00
                                           0.00
                                                      0.00
                                                                 0.00
                                                                               0.000
                      O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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 ENTRANCE LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                           ENTRANCE LOSSES = 0.000 FEET
  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(POUL
0.000 0.288 19.346 6.104 174.29
                                                                  MOMENTUM (POUNDS)
                                                                          174. 25
                           0. 288
                                      19. 386
           0.511
                                                                          174.60
                                                        6. 127
                                                                          174. 94
175. 29
                           0. 288
                                      19. 425
           1.045
                                                        6. 150
                                                    6. 174
6. 197
6. 221
6. 245
6. 269
6. 293
6. 317
6. 342
6. 366
6. 391
6. 416
6. 441
6. 466
6. 491
6. 517
6. 542
6. 568
6. 594
                           0. 287
0. 287
           1.604
                                      19. 464
                                                        6. 174
                                       19. 504
                                                                           175.64
           2. 190
           2.806
                           0. 286
                                      19. 544
                                                                           175.99
                           0. 286
                                      19. 584
           3.455
                                                                          176.34
           4. 141
                           0. 285
                                      19. 624
                                                                          176.69
           4.867
                           0. 285
                                      19. 664
                                                                           177.04
                                      19. 705
                           0. 285
                                                                           177.39
           5. 639
                                      19. 745
19. 786
           6. 462
                           0. 284
                                                                           177.75
           7. 344
8. 294
                           0. 284
                                                                           178.11
                           0.283
                                       19.827
                                                                           178.47
                           0.283
                                       19.867
           9. 321
                                                                           178.82
          10.440
                           0. 283
                                       19. 909
                                                                           179.18
                                                                           179. 55
          11.669
                           0. 282
                                      19. 950
                           0. 282
                                      19. 991
                                                                           179.91
          13.030
                                       20.033
          14.555
                           0. 281
                                                                           180.27
                                       20.074
          16. 287
                           0. 281
                                                                           180.64
                           0. 281
          18.290
                                       20. 116
                                                                           181.01
                                      20. 158
20. 200
20. 243
                           0.280
          20.665
                                                                           181.38
          23. 577
27. 340
                           0.280
                                                        6.620
                                                                           181.75
                           0. 279
                                                                           182.12
                                                        6. 646
                           0.279
                                       20. 285
                                                                           182.49
          32.656
                                                        6. 673
                                                        6.699
                                       20. 328
                           0.279
          41.778
                                                                          182.87
         108, 000
                           0. 278
                                       20. 334
                                                        6. 703
                                                                          182. 92
  NODE 1030.00 : HGL = < 216.168>; EGL= < 221.984>; FLOWLINE= < 215.880>
```

Page 4

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************************
 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:
       PI PE
                FLOW DIAMETER
                                      ANGLE
                                              FLOWLI NE
                                                           CRI TI CAL
                                                                       VELOCITY
                          (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
     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
                                                                         0.000
                                                             0.00
    LATERAL #2
                                                                          0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       05
  LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
  DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
      \overline{04}*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
               MANNI NG' S N = 0.01300; FRI CTI ON SLOPE = 0.45519
MANNI NG' S N = 0.01300; FRI CTI ON SLOPE = 0.29379
  DOWNSTREAM:
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.37449
 JUNCTION LENGTH = 4.00 FEET ENTRANCE LOSSES | 1.498 FEET ENTRANCE LOSSES | JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES) JUNCTION LOSSES = (2.404)+(0.000) = 2.404
                                        ENTRANCE LOSSES = 0.000 FEET
  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+
ENERGY(FT) MOMENTUM(POUN
   CONTROL(FT)
                     (FT)
                                  (FT/SEC)
                                                              MOMENTUM (POUNDS)
          0.000
                          0.752
                                     5. 187
                                                     1. 170
                                                                       63.91
                         0.732
                                     5.373
                                                     1. 180
                                                                       64.46
          0.017
                                     5. 572
5. 787
                                                     1. 194
          0.039
                         0.711
                                                                       65.17
                         0.691
          0.068
                                                     1. 211
                                                                       66.04
                                                                       67. 11
68. 38
          0.105
                         0.670
                                     6.018
                                                     1.233
                                                     1.260
                         0.650
          0. 151
                                     6. 267
          0.206
                         0.629
                                     6. 537
                                                     1.293
                                                                       69.87
                                    6. 830
7. 149
          0.275
                         0.609
                                                     1.334
                                                                       71.61
                         0.589
                                                    1. 383
                                                                       73.61
          0.357
                                   7. 496
7. 877
8. 294
          0.457
                         0.568
                                                    1. 441
                                                                       75.91
                         0.548
          0.577
                                                     1. 512
                                                                       78.54
                                                     1. 596
                         0.527
          0.722
                                                                       81.53
                                                  1. 596
1. 698
1. 819
1. 966
2. 145
2. 361
2. 627
2. 954
                                    8. 754
9. 263
9. 827
          0.897
                         0.507
                                                                       84.95
          1.109
                         0. 486
                                                                       88.83
          1.368
                         0.466
                                                                       93.25
                         0.446
                                    10. 457
                                                                       98. 29
          1.685
          2.078
                         0. 425
                                    11. 163
                                                                      104.04
                         0.405
                                    11. 959
                                                                      110.63
          2.570
                                    12.861
          3. 195
                         0. 384
                                                    2. 954
                                                                      118. 20
          4.003
                         0.364
                                    13. 891
                                                     3.362
                                                                      126.95
                                        Page 5
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1045_V. RES
           5.074
                           0.343
                                       15. 075
                                                         3.875
                                                                           137. 10
                                      16. 449
           6. 546
                           0.323
                                                                           148.98
                                                         4. 527
                                                      5. 369
6. 472
7. 945
                                      18. 057
19. 959
22. 238
                           0. 303
0. 282
           8.679
                                                                           162.97
          12.061
                                                                           179.63
                                      22. 238
22. 575
                                                         7. 945
                           0.262
                                                                           199.67
          18. 592
          72.000
                           0. 259
                                                       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:
       PI PE
                   FLOW DIAMETER ANGLE FLOWLINE
                                                              CRI TI CAL
                                                                            VELOCITY
                             (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                    (CFS)
     UPSTREAM
                      4.60
                               18. 00 47. 00 260. 36
                                                                  0. 82
                                                                                5.643
                     4.60
                                                    260.03
    DOWNSTREAM
                               18. 00
                                                                  0. 82
                                                                                5. 189

      0. 00
      0. 00
      0. 00
      0. 00

      0. 00
      0. 00
      0. 00
      0. 00

    LATERAL #1
                     0.00
                                                                  0.00
                                                                               0.000
    LATERAL #2
                                                                  0.00
                                                                               0.000
                      O. OO===Q5 EQUALS BASIN INPUT===
       05
  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
                MANNING'S N = 0.01300; FRICTION SLOPE = 0.00952
MANNING'S N = 0.01300; FRICTION SLOPE = 0.00760
  UPSTREAM:
  DOWNSTREAM:
  AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00856
 AVERAGED FRICTION SLOPE IN JOINGTON ASSESSION JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.034 FEET ENTRANCE LOSSES)
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.359)+(0.000) = 0.359
                                            ENTRANCE LOSSES = 0.000 FEET
  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:
 DI STANCE FROM FLOW DEPTH VELOCITY SPECIFIC PRESSURE+

CONTROL(FT) (FT) (FT/SEC) ENERGY(FT) MOMENTUM(POUN

0.000 0.823 4.628 1.156 63.12
                                                                   MOMENTUM (POUNDS)
                                                        1. 156
                           Ò. 823
                                       4.628
                                                                            63.12
           0.014
                           0.818
                                        4.664
                                                         1. 156
                                                                            63.13
                                      4. 700
           0.059
                           0.813
                                                         1. 157
                                                                            63.14
                                      4. 737
4. 775
4. 813
4. 852
                           0.808
                                                         1. 157
           0.138
                                                                            63.16
                           0.803
           0. 253
                                                         1. 157
                                                                            63.18
                                                        1. 158
1. 159
                                                                            63. 22
63. 26
                           0.798
           0.408
                           0.793
           0.608
                                                        1. 159
                           0.788
                                      4. 892
                                                                            63.31
           0.857
                                      4. 932
           1. 161
                           0. 783
                                                        1. 161
                                                                            63.37
                           0.777
                                      4. 973
                                                        1. 162
           1. 526
                                                                            63.44
                                      5. 015
           1. 962
                           0. 772
                                                        1. 163
                                                                           63.52
                                      5. 057
           2.478
                           0. 767
                                                         1. 165
                                                                            63.60
                                           Page 6
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1045_V. RES
          3.085
                          0.762
                                      5. 100
                                                      1. 166
                                                                        63.70
                                                      1. 168
          3.799
                          0.757
                                     5. 144
                                                                        63.80
                                     5. 188
5. 234
5. 280
                                                                        63.92
          4.638
                          0.752
                                                      1. 170
                          0. 747
0. 742
                                                      1. 172
1. 175
          5.626
                                                                         64.04
                                                                         64.17
          6.796
                                                                        64.31
          8.189
                          0.736
                                      5.327
                                                      1. 177
          9.867
                          0.731
                                     5. 375
                                                      1. 180
                                                                         64.46
         11.918
                          0. 726
                                     5. 423
                                                      1. 183
                                                                         64.63
                                     5. 473
         14.477
                          0. 721
                                                      1. 186
                                                                         64.80
                                    5. 523
                          0.716
                                                      1. 190
                                                                         64.98
         17. 776
                                                      1. 194
         22. 242
                          0. 711
                                     5. 574
                                                                         65.17
                                  5. 627
5. 642
                                                      1. 198
         28. 843
                          0. 706
                                                                         65.38
                          0.704
                                                      1. 199
         32. 170
                                                                         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:
                        DIAMETER ANGLE FLOWLINE
                   FLOW
       PI PE
                                                            CRI TI CAL
                                                                        VELOCITY
                           (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
                     4. 60
                                     60. 50 261. 01
     UPSTREAM
                             18.00
                                                            0.82
                                                                            5.882
                                                  260.68
    DOWNSTREAM
                     4.60
                              18.00
                                                              0.82
                                                                           4. 629
                                         0.00
                                                 0.00
                                                             0.00
    LATERAL #1
                     0.00
                             0.00
                                                                           0.000
                              0.00
                                        0.00
    LATERAL #2
                     0.00
                                                    0.00
                                                               0.00
                                                                           0.000
                     O. OO===Q5 EQUALS BASIN INPUT===
       05
  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 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (0.393)+(0.000) = 0.393
                                          ENTRANCE LOSSES = 0.000 FEET
  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(POUN
                                                                MOMENTUM (POUNDS)
          0.000
                                   6. 814
                          Ò. 610
                                                 1. 331
                                                               71. 51
                                      6. 765
                                                      1.324
          1.238
                          0.613
                                                                        71. 21
          2.508
                          0. 617
                                     6. 717
                                                      1. 318
                                                                        70.93
          3.812
                          0.620
                                     6. 670
                                                      1. 311
                                                                        70.65
                                         Page 7
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1045_V. RES
          5. 153
                           0.623
                                       6.624
                                                        1.305
                                                                           70.37
                                                        1. 299
                           0.626
                                                                           70.10
          6.536
                                       6. 578
                                                        1. 293
1. 287
1. 281
                                      6. 532
          7.964
                           0.630
                                   6. 532
6. 487
6. 443
6. 399
6. 356
6. 314
6. 272
6. 230
6. 189
6. 149
6. 109
6. 069
6. 030
5. 992
5. 954
5. 880
                                                                           69.84
          9.443
                           0.633
                                                                           69.59
                                                                           69.34
         10.979
                           0.636
                                                                           69.10
         12.578
                           0.640
                                                        1. 276
         14. 248
                           0.643
                                                        1. 271
                                                                           68.86
         15. 999
                           0.646
                                                        1. 266
                                                                           68.63
         17.845
                           0.649
                                                        1. 261
                                                                           68.40
         19. 799
                           0.653
                                                        1. 256
                                                                           68.18
         21. 880
                                                                           67.97
                           0.656
                                                        1. 251
                                                        1. 247
         24. 114
                           0.659
                                                                           67.76
         26. 533
                           0.663
                                                        1. 242
                                                                           67.56
                                                                           67.36
         29. 179
                           0.666
                                                        1.238
         32. 114
                           0.669
                                                        1.234
                                                                           67. 17
         35. 429
                           0.672
                                                        1.230
                                                                           66.99
                                                        1. 227
         39, 260
                           0.676
                                                                           66.80
                           0.679
         43.843
                                                        1. 223
                                                                           66.63
                          0. 682 5. 880
         49. 420
                                                        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:
       PI PE
                   FLOW DIAMETER
                                        ANGLE
                                                 FLOWLI NE
                                                              CRI TI CAL
                                                                           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
                     0.00
    LATERAL #1
                                                                 0.00
                                                                              0.000
    LATERAL #2
                                                                 0.00
                                                                              0.000
                     O. OO===Q5 EQUALS BASIN INPUT===
       05
  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+
                                           Page 8
```

```
1045_V. RES
                                    (FT/SEC)
                                                  ENERGY(FT)
   CONTROL(FT)
                           (FT)
                                                                  MOMENTUM (POUNDS)
          0.000
                           0.823
                                                       1. 156
                                       4. 628
                                                                           63. 12
                                                                           63.13
          0.014
                           0.818
                                       4.663
                                                        1. 156
          0.059
                           0.813
                                       4.699
                                                        1. 157
                                                                           63.14
                                      4. 735
                                                        1.157
                                                                           63.16
          0.136
                           0.808
                                      4.772
                                                       1. 157
          0.250
                          0.803
                                                                           63.18
          0.404
                          0. 798
                                     4.810
                                                       1. 158
                                                                           63.22
                                     4.848
                          0.793
                                                       1. 159
                                                                           63.26
          0.601
          0.847
                          0. 788
                                     4. 886
                                                       1. 159
                                                                           63.31
                                     4. 926
          1. 148
                          0. 783
                                                       1. 160
                                                                           63.36
                                     4. 966
                                 4. 966
5. 006
5. 048
5. 090
5. 132
5. 176
5. 220
5. 265
5. 311
5. 357
5. 404
5. 453
5. 502
5. 510
          1.510
                          0. 778
                                                       1. 161
                                                                           63.43
          1. 941
                          0. 773
                                                       1. 163
                                                                           63.50
                          0.768
          2.450
                                                    1. 164
1. 166
1. 168
1. 170
1. 172
1. 174
1. 176
1. 179
1. 182
1. 185
1. 188
                                                        1. 164
                                                                           63.59
                          0. 763
0. 758
          3.051
                                                                           63.68
          3.757
                                                                          63.78
          4. 586
                          0.753
                                                                          63.88
          5. 563
                          0. 748
                                                                          64.00
          6. 719
                          0. 743
                                                                          64. 13
          8.097
                          0. 738
                                                                          64. 26
          9. 755
                          0.733
                                                                          64.41
         11. 782
                          0. 728
                                                                          64. 56
                          0. 723
0. 718
         14. 312
17. 572
                                                                          64.73
                                                                          64. 90
                          0. 717
                                                    1. 189
                                                                          64. 93
         18. 330
         ------
 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
 NODE NUMBER = 1010.00 FLOWLINE ELEVATION = 262.02
ASSUMED UPSTREAM CONTROL HGL = 262.84 FOR DOWNSTREAM RUN ANALYSIS
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

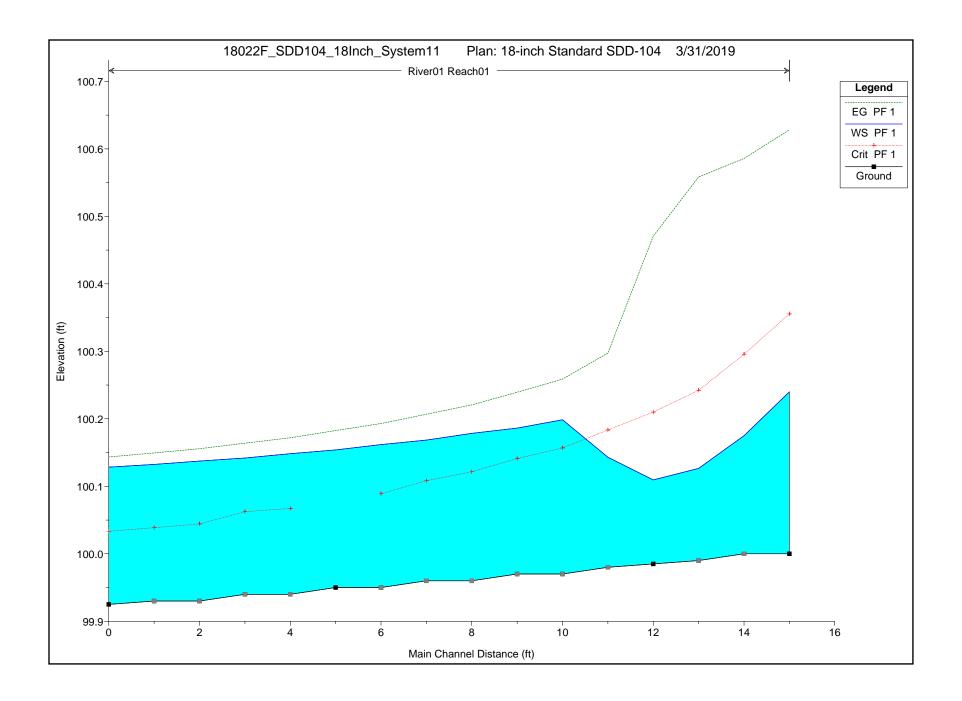
RIP RAP PAD AT NODE 1125 SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

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 |
| Reach01 | 96.* | PF 1 | 1.80 | 99.98 | 100.14 | 100.18 | 100.30 | 0.069102 | 3.15 | 0.57 | 6.17 | 1.38 |
| Reach01 | 95.* | PF 1 | 1.80 | 99.97 | 100.20 | 100.16 | 100.26 | 0.017183 | 1.97 | 0.91 | 7.21 | 0.73 |
| 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 |
| 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 |

End of Wing Wall Start of No.2 Backing Hydraulic Jump

End of No.2 Backing



PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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 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 PRESSURE+ MODEL **PRESSURE** PRESSURE+ FLOW NUMBER **PROCESS** MOMENTUM (POUNDS) DEPTH(FT) MOMENTUM (POUNDS) HEAD(FT) 0.41* 0.50 Dc 1125.00-18.84 20. 15 FRI CTI ON 1120.00-0.50 Dc 18.84 0.38* 21.09 JUNCTI ON 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 PIPE FLOW = 1.80 FLOWLINE ELEVATION = 154.55 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
Page 1

| PIPE LENGTH = | 18.00 FEET | 1125_V.F MANN | RES NING'S N = 0. | 01300 |
|--|--|--|--|--|
| NORMAL DEPTH(FT) | = 0.42 | CRI 1 | TICAL DEPTH(FT) | = 0.50 |
| UPSTREAM CONTROL | ASSUMED FLOWD | EPTH(FT) = | 0. 38 | ======================================= |
| 00401141114 1465 | EL OW BROELLE | | DILLET ON | |
| DI STANCE FROM CONTROL (FT) 0.000 0.654 1.327 2.021 2.738 3.480 4.250 5.051 5.886 6.759 7.677 8.643 9.667 10.756 11.923 13.183 14.554 16.064 17.749 18.000 | FLOW DEPTH (FT) 0. 384 0. 385 0. 387 0. 388 0. 390 0. 391 0. 393 0. 394 0. 395 0. 397 0. 398 0. 400 0. 401 0. 403 0. 404 0. 404 0. 406 0. 407 0. 409 0. 410 0. 410 | VELOCITY (FT/SEC) 5. 040 5. 013 4. 987 4. 961 4. 935 4. 909 4. 883 4. 858 4. 858 4. 784 4. 759 4. 735 4. 711 4. 688 4. 664 4. 641 4. 618 4. 595 4. 592 | SPECIFIC ENERGY (FT) 0. 779 0. 776 0. 773 0. 771 0. 768 0. 766 0. 763 0. 761 0. 758 0. 756 0. 754 0. 752 0. 750 0. 748 0. 746 0. 744 0. 742 0. 740 0. 738 0. 738 | PRESSURE+ MOMENTUM (POUNDS) 21. 09 21. 03 20. 97 20. 92 20. 86 20. 80 20. 75 20. 69 20. 64 20. 58 20. 53 20. 48 20. 43 20. 38 20. 34 20. 29 20. 24 20. 29 20. 215 20. 15 |
| 11002 1120.00 | 100.1 | 117,202 | 100.007712011211 | 10117005 |
| FLOW PROCESS FRO UPSTREAM NODE 1 | M NODE 1120.00 120.00 ELE | O TO NODE 11 VATION = 15 | 120.00 IS CODE 55.06 (FLOW IS | SUPERCRI TI CAL) |
| CALCULATE JUNCTI PIPE UPSTREAM DOWNSTREAM LATERAL #1 LATERAL #2 Q5 | ON LOSSES: FLOW DI AMET (CFS) (I NCHE: 1.80 18.0 1.80 18.0 0.00 0.0 | ER ANGLE S) (DEGREES) 0 60.00 0 - 0 0.00 0 0.00 | ELEVATION DEP 155. 06 154. 73 0. 00 0. 00 | ITICAL VELOCITY TH(FT.) (FT/SEC) 0.50 14.513 0.50 5.041 0.00 0.000 0.000 |
| LACFCD AND OCEMA DY=(Q2*V2-Q1*V1*) Q4*V4*COS(DE UPSTREAM: MAN DOWNSTREAM: MAN AVERAGED FRICTIO JUNCTION LENGTH FRICTION LOSSES JUNCTION LOSSES JUNCTION LOSSES | COS(DELTA1) - 03 LTA4)) / ((A1+A2) NI NG' S N = 0.0 NI NG' S N = 0.0 N SLOPE IN JUN = 4.00 FEET = 0.602 FEET = (DY+HV1-HV2) | *V3*COS(DELTA)*16.1)+FRICTI 1300; FRICTI 1300; FRICTI CTION ASSUMED ENTRA +(ENTRANCE LO | A3) - FI ON LOSSES ON SLOPE = 0.20 ON SLOPE = 0.00 ON AS 0.15038 ANCE LOSSES = 000000000000000000000000000000000 | 1427 |
| NODE 1120.00 : | HGL = < 155. 2 | 44>; EGL= < 1 | 158. 515>; FLOWLI | NE= < 155. 060> |
| FLOW PROCESS FRO UPSTREAM NODE 1 | M NODE 1120.0 150.00 ELE | O TO NODE 11 VATION = 20 | 150.00 IS CODE : 02.18 (FLOW IS | ************************************** |
| | | Page 2 | 2 | |

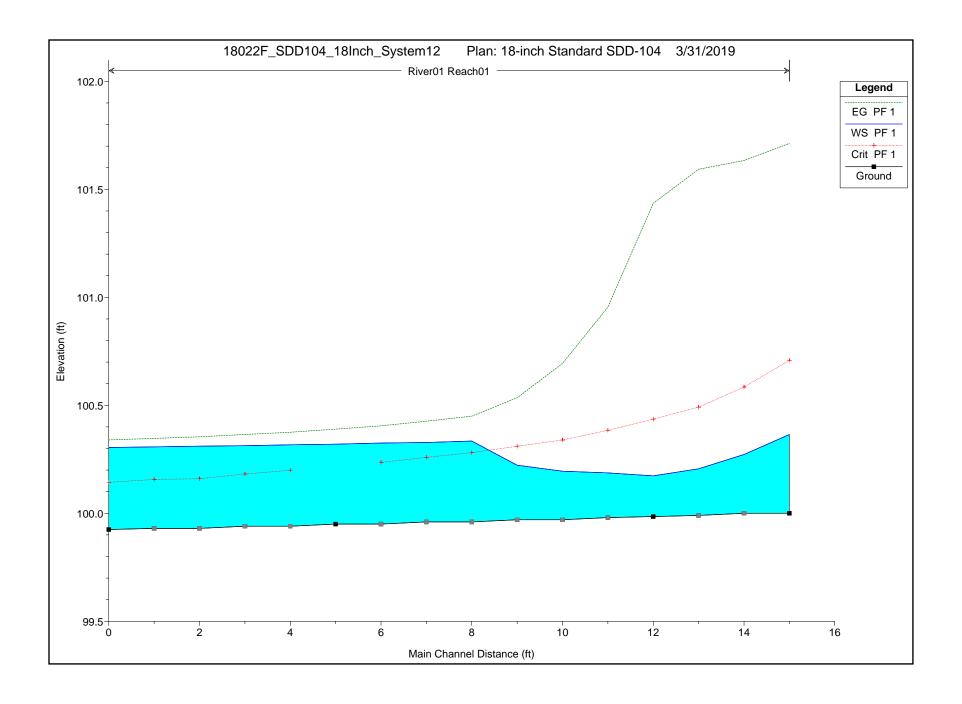
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CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW = 1.80 CFS PIPE DIAMETER = 18.00 INCHES
PIPE LENGTH = 140.78 FEET MANNING'S N = 0.01300
                               MANNING'S N = 0.01300
 NORMAL DEPTH(FT) = 0.18 CRITICAL DEPTH(FT) = 0.50
______
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.50
______
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
 _____
 DISTANCE FROM
                   FLOW DEPTH VELOCITY
                                           SPECI FI C
                                                    PRESSURE+
                   (FT)
  CONTROL(FT)
                              (FT/SEC)
                                          ENERGY(FT)
                                                        MOMENTUM (POUNDS)
         0.000
                       0.505
                                 3. 444
                                               0.689
                                                               18.84
                      0.492
                                 3.570
         0.002
                                               0.690
                                                               18.86
         0.009
                      0.479
                                 3. 706
                                                               18.93
                                               0.692
         0.021
                      0.466
                                 3.850
                                               0.696
                                                               19.04
                                               0.702
         0.038
                      0.452
                                4.006
                                                               19. 21
         0.063
                      0.439
                                4. 173
                                               0.710
                                                               19.43
                                4. 352
         0.096
                      0.426
                                                               19.71
                                               0. 721
                                4. 546
4. 756
4. 984
5. 232
                                               0.734
                      0. 413
                                                               20.06
         0.138
                      0.400
         0.192
                                               0. 752
                                                               20.48
                      0. 387
0. 374
                                               0. 773
0. 799
         0.258
                                                               20.97
                                                               21.55
         0.340
         0.441
                      0.361
                                5. 502
                                              0.831
                                                               22.21
         0.564
                      0.348
                                5. 798
                                                               22.99
                                              0.870
                                6. 124
6. 482
         0.715
                      0.334
                                              0. 917
                                                               23.87
                                              0. 974
         0. 901
                      0. 321
                                                               24.89
         1. 129
                                               1.043
                      0.308
                                6. 879
                                                               26.05
                                7. 320
7. 812
8. 365
                                                               27.39
                      0. 295
                                               1. 128
         1. 413
                      0. 282
                                                               28.91
         1.767
                                               1. 230
         2. 216
                      0.269
                                               1.356
                                                               30.66
                      0. 256
                                8. 989
                                               1.511
         2.794
                                                               32.66
                                               1. 704
                                9. 698
         3.557
                      0.243
                                                               34.98
                                               1. 945
                                                               37.66
                      0.230
                                10.508
         4.598
                                               2. 251
         6.092
                      0. 217
                                11. 443
                                                               40.79
                      0.203
                                12.530
                                               2.643
                                                               44.46
         8. 438
                      0.190
        12.917
                                               3. 152
                                                               48.80
                                13.806
                                               3.455
       140. 780
                      0. 184
                                14. 508
                                                               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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Page 3

RIP RAP PAD AT NODE 1230 SYSTEM 5 MAPLE CAYON RESTORATION PHASE 1

HEC-RAS Plan: 18-inch SDD104 River: River01 Reach: Reach01 Profile: PE 1

| | | DD104 River: F | | | rofile: PF 1 | | | | | | | | 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 |
| Reach01 | 96.* | PF 1 | 5.10 | 99.98 | 100.19 | 100.38 | 100.95 | 0.249892 | 7.03 | 0.73 | 6.42 | 2.72 | Facing Class |
| Reach01 | 95.* | PF 1 | 5.10 | 99.97 | 100.19 | 100.34 | 100.69 | 0.145952 | 5.67 | 0.90 | 7.19 | | ı |
| 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 | |



PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (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 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

"*" indicates nodal point data used.)

| | • | | /I RUN | DOWNSTRÉA | |
|-----------|------------|----------|-------------------|-----------|-------------------|
| | 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 |
| | FRI CTI ON | | | | |
| 1225. 00- | | 0.88 Dc | 74. 13 | 0. 53* | 101. 26 |
| | JUNCTI ON | | | | |
| 1225. 00- | | 0. 97 | 75. 18 | 0. 27* | 238. 15 |
| | FRI CTI ON | | | | |
| 1220. 00- | | 0.88 Dc | 74. 13 | 0. 32* | 191. 12 |
| | JUNCTI ON | | | | |
| 1220. 00- | | 0.88 Dc | 74. 13 | 0. 29* | 225. 48 |
| | FRI CTI ON | | | | |
| 1215. 00- | | 0.88*Dc | 74. 13 | 0.88*Dc | 74. 13 |
| | JUNCTI ON | 4 40 | 05.40 | 0 0 4 | 1/0.00 |
| | EDI OTI ON | 1. 19 | 85. 40 | 0. 36* | 163. 80 |
| | FRI CTI ON | 0.00*D- | 74 12 | 0.00*D- | 74 10 |
| | CATCH DAG | 0. 88*Dc | 74. 13 | 0.88*Dc | 74. 13 |
| 1210 00 | CATCH BAS | | 41 12 | 0 00 00 | 2F 27 |
| 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 PIPE FLOW = 5.20 FLOWLINE ELEVATION = PIPE FLOW = 5.20 CFS ASSUMED DOWNSTREAM CONTROL HGL = PIPE DIAMETER = 18.00 INCHES

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

Page 1

```
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+
                                             ENERGY(FT)
                                                           MOMENTUM (POUNDS)
  CONTROL(FT)
                         (FT)
                                (FT/SEC)
         0.000
                        0.531
                                   9. 280
                                                  1.869
                                                                  101. 26
                                   9.080
                        0.540
                                                  1.821
                                                                   99.55
         2. 115
         4. 260
                        0.548
                                                  1. 776
1. 734
                                                                   97.92
                                  8. 888
                                 8. 704
8. 526
8. 355
8. 190
         6.438
                        0.557
                                                                   96.38
                        0.566
                                                                   94.91
         8.653
                                                  1.695
         10. 909
                        0.574
                                                                   93.51
                                                  1.659
         13. 209
                        0.583
                                                  1.625
                                                                   92.19
        15. 558
                        0.591
                                  8. 031
                                                  1. 593
                                                                   90.93
                                                                   90.71
        16.000
                        0. 593
                                   8.003
                                                  1. 588
 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:
                 FLOW
                       DI AMETER ANGLE
                                            FLOWLI NE
      PI PE
                                                       CRI TI CAL
                                                                   VELOCITY
                 (CFS)
5. 20
5. 20
                         (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                                                                   (FT/SEC)
                           18. 00<sup>°</sup>
                                     60. 00<sup>°</sup>
    UPSTREAM
                                             139. 03
                                                          0.88
                                                                     23. 480
                                                                     9. 283
0. 000
   DOWNSTREAM
                           18.00
                                              138. 70
                                                          0.88
                                             0.00
                   0.00
                                      0.00
    LATERAL #1
                            0.00
                                                          0.00
                          0.00
                                     0.00
                                               0.00
   LATERAL #2
                   0.00
                                                          0.00
                                                                      0.000
                   O. OO===Q5 EQUALS BASIN INPUT===
      Q5
  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)+FRI CTI ON LOSSES

UPSTREAM: MANNI NG'S N = 0.01300; FRI CTI ON SLOPE = 0.45880

DOWNSTREAM: MANNI NG'S N = 0.01300; FRI CTI ON SLOPE = 0.03390

AVERAGED FRI CTI ON SLOPE IN JUNCTI ON 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)
 JUNCTI ON 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 DIAMETER = 18.00 INCHES
 PIPE FLOW = 5. 20 CFS
                                        MANNING'S N = 0.01300
 PIPE LENGTH =
                  140.00 FEET
                                      Page 2
```

```
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(POUN
                                                                     MOMENTUM (POUNDS)
           0.000
                            Ò. 321
                                      18. 735
                                                          5.775
                                                                             191.12
           0.414
                                                                             192.72
                                        18.896
                            0.319
                                                          5.867
                            0. 317
0. 315
                                        19. 061
19. 228
                                                                             194. 34
195. 99
                                                          5.962
           0.850
           1. 310
1. 796
                                                          6.060
                                        19. 397
                            0.314
                                                                             197.66
                                                          6. 159
                                                      6. 159
6. 262
6. 366
6. 474
6. 584
6. 697
6. 813
6. 931
7. 053
7. 178
7. 307
7. 439
7. 574
7. 713
7. 855
8. 002
8. 152
8. 307
8. 466
8. 630
8. 798
                            0. 312
                                        19. 569
                                                          6. 262
                                                                             199. 37
           2. 311
                                        19. 744
           2.857
                            0.310
                                                                             201.09
           3. 439
                            0.308
                                       19. 921
                                                                             202.85
                            0.306
                                       20. 101
           4.061
                                                                             204.64
                                       20. 284
           4.726
                            0.304
                                                                             206.45
           5.442
                            0.302
                                       20. 470
                                                                             208.29
                                       20. 659
20. 851
21. 046
21. 244
                            0. 300
0. 298
                                                                             210.17
           6. 215
           7.053
                                                                             212.07
                            0. 296
           7. 967
                                                                             214.01
           8.971
                            0. 294
                                                                             215.98
          10.082
                            0. 292
                                       21. 446
                                                                             217.98
                           0. 290
                                       21. 651
                                                                             220.02
          11. 322
                           0. 288
                                       21.859
          12. 722
                                                                             222.09
                                       22. 071
22. 287
          14. 325
16. 193
                            0. 286
                                                                             224.20
                            0. 285
                                                                             226.34
                                        22. 506
22. 728
          18. 426
                            0. 283
                                                                             228.52
                            0. 281
          21. 185
                                                                             230.74
                                        22. 955
23. 186
                            0. 279
0. 277
          24. 779
                                                                             233.00
                                    22. 955 8. 466
23. 186 8. 630
23. 420 8. 798
23. 473 8. 835
          29.895
                                                                             235.29
                           0. 275
          38. 745
                                                                             237.63
                          0. 274
         140.000
                                                                             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:
                    FLOW DIAMETER ANGLE FLOWLINE
       PI PE
                                                                 CRI TI CAL
                                                                              VELOCITY
                             (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                    (CFS)
                                                                              (FT/SEC)
                      5. 20
5. 20
                             18. 00 15. 00 205. 04
     UPSTREAM
                                                                    0. 88
                                                                                22. 207
    DOWNSTREAM
                                                                                 18.740
                                18.00
                                                      204.71
                                                                    0.88
                              0.00
    LATERAL #1
                      0.00
                                            0.00
                                                        0.00
                                                                    0.00
                                                                                 0.000
    LATERAL #2
                      0.00
                                                                    0.00
                                                                                 0.000
                                 0.00
                                           0. 00
                                                        0.00
                      O. OO===Q5 EQUALS BASIN INPUT===
       05
  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>
                                            Page 3
```

```
*************************
 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+
                     (FT)
                                  (FT/SEC)
   CONTROL(FT)
                                               ENERGY(FT)
                                                              MOMENTUM (POUNDS)
                                                    1. 242
                          0.878
          0.000
                                     4.837
                                                                      74. 13
                         0.853
                                                     1.243
                                                                      74.22
          0.003
                                     5.007
                                  5. 007
5. 191
5. 389
5. 604
5. 837
6. 090
6. 365
                                                     1. 247
          0.011
                         0.829
                                                                       74.51
                                                     1. 255
1. 267
1. 284
                         0.804
                                                                       74.99
          0.025
          0.047
                         0.779
                                                                       75.70
                         0. 755
          0.077
                                                                       76.65
                         0.730
          0. 118
                                                    1. 306
                                                                      77.85
                                                                      79.34
                         0.705
          0.170
                                                    1. 335
                                   6. 666
6. 996
                         0. 681
                                                                      81.15
          0.236
                                                    1. 371
          0.320
                         0. 656
                                                    1. 417
                                                                      83.30
                                    7. 359
7. 759
                                                    1. 473
          0. 423
                         0. 631
                                                                      85.84
          0.552
                         0.607
                                                    1. 542
                                                                      88.82
                         0.582
                                    8. 201
                                                                      92.28
          0.711
                                                     1. 627
          0.907
                         0.557
                                    8. 694
                                                     1.732
                                                                      96.30
                                                                      100.95
          1. 151
                         0.533
                                    9. 244
                                                    1.860
          1.455
                         0.508
                                    9.862
                                                    2.019
                                                                      106.33
                                                 2. 216
2. 460
2. 768
                         0.483
                                    10. 559
          1.836
                                                                      112.58
                         0.459
                                    11. 350
                                                                      119.82
          2. 321
          2.945
                         0.434
                                    12. 255
                                                                      128.27
                                   13. 298
14. 509
15. 930
17. 616
                         0.409
          3.763
                                                    3. 157
                                                                      138. 15
                                                                      149.79
                         0. 385
          4.862
                                                    3. 656
                         0. 360
0. 335
          6.392
                                                    4.303
                                                                      163.58
                                                    5. 157
                                                                      180.09
          8.638
                                   17.616
19.640
22.106
22.200
                         0. 311
         12. 248
                                                    6.304
                                                                      200.07
                        0. 286
         19. 318
                                                    7.879
                                                                      224.55
                        0. 285
                                                    7. 943
         36, 000
                                                                     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:
       PI PE
                  FLOW
                          DI AMETER
                                      ANGLE
                                              FLOWLI NE
                                                          CRI TI CAL
                                                                       VELOCITY
                           (INCHES) (DEGREES) ELEVATION DEPTH(FT.)
                   (CFS)
                                                                       (FT/SEC)
                    5. 20
5. 20
     UPSTREAM
                                                             0. 88
                                                                       15. 95́8
                             18. 00<sup>°</sup>
                                       90.00
                                                 225. 49
                                                 225. 16
                                                             0.88
                                                                         4.839
    DOWNSTREAM
                             18.00
    LATERAL #1
                                       0. 00
                    0.00
                              0.00
                                                   0.00
                                                             0.00
                                                                          0.000
    LATERAL #2
                                                             0.00
                                                                          0.000
                    0.00
                              0.00
                                                   0.00
                    O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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)+FRICTIÓN LOSSES

1230_V. RES MANNI NG' S N = 0.01300; FRI CTI ON SLOPE = 0.15397 MANNI NG' S N = 0.01300; FRI CTI ON SLOPE = 0.00586 UPSTREAM: DOWNSTREAM: AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.07992 JUNCTION LENGTH = 4.00 FEET FRICTION LOSSES = 0.320 FEET ENTRANCE LOSSES)
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (3.402)+(0.000) = 3.402 ENTRANCE LOSSES = 0.000 FEET 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: ______ SPECIFIC PRESSURE+ FLOW DEPTH VELOCITY DISTANCE FROM (FT) (FT/SEC) CONTROL(FT) ENERGY(FT) MOMENTUM (POUNDS) Ò. 878 1. 242 74. 13 0.000 4.837 1. 243 74. 22 0.003 0.853 5.008 5. 191 5. 389 5. 604 1. 247 1. 255 0.829 74.51 0.011 0.804 74.99 0.025 0.779 5. 604 5. 837 6. 090 6. 365 6. 666 6. 996 7. 359 7. 759 8. 202 8. 694 9. 244 9. 862 75.70 0.047 1.267 0. 755 0. 730 0.077 1. 284 76.65 0.117 1. 306 77.85 0.705 1. 335 79.35 0. 170 81.15 0. 236 0. 681 1. 371 0. 656 1. 417 0.320 83. 31 1. 473 0.631 85.85 0.423 0.552 0. 607 1. 542 88.82 0.710 0. 582 1. 627 92. 28 1. 627 1. 732 1. 861 2. 019 2. 216 2. 461 2. 768 3. 157 3. 656 0.907 0. 557 96.30 1. 150 0.533 100.95 9.80∠ 10.559 11.351 0.508 1.454 106.34 112.58 1.836 0. 483 11. 351 12. 256 2. 320 0. 459 119.83 2. 944 0.434 128. 28 13. 299 3. 762 0.409 138. 16 14. 511 3. 656 149.80 4.860 0. 385 0. 360 0. 360 6.390 15. 932 4.304 163.60 15. 932 4. 304 15. 953 4. 314 6. 420 163.80 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>

오 **-**



5620 Friars Road San Diego, CA 92110-2596

Tel: (619) 291-0707 Fax: (619) 291-4165 Date

Job No. Page 3/312019 18022-F

Fax: (619) 291-4165 Done By Energy Dissipater @ Node 1350 System 13 Checked By 36" 50 End of 522-105 standard 5220-105 Facing class Rip Rap @ 1.5:1(H:V) Side Slope 12' Riprap -11 * NOT TO SCALE Per geotechnical engineer's recommendation. For last 5 pt install double

Thickness rip-rap - T = 2.8'

Date: 3/31/2019

SDD-105 Rip-Rap Sizing

1350 **Outfall Location:**

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 С 3 **12.33** feet

From SDD-105 standard detail

Solving for H, depth of weir flow

1.09 feet H depth of weir flow

Area, A = Length * Height 13.4 square-feet

3.1 feet/second Velocity, V

OK Velocity < 5 ft/sec. Hence, non-erosive

STEP 4

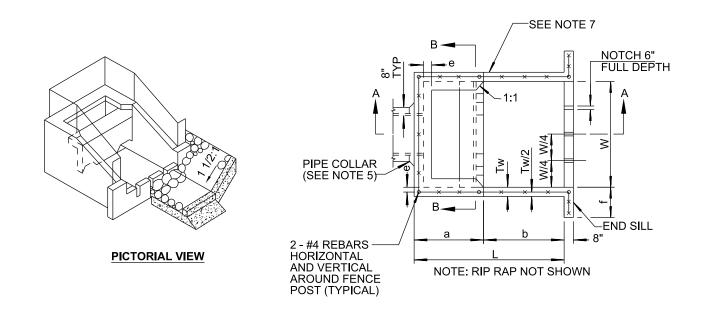
Check for depth of weir flow, H < d+ (g/2)

From SDD-105 standard detail

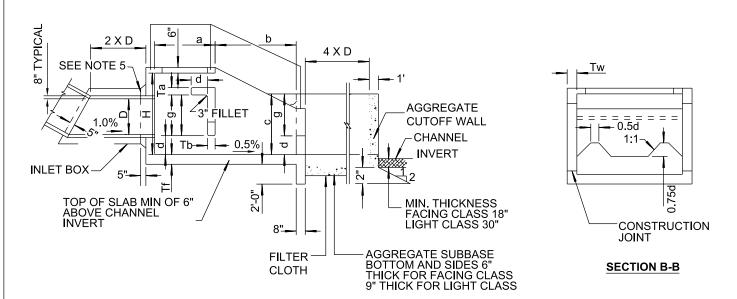
d 1.6 feet 3.5 feet g d + (g/2)3.3 feet

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.



PLAN



SECTION A-A

NOTES

SEE TABLE ON SHEET 2 FOR DIMENSIONS, SEE NOTES ON SHEET 2.

SHEET 1 OF 2

| UPDATED | BD | J. NAGELVOORT J. NAGELVOORT | 08/15 | CITY OF SAN DIEGO – STANDARD DRAWING | | TUNGER 9/10/18 |
|-----------|----|-----------------------------|-------|--------------------------------------|---------|--------------------------|
| UPDATED | AB | J. NAGELVOORT | 02/16 | CONCRETE ENERGY DISSIPATOR | | ATOR / R.C.E. 56523 DATE |
| REDRAFTED | CD | J. NAGELVOORT | 09/18 | JOHORETE ENERGY DIOON ATOR | | |
| | | | | | DRAWING | SDD-105 |
| | | | | | NUMBER | 3DD-103 |

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" |
| Н | 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" |
| а | 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" |
| С | 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" |
| е | 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" | | | | | |
| Та | 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.
- 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 ORIGINAL* | BY KA | APPROVED J. NAGELVOORT | DATE 01/12 | CITY OF SAN DIEGO - STANDARD DRAWING | RECOMMENDED BY THE CITY OF SAN DIEGO STANDARDS COMMITTEE |
|--------------------|----------|-----------------------------|---------------|--------------------------------------|--|
| | | J. NAGELVOORT J. NAGELVOORT | | | Attungea 9/10/18 |
| REDRAFTED | CD | J. NAGELVOORT | 09/18 | CONCRETE ENERGY DISSIPATOR | COORDINATOR R.C.E. 56523 DATE DRAWING SDD-105 |
| | | | | | NUMBER SDD-103 |

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE (Reference: LACFCD, LACRD, AND OCEMA HYDRAULICS CRITERION)
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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 619-291-410 Fax 619-291-4165

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 | n RUN . | DOWNSTRÉA | AM RUN |
|-----------|------------|----------|-------------------|-----------|-------------------------------|
| NODE | MODEL | PRESSURE | PRESSURE+ | FLOW | PRESSURE+ |
| NUMBER | PROCESS | HEAD(FI) | MOMENTUM (POUNDS) | DEPIH(FI) | MOMENTUM (POUNDS) 2437. 75 |
| 1350.00- | FRI CTI ON | 2. II DC | 949. 68 | 0.76^ | 2437.75 |
| | PRICITON | 2.11 Dc | 949. 68 | 0. 72* | 2615. 56 |
| | JUNCTI ON | 2 | 717100 | 0.72 | 2010.00 |
| 1345.00- | | 2.42 | 848. 63 | 0. 58* | 2770. 06 |
| } | FRI CTI ON | 4 07 5 | 707.07 | 0 (54 | 2252 12 |
| 1342. 50- | HINCTLON | 1.97 Dc | 797. 87 | 0. 65* | 2352. 18 |
| 1342. 50- | JUNCTI ON | 1.97 Dc | 797. 87 | 0. 62* | 2503. 68 |
| | FRI CTI ON | 1. 77 BC | 777.07 | 0.02 | 2303.00 |
| 1340.00- | | 1.97 Dc | 797. 87 | 1. 54* | 868. 19 |
| | JUNCTI ON | | | | |
| 1340.00- | | 1. 97*Dc | 797. 87 | 1. 97*Dc | 797. 87 |
| 1335. 00- | FRI CTI ON | 2. 03* | 798. 73 | 1.97 Dc | 797. 87 |
| | JUNCTI ON | 2.03 | 770.73 | 1. 77 DC | 777.07 |
| 1335.00- | | 2. 79* | 694. 33 | 1. 42 | 382. 71 |
| } | FRI CTI ON | | | | |
| 1332. 00- | | 2. 24* | 505. 94 | 1.47 Dc | 381. 99 |
| 1332.00- | JUNCTI ON | 2. 38 | 496. 74 | 0.74* | 621. 45 |
| 1332.00- | FRI CTI ON | 2. 30 | 470.74 | 0.74 | 021.45 |
| 1330.00- | | 1. 49*Dc | 359. 10 | 1. 49*Dc | 359. 10 |
| } | CATCH BAS | IN | | | |
| 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:

```
FLOWLINE ELEVATION = 138.67
 NODE NUMBER = 1350.00
 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(POUNI
0.000 0.723 31.904 16.538 2615.56
10.000 0.761 29.674 14.443 2437.75
                                                                 MOMENTUM (POUNDS)
 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:
                   FLOW DIAMETER ANGLE
       PI PE
                                                FLOWLI NE
                                                              CRI TI CAL
                                                                          VELOCITY
                           (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
                    36. 80
41. 90
5. 10
                            36. 00 7. 82 139. 10
36. 00 - 138. 77
     UPSTREAM
                                                             1. 97
                                                                             38.647
    DOWNSTREAM
                                                                 2. 11
                                                                             31.913
                                         90.00
                                                                             4.804
                              18.00
                                                   140.60
                                                                0.87
    LATERAL #1
                     0.00 0.00
                                        0.00 0.00
    LATERAL #2
                                                                0.00
                                                                             0.000
       05
                     O. OO===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

REAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.46438

ISTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.24293
  UPSTREAM:
 DOWNSTREAM:
 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 DIAMETER = 36.00 INCHES
 PIPE FLOW =
                      36.80 ČFS
                                          Page 2
```

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 (POUN
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 0.619 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 23.170 2770.06 -----MOMENTUM (POUNDS) 2352. 18 2367. 36 2382. 72 2414.00 2478. 83 2495. 54 2512. 44 267 2693. 50 2712. 96 2732. 61 2752, 52 2752. 52 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 CRI TI CAL **VELOCITY** (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) (CFS) 36.00 8.50 188.38 1.97 UPSTREAM `36. ⁸⁰ 34.874 DOWNSTREAM 36.80 36.00 188. 05 1. 97 32.723 0.00 0. 00 0. 00 0. 00 0. 00 LATERAL #1 0.00 0.00 0.000 0.00 LATERAL #2 0.00 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== 05 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> Page 3

```
********************
  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(POUL
0.000 1.538 10.082 3.118 868.19
                                                                MOMENTUM (POUNDS)
                                                       3. 118
                                                                        868. 19
                          1. 499
          0. 130
                                     10. 418
                                                       3. 185
                                                                        883.35
          0. 283
                                     10. 777
                          1.460
                                                                        900.45
                                                      3. 264
                          1. 421
1. 381
1. 342
1. 303
                                     11. 161
11. 573
12. 015
                                                      3. 356
                                                                        919.65
          0.460
          0.666
                                                       3.462
                                                                        941.11
                                                      3.585
          0.905
                                                                        965.04
                                     12. 491
          1. 183
                                                      3.727
                                                                        991.67
                                                      3.892
                          1. 264
                                     13.005
           1.505
                                                                       1021. 26
                                                   4. 082
4. 302
           1.879
                          1. 225
                                     13.560
                                                                       1054. 10
                         1. 185
           2. 315
                                     14. 162
                                                                       1090.53
                          1. 146
                                     14. 816
           2.823
                                                      4. 557
                                                                       1130. 95
                                     15. 528
           3. 420
                          1. 107
                                                      4.853
                                                                       1175.81
                                                  4. 853
5. 199
5. 603
6. 077
6. 637
7. 300
8. 091
9. 039
10. 187
11. 586
13. 308
15. 451
18. 149
19. 505
                                     16. 306
17. 158
                          1.068
          4. 121
                                                                       1225.65
                          1. 029
          4. 951
                                                                       1281.09
                                     18.096
                                                                       1342.86
          5.940
                          0. 990
          7. 126
                          0. 950
                                     19. 131
                                                                       1411.85
                                                                       1489. 10
          8.563
                          0. 911
                                     20. 278
                                     21. 554
22. 982
         10.326
                          0.872
                                                                       1575.87
         12.519
                          0.833
                                                                       1673.69
                          0. 794
                                     24. 588
         15. 299
                                                                       1784.42
                                     26. 403
28. 469
30. 837
33. 572
         18. 913
23. 780
                          0. 754
0. 715
                                                                       1910.39
                                                                       2054.49
                          0.676
                                                                       2220.37
         30. 688
                                    33. 572
34. 863
                          0.637
                                                                       2412.72
         41. 423
         50.030
                          0.620
                                                     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:
       PI PE
                   FLOW
                          DIAMETER ANGLE
                                                FLOWLI NE
                                                             CRI TI CAL
                                                                         VELOCITY
                            (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
     UPSTREAM
                    36.80
                              36. 00 0. 00 215. 29
                                                            1. 97
                                                                             7.466
                                                               1. 97
    DOWNSTREAM
                    36.80
                              36.00
                                          _
                                                   214. 96
                                                                            7. 466
                                     0. 00
0. 00
                                                 0. 00
0. 00
                               0.00
                     0.00
                                                               0.00
                                                                            0.000
    LATERAL #1
                     0.00
    LATERAL #2
                               0.00
                                                               0.00
                                                                            0.000
                     O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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
                MANNING'S N = 0.01300;
                                        FRICTION SLOPE = 0.00515
  DOWNSTREAM:
                                          Page 4
```

```
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00515
  JUNCTION LENGTH = 4.00 FEET
 FRICTION LOSSES = 0.021 FEET ENTRANCE LOSSES)
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.330)+(0.000) = 0.330
                                           ENTRANCE LOSSES = 0.000 FEET
  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
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)
                                                  2. 838
                                                                         797.87
                           1. 973
                                     7. 464
          0.000
                                                        2.838
          0.013
                          1. 975
                                       7.454
                                                                         797.87
                          1. 977
                                                                         797.88
          0.054
                                      7. 445
                                                       2.838
                          1. 980
          0. 126
                                       7. 435
                                                        2.838
                                                                         797.88
                          1. 982
                                      7. 425
          0. 230
                                                        2.838
                                                                          797.89
                                      7. 416
                           1. 984
                                                        2.839
                                                                         797.91
          0.371
                          1. 986
                                       7.406
                                                        2.839
                                                                          797.92
          0.552
                                      7. 397
                          1. 989
                                                        2.839
                                                                         797.94
          0.778
                                    7. 397
7. 387
7. 378
7. 369
7. 359
7. 350
7. 341
7. 331
7. 322
7. 313
7. 304
7. 295
7. 285
7. 276
7. 267
7. 258
7. 249
7. 240
          1.054
                          1. 991
                                                        2.839
                                                                         797.97
                          1. 993
                                                       2.839
                                                                         797.99
           1. 385
           1.779
                          1. 995
                                                       2.839
                                                                         798.02
                          1. 997
           2. 245
                                                       2.839
                                                                         798.05
                          2. 000
2. 002
2. 004
2. 006
2. 009
           2. 793
                                                       2.839
                                                                         798.09
                                                       2.839
           3. 436
                                                                         798.12
           4. 191
                                                        2.839
                                                                          798.16
                                                        2.839
                                                                         798.21
          5.080
                                                       2.840
                                                                         798.25
          6. 131
          7. 382
                          2.011
                                                    2. 840
2. 840
2. 840
2. 841
2. 841
2. 841
                                                       2.840
                                                                         798.30
          8.886
                          2.013
                                                                         798.36
         10.722
                          2. 015
                                                                         798.41
                          2. 018
                                                                         798.47
         13. 011
                          2. 020
                                                                          798.53
         15.958
         19. 944
                           2.022
                                  7. 258
7. 249
7. 240
7. 240
                                                                          798.59
         25.828
                           2.024
                                                                          798.66
                                                                         798.73
                           2.027
                                                        2.841
         36. 364
                                                   2.841
                          2. 027
         84.000
                                                                         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:
                  FLOW DIAMETER ANGLE
                                                FLOWLI NE
       PI PE
                                                             CRI TI CAL
                                                                          VELOCITY
                            (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                   (CFS)
     UPSTREAM
                    21. 00
                              36. 00<sup>°</sup>
                                      90. 00 216. 07 1. 47 3. 066
                                                                1. 97
    DOWNSTREAM
                    36.80
                              36.00
                                                   215. 69
                                                                              7. 242
                                        48. 30
                    14.30
                              24.00
                                                   216.69
                                                                1.36
    LATERAL #1
                                                                             5. 315
                                         Page 5
```

1. 50 18. 00 14. 80 217. 19 LATERAL #2 0. 46 1. 082 O. OO===Q5 EQUALS BASIN INPUT=== Q5 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(POUN
0.000 2.789 3.065 2.935 694.33 MOMENTUM (POUNDS) 694.33 2.736 2.886 673.54 12. 481 3. 104 3. 147 3. 195 3. 248 3. 306 3. 368 3. 436 3. 509 3. 587 3. 104 2. 683 24.862 2.837 653.23 2.631 2. 789 37. 158 633.44 2.578 49. 379 2.742 614.17 2. 525 2. 695 61. 533 595.46 2. 473 2. 420 2. 367 73.626 2.649 577.33 2.603 85.661 559.80 97.640 542.90 2.559 2. 315 109. 564 2.515 526.64 ა. 672 3. 702 2. 262 121. 434 2. 471 511.06 125. 440 2. 244 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:

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED: DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-Page 6

DI AMETER

30.00

36.00

36.00

0.00

O. OO===Q5 EQUALS BASIN INPUT===

ANGLE

58. 70

90. 00 217. 00

58. 70 0. 00 217. 00 0. 00

FLOWLINE CRITICAL

1. 49

1.47

0.40

0.00

(INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)

216.67

217.00

VELOCI TY

16. 006

3. 703 0. 565

0.000

FLOW

(CFS) 19. 30

21.00

1.70

0.00

PI PE

UPSTREAM

DOWNSTREAM

LATERAL #1

LATERAL #2

Q5

```
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 LOSSES = 0.127 FEET ENTRANCE LOSSES = 0.000
                                           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)
                                                   ENERGY(FT)
                                                                   MOMENTUM (POUNDS)
                                    (FT/SEC)
                            1. 490
           0.000
                                        6. 325
                                                         2. 111
                                                                            359.10
                           1. 455
                                                         2. 113
                                                                            359.41
           0.014
                                        6.509
                                                                            360. 35
361. 97
                            1.420
                                       6. 705
                                                         2. 118
          0.057
                                        6. 913
                            1.385
                                                         2. 127
           0.133
                                       7. 136
7. 374
                            1.350
                                                         2. 141
                                                                            364.30
           0. 247
           0.405
                           1.315
                                                         2. 160
                                                                            367.40
                                     7. 374
7. 629
7. 902
8. 196
8. 512
8. 852
9. 221
9. 613
                                                                            371.31
                           1. 280
                                                         2. 184
          0.612
           0.876
                           1. 245
                                                        2. 215
                                                                            376.11
           1. 206
                           1. 210
                                                        2. 254
                                                                            381.86
                                                        2. 301
2. 358
                           1. 175
           1.614
                                                                            388.64
           2. 112
                           1. 140
1. 105
1. 070
                                                                            396.53
           2. 718
                                                         2.426
                                                                            405.64
                                                         2. 508
           3. 452
                                                                            416.08
                           1.035
                                      10.052
                                                        2.605
           4.340
                                                                            428.00
                                                     2. 005
2. 721
2. 858
3. 021
3. 215
3. 447
3. 724
4. 056
4. 457
                           1.000
                                                                            441.53
           5. 417
                                      10. 524
           6.726
                           0. 965
                                       11. 038
                                                                            456.87
                           0. 930
          8. 327
                                       11. 602
                                                                            474.22
                           0.895
         10. 301
                                       12. 220
                                                                            493.84
                                       12. 903
13. 658
         12.763
                           0.860
                                                                            516.02
          15.884
                           0.825
                                                                            541.11
                           0. 790
0. 755
                                       14. 498
15. 436
          19. 932
                                                                            569.53
          25. 355
                                               4. 457
4. 714
                                                                           601.80
                                   15. 436
16. 001
                           0.736
         29. 570
                                                                           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>
                                           Page 7
```

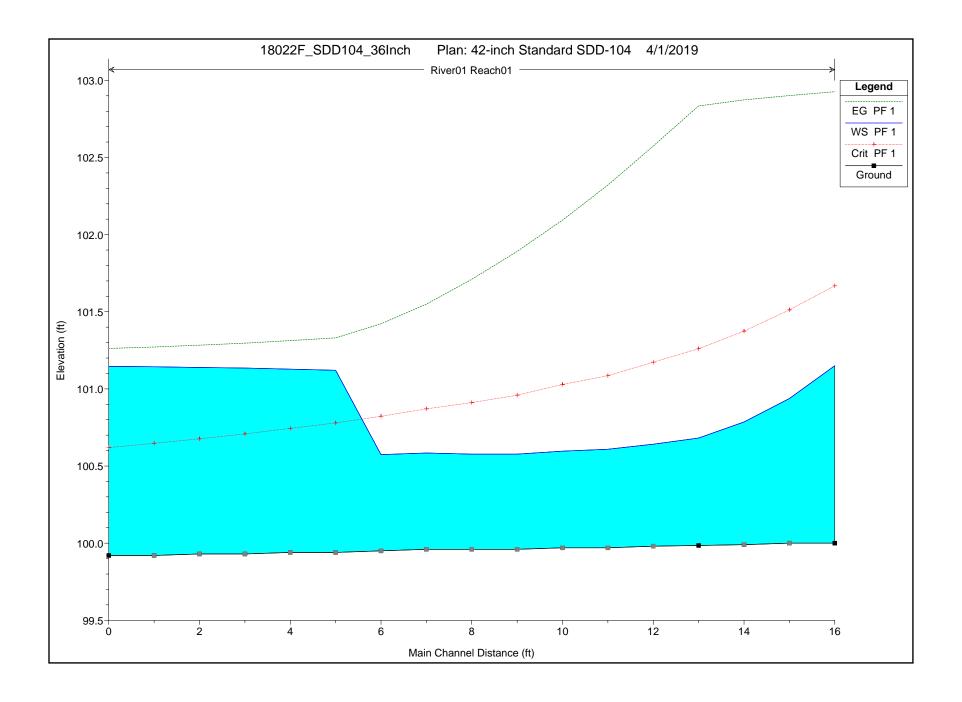
UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1330.00 FLOWLINE ELEVATION = 220.72
ASSUMED UPSTREAM CONTROL HGL = 222.21 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

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

| 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 |



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:

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******* 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 NUMBER | MODEL I PROCESS I | PRESSURE HEAD(FT) | PRESSURE+ MOMENTUM(POUNDS) 800.77 | FLOW DEPTH(FT) | PRESSURE+ MOMENTUM (POUNDS) | | |
| 1570.00- | FRI CTI ON | 1. 98 DC | 800.77 | 1.50^ | 888. /3 | | |
| 1565.00- | JUNCTI ON | 1.98 Dc | 800. 77 | 1. 47* | 897. 98 | | |
| 1565.00- | | 2. 57 | 886. 96 | 0. 81* | 1745. 62 | | |
| 1560.00- | FRI CTI ON | 2. 24 | 819. 73 | 0. 71* | 2076. 68 | | |
| } 1560. 00- | JUNCTI ON | 1.98 Dc | 800. 77 | 0. 64* | 2395. 34 | | |
| } | FRI CTI ON | | | | | | |
| 1555. 00- } | JUNCTI ON | 1.98 Dc | 800. 77 | 0. 69* | 2159. 48 | | |
| 1555. 00- } | FRI CTI ON | 1.98 Dc | 800. 77 | 0. 65* | 2340. 69 | | |
| 1535. 00- | | 1.98 Dc | 800.77 | 1. 93* | 801. 51 | | |
| 1535. 00- | | 1.98 Dc | 800.77 | 1. 87* | 804.38 | | |
| } 1530. 00- | FRI CTI ON | 1. 98*Dc | 800. 77 | 1. 97*Dc | 800. 77 | | |
| } 1530. 00- | JUNCTI ON | | 894. 13 | 1. 64 | 839. 60 | | |
| } | FRI CTI ON | } HY | DRAULIC JUMP | | | | |
| 1525. 00 <i>-</i> } | JUNCTI ON | 1.98 DC | 800. 77 | 1. 81* | 809. 96 | | |
| 1525. 00- | | 1.98 Dc | 800. 77 | 1. 73* | 820. 91 | | |
| 1520.00- | | 1. 98*Dc | 800.77 | 1. 98*Dc | 800. 77 | | |
| 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 Page 1

1570 V. RES CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA DESIGN MANUALS. ************************************ DOWNSTREAM PIPE FLOW CONTROL DATA: NODE NUMBER = 1570.00 PIPE FLOW = 36.90 CFS FLOWLINE ELEVATION = 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 MANNING'S N = 0.01300NORMAL DEPTH(FT) = 1.59 CRITICAL DEPTH(FT) = 1.98 ___________ UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.47 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION: ______ DI STANCE 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. 669 10. 625 10. 582 10. 539 891.74 1. 489 3. 214 10. 390 10. 496 10. 475 3. 205 889.72 14.093 1. 493 16.000 1. 496 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: FLOW DIAMETER ANGLE FLOWLINE PI PE CRI TI CAL **VELOCITY** (CFS) (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC) 36. **9**0 100. 28 1. 98 99. 91 1. 98 36.00 60.00 UPSTREAM 23. 964 36. 90 DOWNSTREAM 36.00 10.673

 0.00
 0.00
 0.00
 0.00

 0.00
 0.00
 0.00
 0.00

 0.00 0.00 0.000 LATERAL #1 LATERAL #2 0.00 0.000 O. OO===Q5 EQUALS BASIN INPUT=== 05LACFCD 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(POUT
0.000 0.712 28.705 13.515 2076.68
9.294 0.748 26.812 11.918 1944.23
                                                           MOMENTUM (POUNDS)
                               28. 705
26. 812
25. 129
23. 957
                                                                 2076.68
                                                                 1944. 21
                                  25. 129
23. 957
10. 594
9. 727
         18. 691
                0. 783
0. 810
                                                                 1826.92
        26.000
                                                                 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:
                         DI AMETER ANGLE
                 FLOW
                                                        CRI TI CAL
      PI PE
                                            FLOWLI NE
                                                                   VELOCITY
                         (INCHES) (DEGREES) ELEVATION
                  (CFS)
                                                       DEPTH(FT.)
                                                                    (FT/SEC)
                                                          1. 98
    UPSTREAM
                   36. 90
                            36. 00<sup>°</sup>
                                     25. 00<sup>°</sup>
                                              100.87
                                                                     33. 243
                                                          1. 98
   DOWNSTREAM
                  36.90
                                              100.54
                                                                     28.714
                            36.00
                   0.00
                                      0.00
   LATERAL #1
                            0.00
                                                0.00
                                                          0.00
                                                                      0.000
   LATERAL #2
                   0.00
                            0.00
                                      0.00
                                                0.00
                                                          0.00
                                                                      0.000
                   O. OO===Q5 EQUALS BASIN INPUT===
      Q5
 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 = 100 MANNING
      36.90 CFS PIPE DIAMETER = 36.00 INCHES MANNING
      36.00 FEET MANNING
      N = 0.01300

   -----
 NORMAL DEPTH(FT) = 0.64 CRITICAL DEPTH(FT) = 1.98
__________
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.69
 ______
```

1570_V. RES GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

| DI STANCE FROM CONTROL (FT) 0. 000 1. 428 2. 924 4. 494 6. 145 7. 884 9. 722 11. 669 13. 736 15. 939 18. 296 20. 828 23. 560 26. 525 29. 764 33. 329 37. 288 41. 736 46. 802 52. 679 59. 662 68. 251 79. 377 95. 137 96. 000 | FLOW DEPTH (FT) 0. 692 0. 690 0. 688 0. 686 0. 684 0. 682 0. 677 0. 675 0. 673 0. 671 0. 669 0. 666 0. 664 0. 662 0. 660 0. 658 0. 656 0. 653 0. 651 0. 649 0. 647 0. 645 0. 643 | VELOCITY (FT/SEC) 29. 885 30. 018 30. 152 30. 287 30. 423 30. 560 30. 698 30. 838 30. 978 31. 120 31. 263 31. 406 31. 551 31. 698 31. 845 31. 994 32. 144 32. 295 32. 447 32. 601 32. 755 32. 912 33. 069 33. 228 | SPECIFIC ENERGY(FT) 14. 569 14. 691 14. 814 14. 938 15. 065 15. 192 15. 322 15. 453 15. 586 15. 720 15. 856 15. 720 16. 134 16. 276 16. 419 16. 564 16. 711 16. 861 17. 012 17. 165 17. 320 17. 477 17. 636 17. 798 | PRESSURE+ MOMENTUM (POUNDS) 2159. 48 2168. 83 2178. 25 2187. 74 2197. 31 2206. 97 2216. 69 2226. 50 2236. 39 2246. 36 2256. 41 2266. 54 2276. 76 2287. 07 2297. 45 2307. 93 2318. 49 2329. 15 2339. 89 2350. 72 2361. 64 2372. 66 2383. 77 2394. 98 |
|--|--|--|---|---|
| NODE 1555. 00 : H | 0. 043 GL = < 131. 39 | 33. 233 92>; EGL= < | 17: 803 145. 269>; FLOWLII | 2373. 34 |
| ************** | | | | |
| FLOW PROCESS FROM UPSTREAM NODE 15 | 55.00 ELE\ | /ATION = 1 | 31. 03 (FLOW IS | = 5 SUPERCRI TI CAL) |
| CALCULATE JUNCTIO PIPE F UPSTREAM DOWNSTREAM LATERAL #1 LATERAL #2 Q5 | N LOSSES: | -D ANOLE | ELOWLINE OF | TTI CAL VELOCITY TH(FT.) (FT/SEC) 1. 98 32. 469 1. 98 29. 894 0. 00 0. 000 0. 00 0. 000 |
| LACFCD AND OCEMA DY=(Q2*V2-Q1*V1*C | FLOW JUNCTION DS(DELTA1) - Q3* TA4))/((A1+A2) ING'S N = 0.01 ING'S N = 0.01 SLOPE IN JUNC 4.00 FEET 1.014 FEET (DY+HV1-HV2)+ | FORMULAE US V3*COS(DELT)*16.1)+FRIC 1300; FRICT CTION ASSUME ENTR | SED: (A3) - (TION LOSSES) (ION SLOPE = 0.2) | 8305 2419 |
| NODE 1555.00 : H | | | | NE= < 131.030> |
| ************************************** | | TO NODE 1 ATION = 1 | 535.00 IS CODE : 74.49 (FLOW IS | = 1 SUPERCRI TI CAL) |
| CALCULATE FRICTIO | | | | |

1570_V. RES DIDE FLOW = 36.90 CES

| PIPE FLOW = PIPE LENGTH = | 36. 90 CFS 109. 11 FEET | 1570_V. PIPE DIAM MAN | FTFR = 36.00 L | NCHES 01300 |
|--|---|--|--|--|
| NORMAL DEPTH(FT) | 0.60 | CRI | TICAL DEPTH(FT) | = 1.98 |
| UPSTREAM CONTROL | _ ASSUMED FLOWDE | EPTH(FT) = | 1. 93 | ======================================= |
| GRADUALLY VARIE | FLOW PROFILE (| OMPHIED INF | $\bigcap PMATI \bigcap Ni$ | |
| DI STANCE FROM CONTROL (FT) 0. 000 0. 022 0. 062 0. 124 0. 209 0. 322 0. 468 0. 653 0. 883 1. 167 1. 516 1. 943 2. 467 3. 109 3. 899 4. 878 6. 098 7. 636 9. 602 12. 161 15. 575 20. 292 27. 165 38. 129 59. 429 109. 110 | 1. 237 1. 184 1. 131 1. 078 1. 025 0. 972 0. 919 0. 866 0. 812 0. 759 0. 706 0. 653 0. 653 | 10. 417 10. 910 11. 448 12. 040 12. 694 13. 420 14. 228 15. 132 16. 149 17. 299 18. 607 20. 106 21. 838 23. 855 26. 228 29. 053 32. 458 32. 458 | 3. 298 3. 432 3. 595 3. 794 4. 035 4. 329 4. 689 5. 130 5. 674 6. 351 7. 200 8. 275 9. 654 11. 448 13. 821 17. 023 17. 023 | 1218. 98 1293. 91 1380. 69 1481. 62 1599. 64 1738. 57 1903. 45 2101. 05 2340. 68 2340. 69 |
| ***** | ****** | ***** | ****** | ***** |
| FLOW PROCESS FRO UPSTREAM NODE | | /ATION = 1 | 74.78 (FLOW IS | SUPERCRITICAL) |
| CALCULATE JUNCTI PIPE UPSTREAM DOWNSTREAM LATERAL #1 LATERAL #2 Q5 | ON LOSSES: FLOW DIAMETE | ER ANGLE S) (DEGREES) 30.00) - 0 0.00 0 0.00 | FLOWLI NE CR ELEVATI ON DEP 174. 78 174. 49 0. 00 0. 00 | TITICAL VELOCITY TH(FT.) (FT/SEC) 1.98 7.971 1.98 7.694 0.00 0.000 0.000 |
| UPSTREAM: MAN | COS(DELTA1) - Q3° ELTA4))/((A1+A2) NNING'S N = 0.0° NNING'S N = 0.0° NN SLOPE IN JUNO = 4.00 FEET = 0.023 FEET = (DY+HV1-HV2)+ | *V3*COS(DELT)*16.1)+FRIC 1300; FRICT 1300; FRICT CTION ASSUME ENTR +(ENTRANCE L | A3) - TION LOSSES ION SLOPE = 0.0 ION SLOPE = 0.0 D AS 0.00580 ANCE LOSSES = 0SSES) 300 | 0554 |

```
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)
                                                     2. 843
                          1. 975
          Ò. 0Ó0
                                     7. 475
                                                                      8<del>0</del>0.77
          0.047
                          1.963
                                     7. 525
                                                     2.843
                                                                      800.81
                          1. 952
1. 940
          0.185
                                     7.576
                                                     2.844
                                                                      800.94
                                     7. 628
          0.421
                                                                      801.15
                                   7. 681
7. 681
                                                     2.844
          0. 765
                          1.929
                                                     2.845
                                                                      801.44
                                   7. 734
                                 7. 734
7. 788
7. 844
7. 900
7. 957
7. 969
                          1. 917
          1. 228
                                                     2.847
                                                                      801.82
                          1. 906
                                                     2.848
                                                                      802.29
          1.822
                         1.894
          2.560
                                                     2.850
                                                                      802.84
                         1.883
                                                                      803.49
          3. 461
                                                     2.852
                         1.871
          4.544
                                                     2.855
                                                                      804.22
          4.810
                         1.869
                                                     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:
                  FLOW DIAMETER ANGLE FLOWLINE (CFS) (INCHES) (DEGREES) ELEVATION
       PI PE
                                                           CRI TI CAL
                                                                       VELOCITY
                                                           DEPTH(FT.)
                                                                       (FT/SEC)
                    36. 90
                                                              1. 98
     UPSTREAM
                                    61. 50°
                                                 175. 19
                             36.00
                                                                          5.684
                   36.90
    DOWNSTREAM
                             36.00
                                                 174.82
                                                              1. 98
                                                                          7.475
                                                0.00
                             0.00
    LATERAL #1
                    0.00
                                        0.00
                                                             0.00
                                                                          0.000
    LATERAL #2
                    0.00
                              0.00
                                        0.00
                                                   0.00
                                                              0.00
                                                                          0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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)+FRI CTI ON LOSSES

UPSTREAM: MANNI NG'S N = 0. 01300; FRI CTI ON SLOPE = 0. 00282

DOWNSTREAM: MANNI NG'S N = 0. 01300; FRI CTI ON 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)
```

| | ON 1 000E0 (1 40E) | 1570_V. | RES | |
|---|--|--|--|--|
| CALCULATE FRICTI PIPE FLOW = PIPE LENGTH = | 36. 90 CFS 61. 90 FEET | CD): PIPE DIAM MAN | METER = 36.00 I NNING'S N = 0. | NCHES 01300 |
| HYDRAULIC JUMP: | DOWNSTREAM RUN | ANALYSIS RI | SULTS | |
| NORMAL DEPTH(FT) | = 1.59 | CRI | TICAL DEPTH(FT) |) = 1.98 ==================================== |
| UPSTREAM CONTROL | ASSUMED FLOWDE | EPTH(FT) = | 1. 81 | |
| GRADUALLY VARIED | FLOW PROFILE (| COMPUTED IN | FORMATION: | |
| DI STANCE FROM CONTROL (FT) 0.000 1.108 2.322 3.652 5.108 6.703 8.451 10.369 12.477 14.798 17.359 20.194 23.345 26.861 30.807 35.264 40.343 46.189 53.008 61.102 61.900 | FLOW DEPTH (FT) 1.807 1.799 1.790 1.782 1.773 1.764 1.756 1.747 1.739 1.730 1.722 1.713 1.704 1.696 1.687 1.679 1.670 1.653 1.644 1.644 | VELOCITY (FT/SEC) 8. 289 8. 337 8. 384 8. 433 8. 482 8. 532 8. 532 8. 633 8. 685 8. 737 8. 790 8. 844 8. 899 8. 954 9. 010 9. 066 9. 124 9. 182 9. 241 9. 301 9. 306 | SPECIFIC ENERGY (FT) 2.875 2.879 2.883 2.887 2.891 2.896 2.900 2.905 2.911 2.916 2.922 2.928 2.935 2.941 2.948 2.956 2.963 2.971 2.980 2.988 2.989 | PRESSURE+ MOMENTUM(POUNDS) 809. 96 810. 96 812. 02 813. 14 814. 31 815. 55 816. 84 818. 19 819. 61 821. 08 822. 62 824. 22 825. 89 827. 62 829. 42 831. 28 833. 21 835. 21 837. 28 839. 43 839. 60 |
| HYDRAULIC JUMP: | UPSTREAM RUN AI | NALYSIS RESU | JLTS | |
| DOWNSTREAM CONTR | OL ASSUMED FLO | WDEPTH(FT) = | = 2.59 ==================================== | ======================================= |
| GRADUALLY VARIED | | | FORMATION: | |
| DI STANCE FROM CONTROL (FT) 0. 000 2. 317 4. 591 6. 822 9. 007 11. 146 13. 237 15. 278 17. 265 19. 197 21. 070 22. 880 24. 624 26. 298 27. 895 29. 410 30. 838 32. 169 33. 396 | FLOW DEPTH (FT) 2. 592 2. 568 2. 543 2. 518 2. 494 2. 469 2. 444 2. 420 2. 395 2. 370 2. 346 2. 321 2. 296 2. 272 2. 247 2. 222 2. 198 2. 173 2. 148 | | 3. 077 3. 061 3. 045 3. 030 3. 015 3. 000 2. 986 2. 973 2. 959 2. 947 2. 935 2. 924 2. 913 2. 903 2. 893 2. 884 2. 876 2. 869 | PRESSURE+ MOMENTUM(POUNDS) 894. 13 887. 42 880. 92 874. 63 868. 56 862. 72 857. 10 851. 71 846. 56 841. 65 836. 99 832. 57 828. 42 824. 52 820. 90 817. 54 814. 47 811. 69 809. 21 |

```
1570_V. RES
                                                    2.862
         34.509
                         2.124
                                    6.896
                                                                    807.02
         35. 497
                                                                    805.15
                         2.099
                                                    2.857
                                   6. 984
                        2. 074
                                   7. 075
7. 169
7. 267
7. 368
         36. 347
                                                    2.852
                                                                    803.60
         37.044
                         2.050
                                                    2.848
                                                                    802.37
         37. 570
                         2.025
                                                    2.845
                                                                    801.49
         37. 904
                                                                    800.95
                         2.000
                                                    2.844
         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:
      PI PE
                FLOW DIAMETER ANGLE
                                             FLOWLI NE
                                                         CRI TI CAL
                                                                     VELOCITY
                         (INCHES) (DEGREES) ELEVATION DEPTH(FT.) (FT/SEC)
                  (CFS)
                   36. 90
                                                        1. 9̀8
                                                                     8. 734
     UPSTREAM
                            36. 00 30. 00
                                               176. 14
                   36. 90
    DOWNSTREAM
                                                175.81
                                                            1. 98
                                                                        8.292
                            36.00
                                                0. 00
0. 00
===
                   0.00
                                      0.00
0.00
                             o. 00
0. 00
                                                            0.00
                                                                        0.000
    LATERAL #1
    LATERAL #2
                                                            0.00
                                                                        0.000
                    O. OO===Q5 EQUALS BASIN INPUT===
       Q5
  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)

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
                                       ENTRANCE LOSSES = 0.000 FEET
  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:
                                               SPECIFIC PRESSURE+
  DISTANCE FROM FLOW DEPTH VELOCITY
  CONTROL(FT)
                        (FT)
                                 (FT/SEC)
                                              ENERGY(FT)
                                                            MOMENTUM (POUNDS)
                         1. 976
          0.000
                                    7. 472
                                                    2.843
                                                                    800.77
                                    7. 541
                                                    2. 843
                         1.960
          0.049
                                                                    800.84
                         1.944
                                    7. 611
                                                                    801.07
          0. 202
                                                    2.844
                         1. 928
          0.470
                                    7. 682
                                                    2.845
                                                                    801.45
                        1. 913
                                                    2.847
                                                                    801.99
          0.861
                                    7. 755
                        1.897
          1.390
                                   7.830
                                                    2.850
                                                                    802.69
                        1.881
                                   7. 906
          2.071
                                                    2.853
                                                                    803.56
                                       Page 8
```

```
1570_V. RES
         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
                                   8. 229
8. 314
         6.696
                        1.819
                                                  2.871
                                                                  808.74
                        1.803
                                                  2.877
         8.459
                                                                  810.49
        10.536
                        1.787
                                  8. 402
                                                  2.884
                                                                  812.42
        12.980
                                                  2.892
                        1.771
                                  8. 491
                                                                  814.54
                                                                  816.86
        15.854
                        1.756
                                  8. 583
                                                  2.900
        19. 242
                        1.740
                                  8. 677
                                                  2.910
                                                                  819.38
                                                  2. 916
        21. 530
                        1. 731
                                   8. 731
                                                                  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
FLOW VELOCITY = 7.47 FEET/SEC.
                               PIPE DIAMETER = 36.00 INCHES
EC. 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:
                                   FLOWLINE ELEVATION = 176.36
 NODE NUMBER = 1520.00
 ASSUMED UPSTREAM CONTROL HGL =
                                 178.34 FOR DOWNSTREAM RUN ANALYSIS
______
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

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

Longitudinai Siope. 0.0050 IVI

Manning's n: 0.0600

Flow: 37.0000 cfs

Result Parameters

Depth: 1.6467 ft

Area of Flow: 18.5976 ft² 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

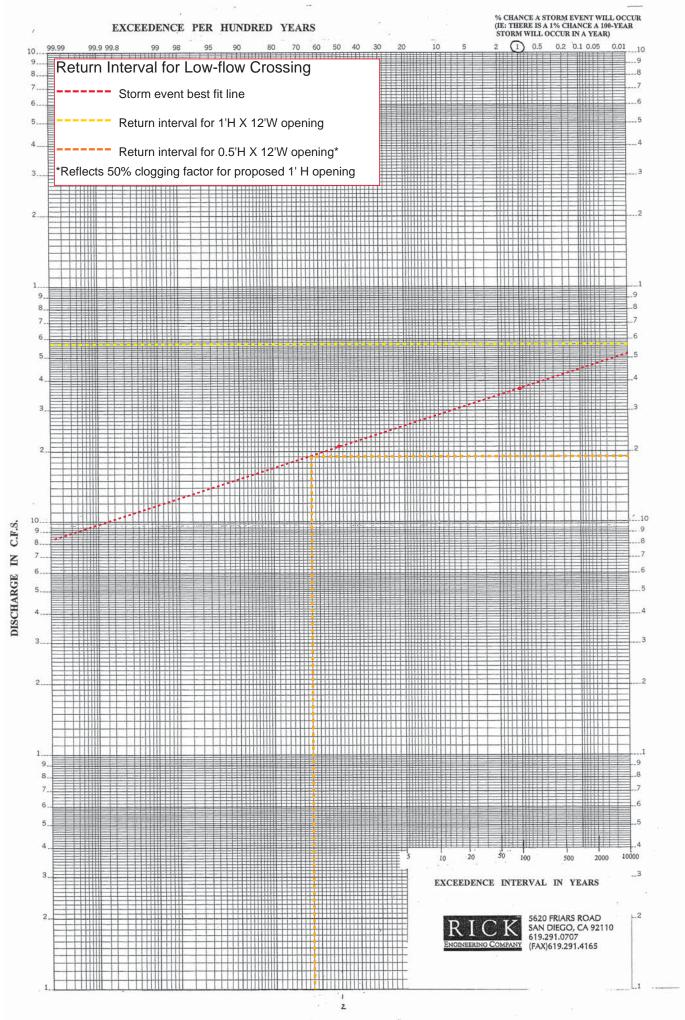
Flow: 18.8262 cfs

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



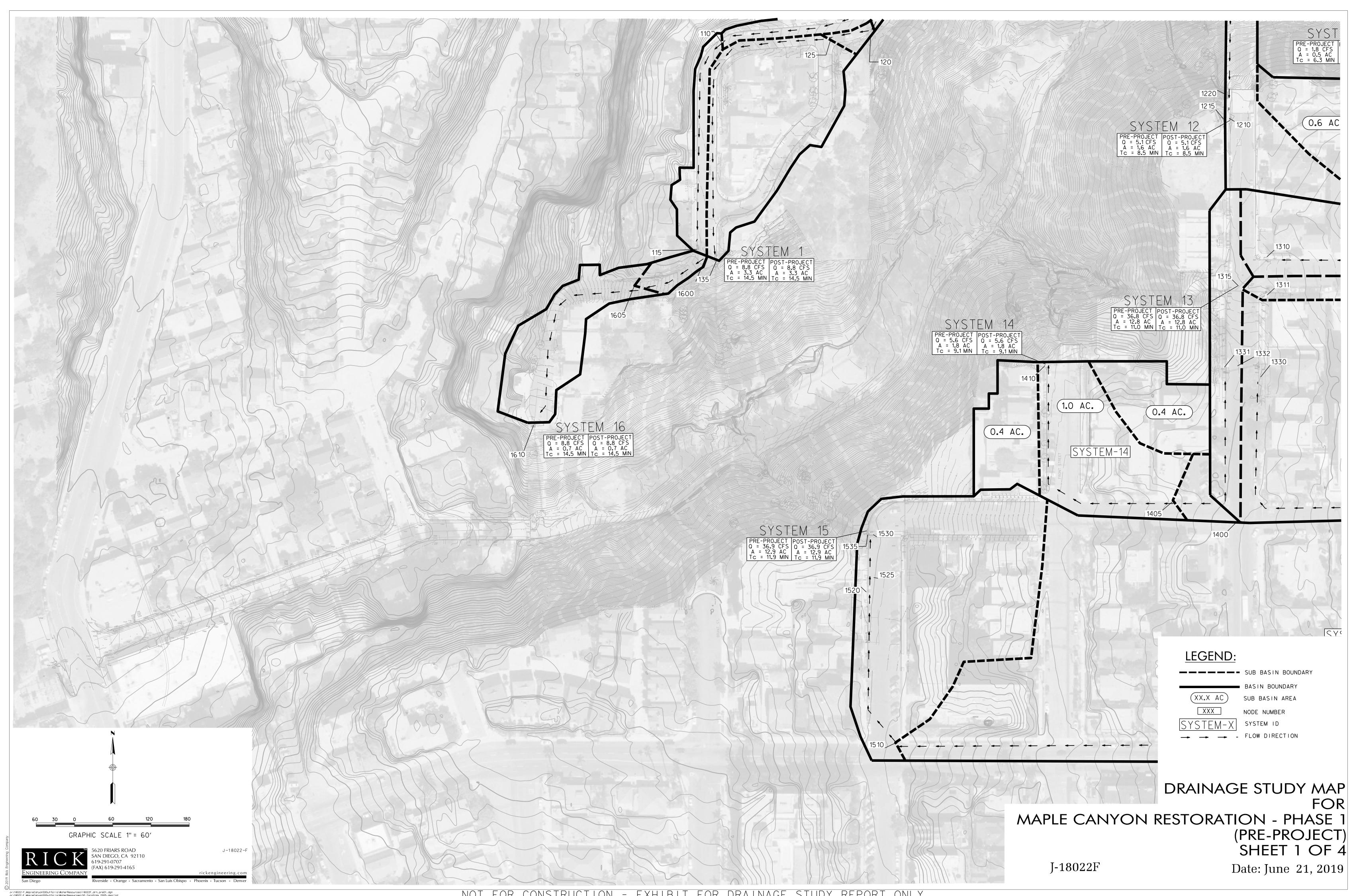
MAP POCKET 1

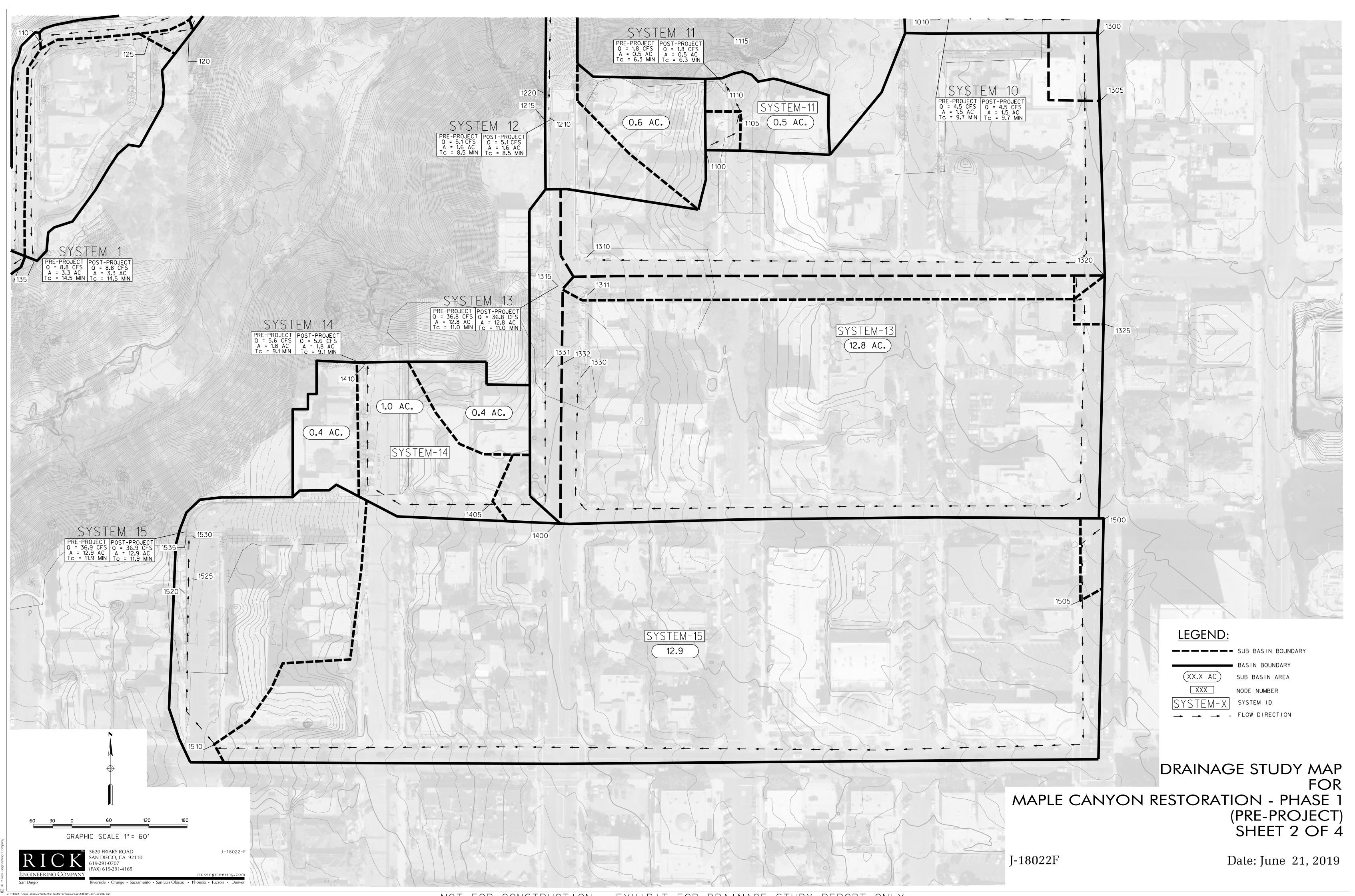
Drainage Study Map

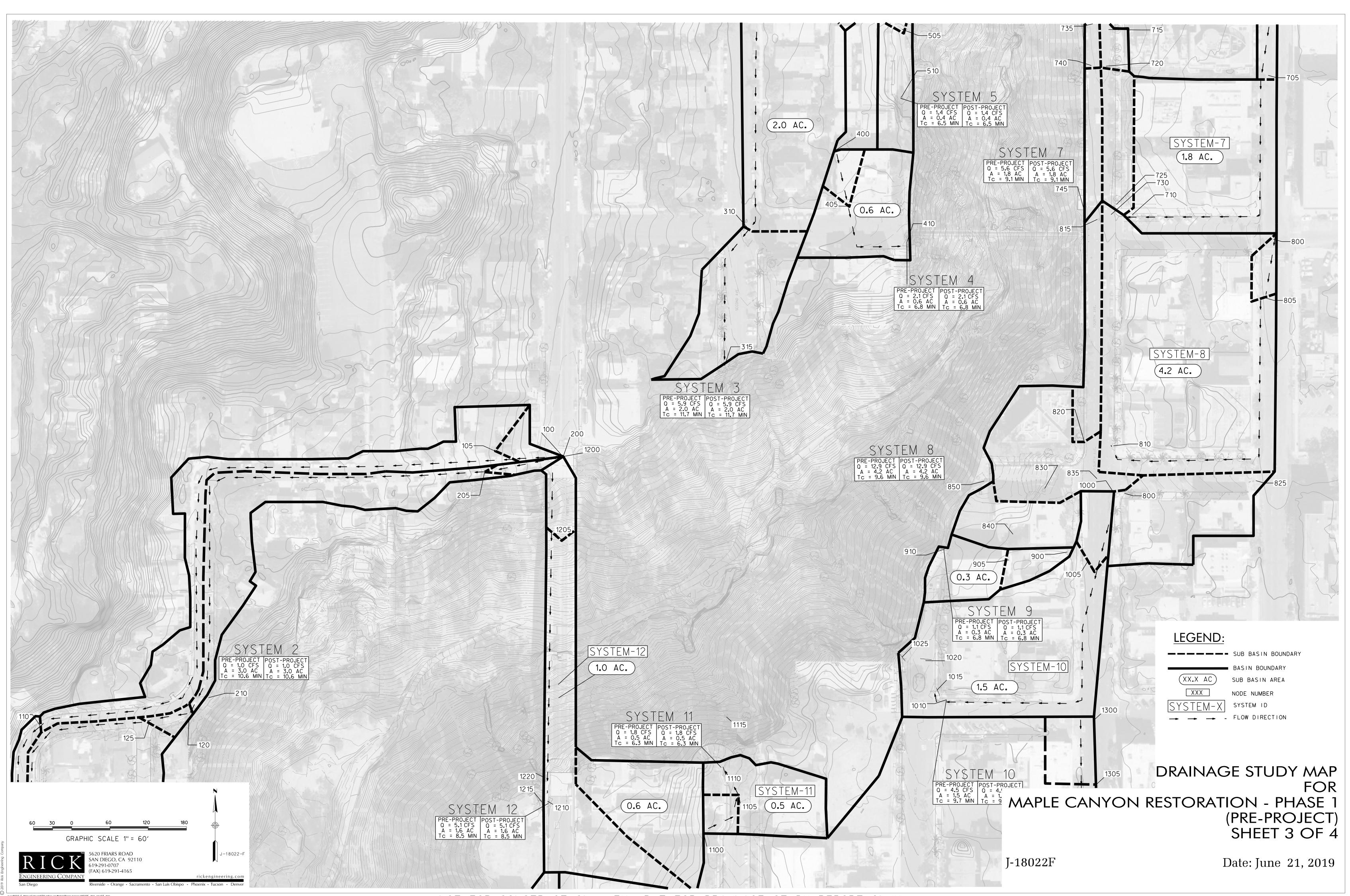
for

Maple Canyon Restoration – Phase I

[Pre-project Condition]









MAP POCKET 2

Drainage Study Map

for

Maple Canyon Restoration – Phase I

[Post-project Condition]

