

100% Submittal
City of San Diego Storm Drain Group Job 828
Drainage Study

San Diego, California



A handwritten signature in black ink, appearing to read "Michael Cairns".

October 7, 2019

Prepared By:
CValdo Corporation



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Michael Cairns, PE

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Purpose of Study

This study presents the hydrologic and hydraulic analyses for replacement drainage facilities in the Colonial Court and Altadena neighborhoods of San Diego. The approximate locations of the improvements are shown on Figure 1 below. The purpose of this study is to determine the tributary peak flows for improvements to existing storm drain systems at six locations and provide hydraulic calculations in support of improvements to these systems.

Figure 1 - Vicinity Map



The improvements associated with this project include:

- Replacing existing corrugated metal pipe (CMP) storm drains with reinforced concrete pipe (RCP), sized for the 100-year tributary flow rates.
- Constructing energy dissipaters at the canyon outlet locations.
- Replacing existing inlets, as needed, to accommodate the 100-year tributary flow rates.
- Constructing appurtenant improvements (e.g. sidewalk replacement, curb and gutter replacement, etc...) as needed to facilitate the work listed above.

One of the alternatives studied was to explore the feasibility of diverting flows from Site 2 to Site 6 via an underground storm drain system extending from the easterly end of Olive Street where it meets Switzer Canyon, westerly within Olive Street to 30th Street, then southerly within 30th Street to join an existing storm drain system that collects runoff from the north and south at a sag location (Site 6). This alternative was deemed feasible, but not desirable, as it was determined that the system at Site 6 is undersized in the existing condition, and thus, this option would trigger additional improvements at Site 6. Since this alternative is not being pursued, the calculations and exhibit supporting the Site 2 to Site 6 diversion analysis are presented in Appendix E, separate from the main body of the study. Additionally, between the 60% and 100% submittals, the City decided that improvements to sites 3 and 5 would not be done at this time. For reference purposes, the hydrologic and inlet sizing calculations for these sites have been kept within this study, while the associated storm drain hydraulic calculations have been removed.

Hydrologic Analysis

HydroWIN v. 2014 from Advanced Engineering Software (AES) was used in preparing the rational method hydrologic analysis. The hydrologic models were prepared utilizing 2017 City of San Diego Drainage Design Manual methodology. Ground surface elevations were obtained from SanGIS 1999 Topography (2-foot interval contours). Weighted runoff coefficients were calculated for each subarea based on the land use and hydrologic soil group, which was assumed to be group D for the entire study area. Supporting runoff coefficient and rational method calculations are provided in Appendix B. Table 1 presents the peak 100-year flow rates at each concentration point analyzed.

Table 1 - Results of Hydrologic Analysis

Basin	Hydrologic Node	Peak Flow Rate - Q_{100} (cfs)
A1 - Maple St.	14	9.6
A2 - Olive St.	22	3.0
A3 - Palm St. West	33	2.4
A3 - Palm St. West	38	3.4

Basin	Hydrologic Node	Peak Flow Rate - Q ₁₀₀ (cfs)
A3 - Palm St. West	39 (confluence 33 and 38)	5.5
A4 - Palm St. East	43	3.5
A5 - Quince St.	53	3.4

Hydraulic Calculations - Inlet Sizing

Inlets sizes were analyzed according to 2017 City of San Diego Drainage Design Manual methodology. Inlets were sized as curb opening style inlets for the tributary 100-year peak runoff. Inlet sizing calculations are provided in Appendix C of this study. Table 2 presents the results of the inlet sizing analysis. The values represent the minimum opening size required to pass the tributary flow rate with the water surface elevation in the street not exceeding the top of curb. The City minimum inlet opening length of four feet governs the design where the required lengths are less than four feet.

Table 2 - Inlet Sizing Calculation Summary

Node	Sag or On-grade	100-year Peak Flow Rate (cfs)	Calculated Inlet Opening Length (ft)	Required Inlet Opening Length * (ft)
14	Sag	9.6	4.7	5.0
22	Sag	3.0	1.5	4.0
33	Sag	2.4	1.2	4.0**
38	On-Grade	3.4	11.3	12.0**
43	Sag	3.5	1.7	4.0
53	Sag	3.4	1.7	4.0**

* Required inlet opening length is the greater of the inlet opening length required to accept the tributary flow rate and the City's minimum allowable inlet opening length.

** Improvements at nodes 33, 38, and 53 not being constructed at this time.

Storm Drain Hydraulic Analysis

Storm drain hydraulic calculations were performed utilizing WSPG software by Civil Design Corporation. Storm drains have been designed to convey the tributary 100-year peak runoff without pressure flow. Table 3 presents the required size for each new drainage facility. Supporting calculations are provided in Appendix D of this study.

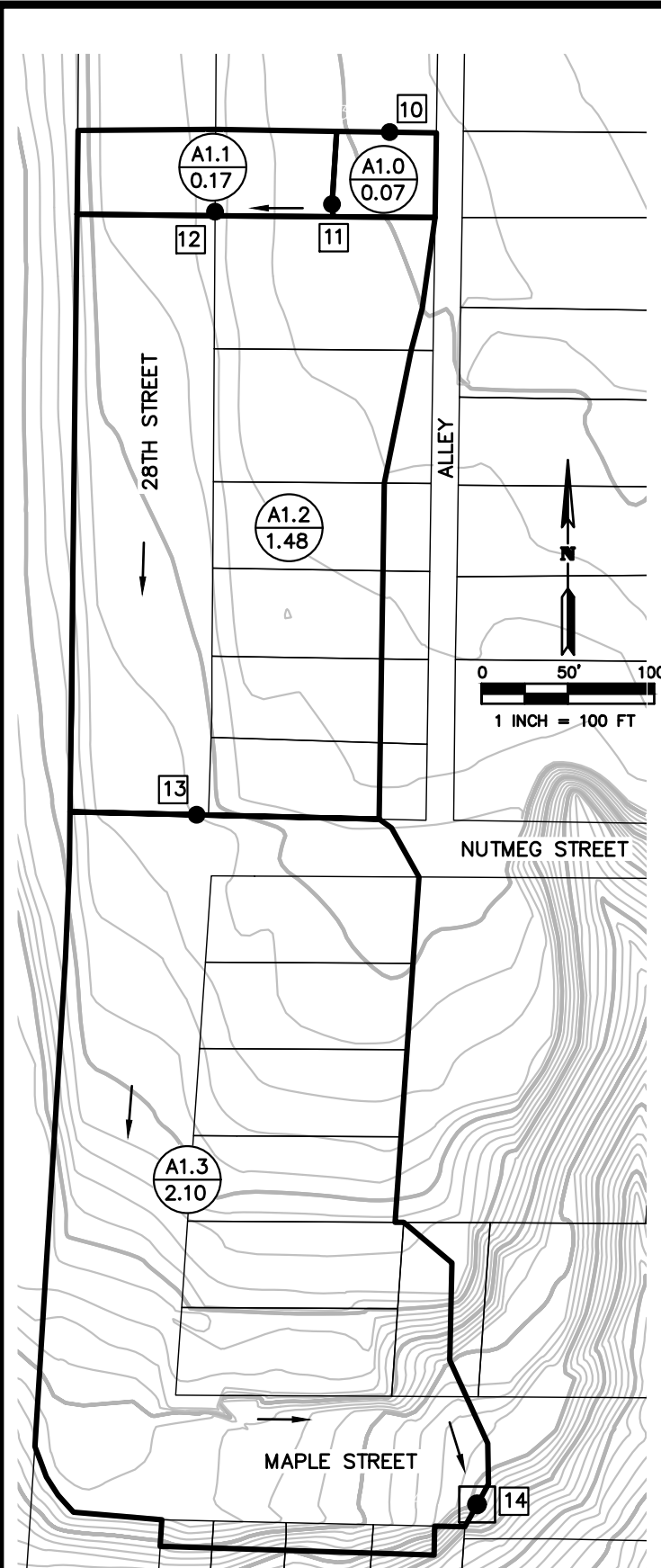
Table 3 - Storm Drain Hydraulic Analysis Summary

Hydrology Workmap Node Number		Q (cfs)	Required Storm Drain Diameter (in)
Upstream	Downstream		
14	Canyon Bottom	9.6	18
22	Canyon Bottom	3.0	18
33	39	2.4	18*
38	39	3.4	18*
39	Canyon Bottom	5.5	18*
43	Canyon Bottom	3.5	18
53	Canyon Bottom	3.4	18*

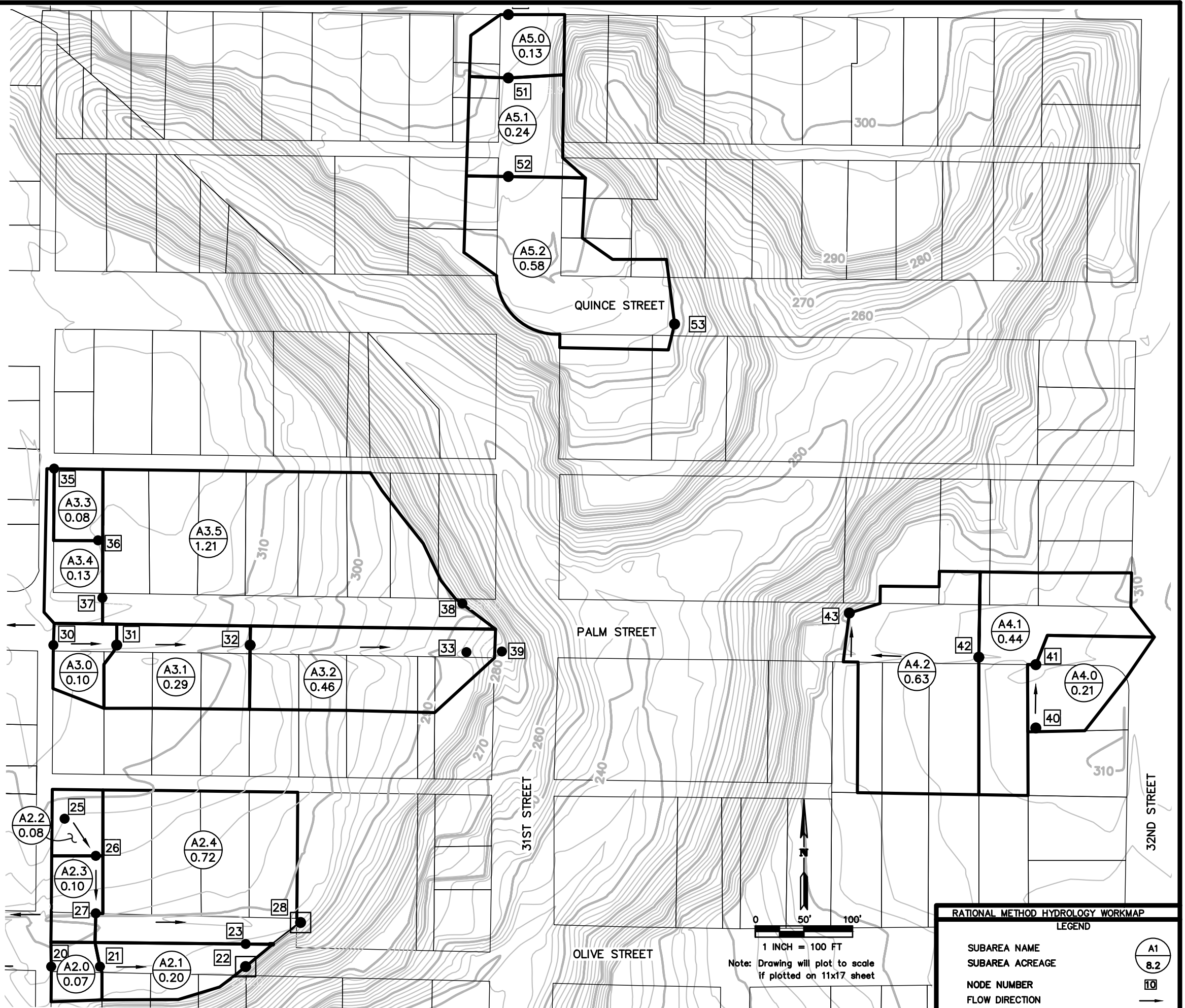
* Storm drain systems from nodes 33 to 39, 38 to 39, 39 to canyon bottom, and 53 to canyon bottom, not being constructed at this time. Required storm drain sizes provided for reference only. Hydraulic calculations not included in this study.

Exit velocities for the drainage facilities are erosive and therefore require energy dissipation. In order to mitigate high velocities and minimize the energy dissipator canyon footprint, concrete energy dissipators per City Standard Drawing SDD-105 are utilized at the storm drain outfalls.

APPENDIX A
RATIONAL METHOD HYDROLOGY WORKMAP



28TH STREET IS APPROXIMATELY 1325 FEET WEST OF 30TH STREET
 MAPLE STREET IS APPROXIMATELY 1000 FEET SOUTH OF PALM STREET



Note: Drawing will plot to scale
 if plotted on 11x17 sheet


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RATIONAL METHOD HYDROLOGY WORKMAP	
LEGEND	
SUBAREA NAME	A1
SUBAREA ACREAGE	8.2
NODE NUMBER	10
FLOW DIRECTION	→

APPENDIX B
COMPOSITE RUNOFF COEFFICIENT
AND
RATIONAL METHOD HYDROLOGY ANALYSIS
CALCULATIONS

City of San Diego Group Job 828

Composite C Value Calculations

CValdo Job 17-002

October 2, 2019

Subarea		A1.0		A1.1		A1.2		A1.3	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.07	0.04	0.08	0.04	0.84	0.46	0.97	0.53
Asphalt/Concrete	0.95			0.09	0.09	0.64	0.61	1.13	1.07
Sum		0.07	0.04	0.17	0.13	1.48	1.07	2.10	1.61
Composite C		0.55		0.76		0.72		0.77	

Subarea		A2.0		A2.1	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA
SFR	0.55	0.04	0.02	0.08	0.04
Asphalt/Concrete	0.95	0.03	0.03	0.12	0.11
Sum		0.07	0.05	0.20	0.16
Composite C		0.72		0.79	

Subarea		A2.2		A2.3		A2.4	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.08	0.04	0.07	0.04	0.59	0.32
Asphalt/Concrete	0.95			0.03	0.03	0.13	0.12
Sum		0.08	0.04	0.10	0.07	0.72	0.45
Composite C		0.55		0.67		0.62	

Subarea		A3.0		A3.1		A3.2		A3.3		A3.4		A3.5	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.06	0.03	0.2	0.11	0.29	0.16	0.08	0.04	0.06	0.03	0.95	0.52
Asphalt/Concrete	0.95	0.04	0.04	0.09	0.09	0.17	0.16	0.00		0.07	0.07	0.26	0.25
Sum		0.10	0.07	0.29	0.20	0.46	0.32	0.08	0.04	0.13	0.10	1.21	0.77
Composite C		0.71		0.67		0.70		0.55		0.77		0.64	

City of San Diego Group Job 828

Composite C Value Calculations

CValdo Job 17-002

October 2, 2019

Subarea		A4.0		A4.1		A4.2	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.13	0.07	0.28	0.15	0.44	0.24
Asphalt/Concrete	0.95	0.08	0.08	0.16	0.15	0.19	0.18
Sum		0.21	0.15	0.44	0.31	0.63	0.42
Composite C		0.70		0.70		0.67	

Subarea		A5.0		A5.1		A5.2	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.03	0.02	0.07	0.04	0.2	0.11
Asphalt/Concrete	0.95	0.10	0.10	0.17	0.16	0.38	0.36
Sum		0.13	0.11	0.24	0.20	0.58	0.47
Composite C		0.86		0.83		0.81	

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2014 Advanced Engineering Software (aes)
Ver. 21.0 Release Date: 06/01/2014 License ID 1575

Analysis prepared by:

***** DESCRIPTION OF STUDY *****
* GROUP JOB 828 *
* 100-YEAR STORM EVENT *
* CVALDO JOB 17-002 -- FEBRUARY 6, 2018 *

FILE NAME: GJ828.DAT
TIME/DATE OF STUDY: 16:12 02/06/2018

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

USER SPECIFIED STORM EVENT (YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE (INCH) = 18.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000

*USER SPECIFIED:

NUMBER OF [TIME,INTENSITY] DATA PAIRS = 10

- 1) 5.000; 4.400
- 2) 10.000; 3.450
- 3) 15.000; 2.900
- 4) 20.000; 2.500
- 5) 25.000; 2.200
- 6) 30.000; 2.000
- 7) 40.000; 1.700
- 8) 50.000; 1.500
- 9) 60.000; 1.300
- 10) 120.000; 0.860

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

NO.	HALF- CROWN TO		STREET-CROSSFALL:			CURB GUTTER-GEOMETRIES:			MANNING FACTOR (n)
	WIDTH (FT)	CROSSFALL (FT)	IN- SIDE	OUT- / SIDE/ WAY	PARK- HEIGHT (FT)	WIDTH (FT)	LIP (FT)	HIKE (FT)	
1	20.0	10.0	0.020	0.020/0.020	0.50	1.50	0.0313	0.125	0.0180
2	18.0	9.0	0.020	0.020/0.020	0.50	1.50	0.0313	0.125	0.0180

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

- 1. Relative Flow-Depth = 0.50 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 10.00 TO NODE 11.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

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*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
UPSTREAM ELEVATION(FEET) = 310.80
DOWNSTREAM ELEVATION(FEET) = 309.20
ELEVATION DIFFERENCE(FEET) = 1.60
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.912
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.227
SUBAREA RUNOFF(CFS) = 0.16
TOTAL AREA(ACRES) = 0.07 TOTAL RUNOFF(CFS) = 0.16

FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 309.20 DOWNSTREAM(FEET) = 305.30
CHANNEL LENGTH THRU SUBAREA(FEET) = 75.00 CHANNEL SLOPE = 0.0520
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.175

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7600
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.43
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.61
AVERAGE FLOW DEPTH(FEET) = 0.22 TRAVEL TIME(MIN.) = 0.27
Tc(MIN.) = 6.18
SUBAREA AREA(ACRES) = 0.17 SUBAREA RUNOFF(CFS) = 0.54
AREA-AVERAGE RUNOFF COEFFICIENT = 0.699
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.70

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.26 FLOW VELOCITY(FEET/SEC.) = 5.32
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 140.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 305.30 DOWNSTREAM ELEVATION(FEET) = 298.00
STREET LENGTH(FEET) = 350.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.67
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.26
HALFSTREET FLOOD WIDTH(FEET) = 6.85

AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.27
PRODUCT OF DEPTH&VELOCITY (FT*FT/SEC.) = 0.60
STREET FLOW TRAVEL TIME (MIN.) = 2.57 Tc (MIN.) = 8.75
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.688
*USER SPECIFIED (SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7200
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.717
SUBAREA AREA (ACRES) = 1.48 SUBAREA RUNOFF (CFS) = 3.93
TOTAL AREA (ACRES) = 1.7 PEAK FLOW RATE (CFS) = 4.55

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.30 HALFSTREET FLOOD WIDTH (FEET) = 8.84
FLOW VELOCITY (FEET/SEC.) = 2.53 DEPTH*VELOCITY (FT*FT/SEC.) = 0.77
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 490.00 FEET.

FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 62

>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA <<<<<
>>>> (STREET TABLE SECTION # 1 USED) <<<<<

=====

UPSTREAM ELEVATION (FEET) = 298.00 DOWNSTREAM ELEVATION (FEET) = 248.00
STREET LENGTH (FEET) = 575.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 20.00

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 = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 7.28
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.28
HALFSTREET FLOOD WIDTH (FEET) = 7.91
AVERAGE FLOW VELOCITY (FEET/SEC.) = 4.89
PRODUCT OF DEPTH&VELOCITY (FT*FT/SEC.) = 1.39
STREET FLOW TRAVEL TIME (MIN.) = 1.96 Tc (MIN.) = 10.71
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 3.372

*USER SPECIFIED (SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7700
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.746
SUBAREA AREA (ACRES) = 2.10 SUBAREA RUNOFF (CFS) = 5.45
TOTAL AREA (ACRES) = 3.8 PEAK FLOW RATE (CFS) = 9.61

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.31 HALFSTREET FLOOD WIDTH (FEET) = 8.97
FLOW VELOCITY (FEET/SEC.) = 5.21 DEPTH*VELOCITY (FT*FT/SEC.) = 1.59
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 1065.00 FEET.

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

>>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS <<<<<

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*USER SPECIFIED (SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7200
S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH (FEET) = 50.00
UPSTREAM ELEVATION (FEET) = 298.50
DOWNSTREAM ELEVATION (FEET) = 298.00
ELEVATION DIFFERENCE (FEET) = 0.50
URBAN SUBAREA OVERLAND TIME OF FLOW (MIN.) = 4.837
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.400
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF (CFS) = 0.22
TOTAL AREA (ACRES) = 0.07 TOTAL RUNOFF (CFS) = 0.22

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 62

>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA <<<<<
>>>> (STREET TABLE SECTION # 1 USED) <<<<<

=====

UPSTREAM ELEVATION (FEET) = 298.00 DOWNSTREAM ELEVATION (FEET) = 296.00
STREET LENGTH (FEET) = 150.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 20.00

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 = 1
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 = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 0.55
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.22
HALFSTREET FLOOD WIDTH (FEET) = 4.72
AVERAGE FLOW VELOCITY (FEET/SEC.) = 1.61
PRODUCT OF DEPTH&VELOCITY (FT*FT/SEC.) = 0.35
STREET FLOW TRAVEL TIME (MIN.) = 1.56 Tc (MIN.) = 6.39
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.136

*USER SPECIFIED (SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.772
SUBAREA AREA (ACRES) = 0.20 SUBAREA RUNOFF (CFS) = 0.65
TOTAL AREA (ACRES) = 0.3 PEAK FLOW RATE (CFS) = 0.86

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.25 HALFSTREET FLOOD WIDTH (FEET) = 6.18
FLOW VELOCITY (FEET/SEC.) = 1.72 DEPTH*VELOCITY (FT*FT/SEC.) = 0.43
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 200.00 FEET.

FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 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.) = 6.39
RAINFALL INTENSITY (INCH/HR) = 4.14
TOTAL STREAM AREA (ACRES) = 0.27
PEAK FLOW RATE (CFS) AT CONFLUENCE = 0.86

FLOW PROCESS FROM NODE 25.00 TO NODE 26.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
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*USER SPECIFIED(SUBAREA):

RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
UPSTREAM ELEVATION(FEET) = 308.00
DOWNSTREAM ELEVATION(FEET) = 306.00
ELEVATION DIFFERENCE(FEET) = 2.00
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.488
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.307
SUBAREA RUNOFF(CFS) = 0.19
TOTAL AREA(ACRES) = 0.08 TOTAL RUNOFF(CFS) = 0.19

FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
=====

ELEVATION DATA: UPSTREAM(FEET) = 306.00 DOWNSTREAM(FEET) = 302.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 60.00 CHANNEL SLOPE = 0.0667
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.268

*USER SPECIFIED(SUBAREA):

RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6700
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.33
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.81
AVERAGE FLOW DEPTH(FEET) = 0.19 TRAVEL TIME(MIN.) = 0.21
Tc(MIN.) = 5.70
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.29
AREA-AVERAGE RUNOFF COEFFICIENT = 0.617
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.47

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.21 FLOW VELOCITY(FEET/SEC.) = 5.33
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 27.00 = 125.00 FEET.

FLOW PROCESS FROM NODE 27.00 TO NODE 28.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>(STREET TABLE SECTION # 1 USED)<<<<<
=====

UPSTREAM ELEVATION(FEET) = 302.00 DOWNSTREAM ELEVATION(FEET) = 299.00
STREET LENGTH(FEET) = 215.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.35

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.28

HALFSTREET FLOOD WIDTH(FEET) = 7.64
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.92
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.54
 STREET FLOW TRAVEL TIME(MIN.) = 1.87 Tc(MIN.) = 7.56
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.913
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6200
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.619
 SUBAREA AREA(ACRES) = 0.72 SUBAREA RUNOFF(CFS) = 1.75
 TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 2.18

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.32 HALFSTREET FLOOD WIDTH(FEET) = 9.50
 FLOW VELOCITY(FEET/SEC.) = 2.14 DEPTH*VELOCITY(FT*FT/SEC.) = 0.68
 LONGEST FLOWPATH FROM NODE 25.00 TO NODE 28.00 = 340.00 FEET.

 FLOW PROCESS FROM NODE 28.00 TO NODE 22.00 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.) = 7.56
 RAINFALL INTENSITY(INCH/HR) = 3.91
 TOTAL STREAM AREA(ACRES) = 0.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.18

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	0.86	6.39	4.136	0.27
2	2.18	7.56	3.913	0.90

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	2.71	6.39	4.136
2	3.00	7.56	3.913

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 3.00 Tc(MIN.) = 7.56
 TOTAL AREA(ACRES) = 1.2
 LONGEST FLOWPATH FROM NODE 25.00 TO NODE 22.00 = 340.00 FEET.

 FLOW PROCESS FROM NODE 30.00 TO NODE 31.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

*USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 S.C.S. CURVE NUMBER (AMC II) = 0
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
 UPSTREAM ELEVATION(FEET) = 313.00
 DOWNSTREAM ELEVATION(FEET) = 312.30
 ELEVATION DIFFERENCE(FEET) = 0.70
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.522

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.301
SUBAREA RUNOFF(CFS) = 0.31
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.31

FLOW PROCESS FROM NODE 31.00 TO NODE 32.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) =	312.30	DOWNSTREAM ELEVATION(FEET) =	307.00
STREET LENGTH(FEET) =	140.00	CURB HEIGHT(INCHES) =	6.0
STREET HALFWIDTH(FEET) =	20.00		

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.71
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.20
HALFSTREET FLOOD WIDTH(FEET) = 3.92
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.60
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.53
STREET FLOW TRAVEL TIME(MIN.) = 0.90 Tc(MIN.) = 6.42
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.130

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6700
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.680
SUBAREA AREA(ACRES) = 0.29 SUBAREA RUNOFF(CFS) = 0.80
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.10

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.23 HALFSTREET FLOOD WIDTH(FEET) = 5.25
FLOW VELOCITY(FEET/SEC.) = 2.78 DEPTH*VELOCITY(FT*FT/SEC.) = 0.64
LONGEST FLOWPATH FROM NODE 30.00 TO NODE 32.00 = 205.00 FEET.

FLOW PROCESS FROM NODE 32.00 TO NODE 33.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) =	307.00	DOWNSTREAM ELEVATION(FEET) =	287.00
STREET LENGTH(FEET) =	150.00	CURB HEIGHT(INCHES) =	6.0
STREET HALFWIDTH(FEET) =	20.00		

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.75

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.22
 HALFSTREET FLOOD WIDTH(FEET) = 4.79
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 5.03
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.12
 STREET FLOW TRAVEL TIME(MIN.) = 0.50 Tc(MIN.) = 6.92
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.036
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.691
 SUBAREA AREA(ACRES) = 0.46 SUBAREA RUNOFF(CFS) = 1.30
 TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 2.37

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.24 HALFSTREET FLOOD WIDTH(FEET) = 5.72
 FLOW VELOCITY(FEET/SEC.) = 5.33 DEPTH*VELOCITY(FT*FT/SEC.) = 1.28
 LONGEST FLOWPATH FROM NODE 30.00 TO NODE 33.00 = 355.00 FEET.

 FLOW PROCESS FROM NODE 33.00 TO NODE 39.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 281.50 DOWNSTREAM(FEET) = 279.50
 FLOW LENGTH(FEET) = 10.00 MANNING'S N = 0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 2.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 13.40
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.37
 PIPE TRAVEL TIME(MIN.) = 0.01 Tc(MIN.) = 6.93
 LONGEST FLOWPATH FROM NODE 30.00 TO NODE 39.00 = 365.00 FEET.

 FLOW PROCESS FROM NODE 39.00 TO NODE 39.00 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.) = 6.93
 RAINFALL INTENSITY(INCH/HR) = 4.03
 TOTAL STREAM AREA(ACRES) = 0.85
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.37

 FLOW PROCESS FROM NODE 35.00 TO NODE 36.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

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*USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5500
 S.C.S. CURVE NUMBER (AMC II) = 0
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 78.00
 UPSTREAM ELEVATION(FEET) = 315.50
 DOWNSTREAM ELEVATION(FEET) = 314.00
 ELEVATION DIFFERENCE(FEET) = 1.50
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.031
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.014
 SUBAREA RUNOFF(CFS) = 0.18
 TOTAL AREA(ACRES) = 0.08 TOTAL RUNOFF(CFS) = 0.18

FLOW PROCESS FROM NODE 36.00 TO NODE 37.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	314.00	DOWNSTREAM(FEET) =	313.60
CHANNEL LENGTH THRU SUBAREA(FEET) =	50.00	CHANNEL SLOPE =	0.0080
CHANNEL BASE(FEET) =	0.00	"Z" FACTOR =	2.000
MANNING'S FACTOR =	0.015	MAXIMUM DEPTH(FEET) =	1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	3.944		

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7700
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.37
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.27
AVERAGE FLOW DEPTH(FEET) = 0.29 TRAVEL TIME(MIN.) = 0.37
Tc(MIN.) = 7.40
SUBAREA AREA(ACRES) = 0.13 SUBAREA RUNOFF(CFS) = 0.39
AREA-AVERAGE RUNOFF COEFFICIENT = 0.686
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.57

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.34 FLOW VELOCITY(FEET/SEC.) = 2.48
LONGEST FLOWPATH FROM NODE 35.00 TO NODE 37.00 = 128.00 FEET.

FLOW PROCESS FROM NODE 37.00 TO NODE 38.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) =	313.60	DOWNSTREAM ELEVATION(FEET) =	288.00
STREET LENGTH(FEET) =	370.00	CURB HEIGHT(INCHES) =	6.0
STREET HALFWIDTH(FEET) =	18.00		

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 9.00
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(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.98
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.25
HALFSTREET FLOOD WIDTH(FEET) = 6.22
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.93
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.98
STREET FLOW TRAVEL TIME(MIN.) = 1.57 Tc(MIN.) = 8.97
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.646

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.647
SUBAREA AREA(ACRES) = 1.21 SUBAREA RUNOFF(CFS) = 2.82
TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 3.35

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.29 HALFSTREET FLOOD WIDTH(FEET) = 8.03

FLOW VELOCITY (FEET/SEC.) = 4.39 DEPTH*VELOCITY (FT*FT/SEC.) = 1.26
LONGEST FLOWPATH FROM NODE 35.00 TO NODE 38.00 = 498.00 FEET.

FLOW PROCESS FROM NODE 38.00 TO NODE 39.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 283.50 DOWNSTREAM (FEET) = 279.00
FLOW LENGTH (FEET) = 33.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.7 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 12.97
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 3.35
PIPE TRAVEL TIME (MIN.) = 0.04 Tc (MIN.) = 9.01
LONGEST FLOWPATH FROM NODE 35.00 TO NODE 39.00 = 531.00 FEET.

FLOW PROCESS FROM NODE 39.00 TO NODE 39.00 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.) = 9.01
RAINFALL INTENSITY (INCH/HR) = 3.64
TOTAL STREAM AREA (ACRES) = 1.42
PEAK FLOW RATE (CFS) AT CONFLUENCE = 3.35

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.37	6.93	4.033	0.85
2	3.35	9.01	3.638	1.42

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	4.95	6.93	4.033
2	5.49	9.01	3.638

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 5.49 Tc (MIN.) = 9.01
TOTAL AREA (ACRES) = 2.3
LONGEST FLOWPATH FROM NODE 35.00 TO NODE 39.00 = 531.00 FEET.

FLOW PROCESS FROM NODE 40.00 TO NODE 41.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED (SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH (FEET) = 65.00
UPSTREAM ELEVATION (FEET) = 308.50
DOWNSTREAM ELEVATION (FEET) = 307.80

ELEVATION DIFFERENCE (FEET) = 0.70
URBAN SUBAREA OVERLAND TIME OF FLOW (MIN.) = 5.663
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.274
SUBAREA RUNOFF (CFS) = 0.63
TOTAL AREA (ACRES) = 0.21 TOTAL RUNOFF (CFS) = 0.63

FLOW PROCESS FROM NODE 41.00 TO NODE 42.00 IS CODE = 62

>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA <<<<<
>>>> (STREET TABLE SECTION # 1 USED) <<<<<

=====

UPSTREAM ELEVATION (FEET) = 307.80 DOWNSTREAM ELEVATION (FEET) = 306.00
STREET LENGTH (FEET) = 65.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 20.00

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 = 1
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 = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 1.27
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.25
HALFSTREET FLOOD WIDTH (FEET) = 6.25
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.50
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 0.63
STREET FLOW TRAVEL TIME (MIN.) = 0.43 Tc (MIN.) = 6.10
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.192

*USER SPECIFIED (SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.700
SUBAREA AREA (ACRES) = 0.44 SUBAREA RUNOFF (CFS) = 1.29
TOTAL AREA (ACRES) = 0.6 PEAK FLOW RATE (CFS) = 1.91

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.28 HALFSTREET FLOOD WIDTH (FEET) = 7.64
FLOW VELOCITY (FEET/SEC.) = 2.72 DEPTH*VELOCITY (FT*FT/SEC.) = 0.76
LONGEST FLOWPATH FROM NODE 40.00 TO NODE 42.00 = 130.00 FEET.

FLOW PROCESS FROM NODE 42.00 TO NODE 43.00 IS CODE = 62

>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA <<<<<
>>>> (STREET TABLE SECTION # 1 USED) <<<<<

=====

UPSTREAM ELEVATION (FEET) = 306.00 DOWNSTREAM ELEVATION (FEET) = 302.00
STREET LENGTH (FEET) = 180.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 20.00

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 = 1
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 = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.75
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.31
 HALFSTREET FLOOD WIDTH(FEET) = 9.44
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.73
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.86
 STREET FLOW TRAVEL TIME(MIN.) = 1.10 Tc(MIN.) = 7.20
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.983
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6700
 S.C.S. CURVE NUMBER (AMC II) = 0
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.685
 SUBAREA AREA(ACRES) = 0.63 SUBAREA RUNOFF(CFS) = 1.68
 TOTAL AREA(ACRES) = 1.3 PEAK FLOW RATE(CFS) = 3.49

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.34 HALFSTREET FLOOD WIDTH(FEET) = 10.51
 FLOW VELOCITY(FEET/SEC.) = 2.86 DEPTH*VELOCITY(FT*FT/SEC.) = 0.96
 LONGEST FLOWPATH FROM NODE 40.00 TO NODE 43.00 = 310.00 FEET.

 FLOW PROCESS FROM NODE 50.00 TO NODE 51.00 IS CODE = 21

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

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*USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .8600
 S.C.S. CURVE NUMBER (AMC II) = 0
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
 UPSTREAM ELEVATION(FEET) = 306.90
 DOWNSTREAM ELEVATION(FEET) = 305.90
 ELEVATION DIFFERENCE(FEET) = 1.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 3.017
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.400
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) = 0.49
 TOTAL AREA(ACRES) = 0.13 TOTAL RUNOFF(CFS) = 0.49

 FLOW PROCESS FROM NODE 51.00 TO NODE 52.00 IS CODE = 62

 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>(STREET TABLE SECTION # 2 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 305.90 DOWNSTREAM ELEVATION(FEET) = 302.80
 STREET LENGTH(FEET) = 100.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 9.00
 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(curbs-to-curbs) = 0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.93
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.23
 HALFSTREET FLOOD WIDTH(FEET) = 5.10
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.46

PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.56
STREET FLOW TRAVEL TIME(MIN.) = 0.68 Tc(MIN.) = 3.70
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.400
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.841
SUBAREA AREA(ACRES) = 0.24 SUBAREA RUNOFF(CFS) = 0.88
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.37

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.25 HALFSTREET FLOOD WIDTH(FEET) = 6.28
FLOW VELOCITY(FEET/SEC.) = 2.67 DEPTH*VELOCITY(FT*FT/SEC.) = 0.67
LONGEST FLOWPATH FROM NODE 50.00 TO NODE 52.00 = 165.00 FEET.

FLOW PROCESS FROM NODE 52.00 TO NODE 53.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 302.80 DOWNSTREAM ELEVATION(FEET) = 292.00
STREET LENGTH(FEET) = 300.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 9.00
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(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.39
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.29
HALFSTREET FLOOD WIDTH(FEET) = 7.97
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.17
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.91
STREET FLOW TRAVEL TIME(MIN.) = 1.58 Tc(MIN.) = 5.27
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.348

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .8100
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.822
SUBAREA AREA(ACRES) = 0.58 SUBAREA RUNOFF(CFS) = 2.04
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 3.40

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.31 HALFSTREET FLOOD WIDTH(FEET) = 9.32
FLOW VELOCITY(FEET/SEC.) = 3.44 DEPTH*VELOCITY(FT*FT/SEC.) = 1.08
LONGEST FLOWPATH FROM NODE 50.00 TO NODE 53.00 = 465.00 FEET.

=====

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 0.9 TC(MIN.) = 5.27
PEAK FLOW RATE(CFS) = 3.40
=====

=====

END OF RATIONAL METHOD ANALYSIS

APPENDIX C
INLET SIZING CALCULATIONS

Note Figure, equation and page references are to City of San Diego Drainage Design Manual dated January 2017

Inlet on grade Equation 3-2
 $LT = Q / (0.7 * ((a + y)^{1.5}))$
 LT = inlet length, a = depression, y = gutter depth at approach, Q = flow rate

Inlet in sag Equation 3-4 (higher flow depth = orifice flow)
 $L = Q / ((0.67 * h) * ((2 * g * do)^{0.5}))$
 where $do = (y + a) - 0.26$
 L = inlet length, h = inlet opening height, do = effective depth at opening, g = gravity constant, Q = flow rate, y = gutter depth at approach, a = depression

Node	Grade or Sag	Street Slope (estimated)	Gutter Depth at Approach (ft) *	Depression (ft)	do (ft)	Q (cfs)	Calculated Inlet Opening Length (ft)	Existing Inlet Size and Type	Required Inlet Opening Length (ft) **
14	Sag	0	0.50	0.33	0.57	9.6	4.7	10' curb opening plus grate	5
22	Sag	0	0.50	0.33	0.57	3.0	1.5	6' curb opening	4
33	Sag	0	0.50	0.33	0.57	2.4	1.2	15" x 15" grate	4
38	Grade	10%	0.24	0.33	n/a	3.4	11.3	n/a	12
43	Sag	0	0.50	0.33	0.57	3.5	1.7	10' curb opening plus grate	4
53	Sag	0	0.50	0.33	0.57	3.4	1.7	6' curb opening	4

* Flow depth per Figure 3-2 for inlets on grade
 Flow depth = to top of 6" curb for inlets in sag

** Required inlet opening length is the greater of the inlet size required to accept tributary flow rate and the City's minimum allowable inlet opening length. Existing inlet may remain if adequately sized, in satisfactory condition, and construction of the new adjacent storm drain facilities permits, at City's discretion.

CHAPTER 3: STREET DRAINAGE, CLEANOUTS, AND INLETS

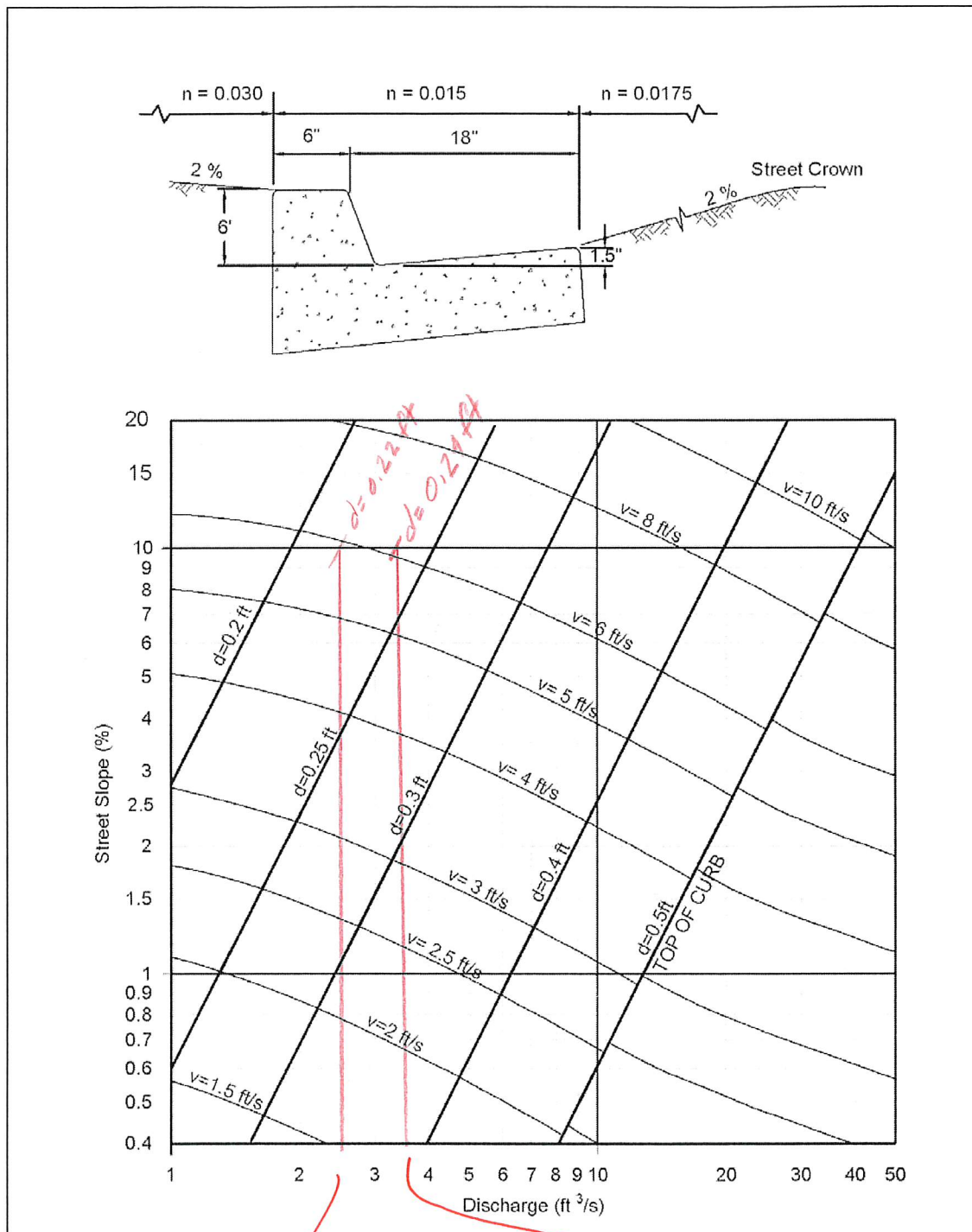


Figure 3-2: Gutter and Roadway Discharge-Velocity Chart (6" Curb)

node 33 $Q = 2.4$ cfs

node 38 $Q = 3.4$ cfs

APPENDIX D
STORM DRAIN HYDRAULIC CALCULATIONS

T1	City of San Diego Group Job 828								
T2	Maple Street Storm Drain								
T3	CValdo	Job#	17-002	10/7/19					
SO	114.330	189.870	1			189.870			
R	118.870	189.900	1	.013			.000	.000	0
R	271.140	230.800	1	.013			.000	.000	0
WE	271.140	230.800	2	.500					
R	275.140	231.000	2	.013			-61.000	.000	0
WX	275.140	231.000	3						
R	308.720	246.400	3	.013			.000	.000	0
WE	308.720	246.400	4	.500					
SH	308.720	246.400	4			246.400			
CD	1	4	1	.000	1.500	.000	.000	.000	.00
CD	2	2	0	.000	6.000	4.000	.000	.000	.00
CD	3	4	1	.000	1.500	.000	.000	.000	.00
CD	4	4	1	.000	99.000	.000	.000	.000	.00
Q		9.600	.0						

WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Maple Street Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:19:54

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | |
114.330 | 189.870 | .449 | 190.319 | 9.60 | 21.62 | 7.26 | 197.58 | .00 | 1.20 | 1.37 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.500 | .0066 | | | | | .2277 | .34 | .45 | 6.70 | 1.50 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
115.830 | 189.880 | .441 | 190.321 | 9.60 | 22.13 | 7.61 | 197.93 | .00 | 1.20 | 1.37 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
3.040 | .0066 | | | | | .2519 | .77 | .44 | 6.92 | 1.50 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
118.870 | 189.900 | .426 | 190.326 | 9.60 | 23.21 | 8.37 | 198.69 | .00 | 1.20 | 1.35 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
27.777 | .2686 | | | | | .2687 | 7.46 | .43 | 7.40 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
146.648 | 197.361 | .426 | 197.787 | 9.60 | 23.21 | 8.37 | 206.15 | .00 | 1.20 | 1.35 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
43.056 | .2686 | | | | | .2655 | 11.43 | .43 | 7.40 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
189.704 | 208.926 | .428 | 209.354 | 9.60 | 23.02 | 8.23 | 217.58 | .00 | 1.20 | 1.35 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
32.372 | .2686 | | | | | .2460 | 7.96 | .43 | 7.31 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
222.076 | 217.621 | .443 | 218.064 | 9.60 | 21.95 | 7.48 | 225.55 | .00 | 1.20 | 1.37 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
12.486 | .2686 | | | | | .2154 | 2.69 | .44 | 6.84 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
234.561 | 220.975 | .459 | 221.434 | 9.60 | 20.93 | 6.80 | 228.24 | .00 | 1.20 | 1.38 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
7.536 | .2686 | | | | | .1887 | 1.42 | .46 | 6.40 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
242.098 | 222.999 | .475 | 223.474 | 9.60 | 19.96 | 6.18 | 229.66 | .00 | 1.20 | 1.40 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
5.275 | .2686 | | | | | .1653 | .87 | .48 | 5.99 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
247.373 | 224.416 | .492 | 224.908 | 9.60 | 19.03 | 5.62 | 230.53 | .00 | 1.20 | 1.41 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
3.989 | .2686 | | | | | .1448 | .58 | .49 | 5.60 | .43 | .013 | .00 | .00 | PIPE |
*****

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City of San Diego Group Job 828

Maple Street Storm Drain

CValdo Job# 17-002 10/7/19

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
251.362 | 225.488 | .509 | 225.997 | 9.60 | 18.14 | 5.11 | 231.11 | .00 | 1.20 | 1.42 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.149 | .2686 | | | | | .1268 | .40 | .51 | 5.24 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
254.511 | 226.333 | .527 | 226.861 | 9.60 | 17.30 | 4.65 | 231.51 | .00 | 1.20 | 1.43 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
2.562 | .2686 | | | | | .1111 | .28 | .53 | 4.90 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
257.073 | 227.022 | .546 | 227.568 | 9.60 | 16.49 | 4.22 | 231.79 | .00 | 1.20 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
2.127 | .2686 | | | | | .0975 | .21 | .55 | 4.58 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
259.200 | 227.593 | .566 | 228.159 | 9.60 | 15.72 | 3.84 | 232.00 | .00 | 1.20 | 1.45 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.797 | .2686 | | | | | .0855 | .15 | .57 | 4.28 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
260.997 | 228.076 | .586 | 228.662 | 9.60 | 14.99 | 3.49 | 232.15 | .00 | 1.20 | 1.46 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.531 | .2686 | | | | | .0750 | .11 | .59 | 3.99 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
262.528 | 228.487 | .607 | 229.094 | 9.60 | 14.30 | 3.17 | 232.27 | .00 | 1.20 | 1.47 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.314 | .2686 | | | | | .0658 | .09 | .61 | 3.73 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
263.842 | 228.840 | .629 | 229.469 | 9.60 | 13.63 | 2.88 | 232.35 | .00 | 1.20 | 1.48 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.130 | .2686 | | | | | .0578 | .07 | .63 | 3.48 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
264.972 | 229.143 | .653 | 229.796 | 9.60 | 13.00 | 2.62 | 232.42 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.984 | .2686 | | | | | .0508 | .05 | .65 | 3.25 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
265.956 | 229.408 | .677 | 230.085 | 9.60 | 12.39 | 2.38 | 232.47 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.856 | .2686 | | | | | .0447 | .04 | .68 | 3.03 | .43 | .013 | .00 | .00 | PIPE |
*****

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Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:19:54

City of San Diego Group Job 828

Maple Street Storm Drain

CValdo Job# 17-002 10/7/19

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
266.813 | 229.638 | .702 | 230.340 | 9.60 | 11.81 | 2.17 | 232.51 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.741 | .2686 | | | | | .0393 | .03 | .70 | 2.83 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
267.554 | 229.837 | .729 | 230.566 | 9.60 | 11.26 | 1.97 | 232.54 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.650 | .2686 | | | | | .0346 | .02 | .73 | 2.63 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
268.204 | 230.011 | .756 | 230.768 | 9.60 | 10.74 | 1.79 | 232.56 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.562 | .2686 | | | | | .0304 | .02 | .76 | 2.45 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
268.766 | 230.162 | .785 | 230.947 | 9.60 | 10.24 | 1.63 | 232.58 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.484 | .2686 | | | | | .0268 | .01 | .79 | 2.28 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
269.250 | 230.292 | .816 | 231.108 | 9.60 | 9.76 | 1.48 | 232.59 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.419 | .2686 | | | | | .0237 | .01 | .82 | 2.12 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
269.669 | 230.405 | .848 | 231.253 | 9.60 | 9.31 | 1.35 | 232.60 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.357 | .2686 | | | | | .0209 | .01 | .85 | 1.97 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
270.026 | 230.501 | .882 | 231.383 | 9.60 | 8.88 | 1.22 | 232.61 | .00 | 1.20 | 1.48 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.301 | .2686 | | | | | .0185 | .01 | .88 | 1.83 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
270.326 | 230.581 | .918 | 231.500 | 9.60 | 8.46 | 1.11 | 232.61 | .00 | 1.20 | 1.46 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.250 | .2686 | | | | | .0164 | .00 | .92 | 1.69 | .43 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
270.577 | 230.649 | .956 | 231.605 | 9.60 | 8.07 | 1.01 | 232.62 | .00 | 1.20 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.200 | .2686 | | | | | .0145 | .00 | .96 | 1.57 | .43 | .013 | .00 | .00 | PIPE |
*****

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WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Maple Street Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:19:54

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | |
270.777 | 230.702 | .997 | 231.700 | 9.60 | 7.69 | .92 | 232.62 | .00 | 1.20 | 1.42 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.159 | .2686 | | | | | .0129 | .00 | 1.00 | 1.44 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
270.936 | 230.745 | 1.040 | 231.785 | 9.60 | 7.34 | .84 | 232.62 | .00 | 1.20 | 1.38 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.113 | .2686 | | | | | .0115 | .00 | 1.04 | 1.33 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
271.048 | 230.775 | 1.087 | 231.862 | 9.60 | 6.99 | .76 | 232.62 | .00 | 1.20 | 1.34 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.070 | .2686 | | | | | .0103 | .00 | 1.09 | 1.22 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
271.118 | 230.794 | 1.138 | 231.932 | 9.60 | 6.67 | .69 | 232.62 | .00 | 1.20 | 1.28 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.022 | .2686 | | | | | .0093 | .00 | 1.14 | 1.11 | .43 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
271.140 | 230.800 | 1.196 | 231.996 | 9.60 | 6.35 | .63 | 232.62 | 1.50 | 1.20 | 1.21 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
WALL ENTRANCE
| | | | | | | | | | | | | | | | |
271.140 | 230.800 | 2.251 | 233.051 | 9.60 | 1.07 | .02 | 233.07 | .04 | .56 | 4.00 | 6.000 | 4.000 | .00 | 0 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
2.064 | .0500 | | | | | .0001 | .00 | 2.29 | .13 | .25 | .013 | .00 | .00 | RECTANG |
| | | | | | | | | | | | | | | | |
273.204 | 230.903 | 2.146 | 233.050 | 9.60 | 1.12 | .02 | 233.07 | .04 | .56 | 4.00 | 6.000 | 4.000 | .00 | 0 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.936 | .0500 | | | | | .0001 | .00 | 2.19 | .13 | .25 | .013 | .00 | .00 | RECTANG |
| | | | | | | | | | | | | | | | |
275.140 | 231.000 | 2.048 | 233.048 | 9.60 | 1.17 | .02 | 233.07 | .00 | .56 | 4.00 | 6.000 | 4.000 | .00 | 0 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
HYDRAULIC JUMP
| | | | | | | | | | | | | | | | |
275.140 | 231.000 | .399 | 231.399 | 9.60 | 25.47 | 10.07 | 241.47 | .00 | 1.20 | 1.33 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.834 | .4586 | | | | | .3456 | .29 | .40 | 8.42 | .37 | .013 | .00 | .00 | PIPE |

```

Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:19:54

City of San Diego Group Job 828

Maple Street Storm Drain

CValdo Job# 17-002 10/7/19

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
275.974 | 231.383 | .400 | 231.783 | 9.60 | 25.32 | 9.96 | 241.74 | .00 | 1.20 | 1.33 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
6.492 | .4586 | | | | | .3213 | 2.09 | .40 | 8.35 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
282.466 | 234.360 | .414 | 234.774 | 9.60 | 24.15 | 9.05 | 243.83 | .00 | 1.20 | 1.34 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
4.558 | .4586 | | | | | .2811 | 1.28 | .41 | 7.82 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
287.024 | 236.450 | .428 | 236.878 | 9.60 | 23.02 | 8.23 | 245.11 | .00 | 1.20 | 1.35 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.448 | .4586 | | | | | .2460 | .85 | .43 | 7.31 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
290.472 | 238.031 | .443 | 238.474 | 9.60 | 21.95 | 7.48 | 245.96 | .00 | 1.20 | 1.37 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
2.731 | .4586 | | | | | .2154 | .59 | .44 | 6.84 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
293.203 | 239.284 | .459 | 239.743 | 9.60 | 20.93 | 6.80 | 246.54 | .00 | 1.20 | 1.38 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
2.232 | .4586 | | | | | .1887 | .42 | .46 | 6.40 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
295.434 | 240.307 | .475 | 240.782 | 9.60 | 19.96 | 6.18 | 246.97 | .00 | 1.20 | 1.40 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.858 | .4586 | | | | | .1653 | .31 | .48 | 5.99 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
297.292 | 241.159 | .492 | 241.651 | 9.60 | 19.03 | 5.62 | 247.27 | .00 | 1.20 | 1.41 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.574 | .4586 | | | | | .1448 | .23 | .49 | 5.60 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
298.867 | 241.881 | .509 | 242.390 | 9.60 | 18.14 | 5.11 | 247.50 | .00 | 1.20 | 1.42 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.346 | .4586 | | | | | .1268 | .17 | .51 | 5.24 | .37 | .013 | .00 | .00 | PIPE
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
300.213 | 242.498 | .527 | 243.026 | 9.60 | 17.30 | 4.65 | 247.67 | .00 | 1.20 | 1.43 | 1.500 | .000 | .00 | 1 | .0
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.161 | .4586 | | | | | .1111 | .13 | .53 | 4.90 | .37 | .013 | .00 | .00 | PIPE
*****

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Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:19:54

City of San Diego Group Job 828

Maple Street Storm Drain

CValdo Job# 17-002 10/7/19

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | |
301.373 | 243.031 | .546 | 243.577 | 9.60 | 16.49 | 4.22 | 247.80 | .00 | 1.20 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.008 | .4586 | | | | | .0975 | .10 | .55 | 4.58 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
302.381 | 243.493 | .566 | 244.059 | 9.60 | 15.72 | 3.84 | 247.90 | .00 | 1.20 | 1.45 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.882 | .4586 | | | | | .0855 | .08 | .57 | 4.28 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
303.263 | 243.898 | .586 | 244.484 | 9.60 | 14.99 | 3.49 | 247.97 | .00 | 1.20 | 1.46 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.772 | .4586 | | | | | .0750 | .06 | .59 | 3.99 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
304.036 | 244.252 | .607 | 244.859 | 9.60 | 14.30 | 3.17 | 248.03 | .00 | 1.20 | 1.47 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.678 | .4586 | | | | | .0658 | .04 | .61 | 3.73 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
304.714 | 244.563 | .629 | 245.192 | 9.60 | 13.63 | 2.88 | 248.08 | .00 | 1.20 | 1.48 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.594 | .4586 | | | | | .0578 | .03 | .63 | 3.48 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
305.309 | 244.835 | .653 | 245.489 | 9.60 | 13.00 | 2.62 | 248.11 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.526 | .4586 | | | | | .0508 | .03 | .65 | 3.25 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
305.834 | 245.077 | .677 | 245.754 | 9.60 | 12.39 | 2.38 | 248.14 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.463 | .4586 | | | | | .0447 | .02 | .68 | 3.03 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
306.298 | 245.289 | .702 | 245.991 | 9.60 | 11.81 | 2.17 | 248.16 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.405 | .4586 | | | | | .0393 | .02 | .70 | 2.83 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
306.703 | 245.475 | .729 | 246.204 | 9.60 | 11.26 | 1.97 | 248.17 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.359 | .4586 | | | | | .0346 | .01 | .73 | 2.63 | .37 | .013 | .00 | .00 | PIPE |

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Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:19:54

City of San Diego Group Job 828

Maple Street Storm Drain

CValdo Job# 17-002 10/7/19

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | |
307.062 | 245.640 | .756 | 246.396 | 9.60 | 10.74 | 1.79 | 248.19 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.313 | .4586 | | | | | .0304 | .01 | .76 | 2.45 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
307.374 | 245.783 | .785 | 246.568 | 9.60 | 10.24 | 1.63 | 248.20 | .00 | 1.20 | 1.50 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.271 | .4586 | | | | | .0268 | .01 | .79 | 2.28 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
307.645 | 245.907 | .816 | 246.723 | 9.60 | 9.76 | 1.48 | 248.20 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.236 | .4586 | | | | | .0237 | .01 | .82 | 2.12 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
307.881 | 246.015 | .848 | 246.863 | 9.60 | 9.31 | 1.35 | 248.21 | .00 | 1.20 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.202 | .4586 | | | | | .0209 | .00 | .85 | 1.97 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
308.083 | 246.108 | .882 | 246.990 | 9.60 | 8.88 | 1.22 | 248.21 | .00 | 1.20 | 1.48 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.171 | .4586 | | | | | .0185 | .00 | .88 | 1.83 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
308.254 | 246.186 | .918 | 247.104 | 9.60 | 8.46 | 1.11 | 248.22 | .00 | 1.20 | 1.46 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.143 | .4586 | | | | | .0164 | .00 | .92 | 1.69 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
308.397 | 246.252 | .956 | 247.208 | 9.60 | 8.07 | 1.01 | 248.22 | .00 | 1.20 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.115 | .4586 | | | | | .0145 | .00 | .96 | 1.57 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
308.511 | 246.304 | .997 | 247.301 | 9.60 | 7.69 | .92 | 248.22 | .00 | 1.20 | 1.42 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.091 | .4586 | | | | | .0129 | .00 | 1.00 | 1.44 | .37 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
308.602 | 246.346 | 1.040 | 247.386 | 9.60 | 7.34 | .84 | 248.22 | .00 | 1.20 | 1.38 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.065 | .4586 | | | | | .0115 | .00 | 1.04 | 1.33 | .37 | .013 | .00 | .00 | PIPE |

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Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:19:54

City of San Diego Group Job 828

Maple Street Storm Drain

CValdo Job# 17-002 10/7/19

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
| | | | | | | | | | | | | | | | |
308.667 | 246.376 | 1.087 | 247.463 | 9.60 | 6.99 | .76 | 248.22 | .00 | 1.20 | 1.34 | 1.500 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.040 | .4586 | | | | | .0103 | .00 | 1.09 | 1.22 | .37 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | | |
308.707 | 246.394 | 1.138 | 247.532 | 9.60 | 6.67 | .69 | 248.22 | .00 | 1.20 | 1.28 | 1.500 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.013 | .4586 | | | | | .0093 | .00 | 1.14 | 1.11 | .37 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | | |
308.720 | 246.400 | 1.196 | 247.596 | 9.60 | 6.35 | .63 | 248.22 | .00 | 1.20 | 1.21 | 1.500 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
WALL ENTRANCE
| | | | | | | | | | | | | | | | |
308.720 | 246.400 | 2.285 | 248.685 | 9.60 | .21 | .00 | 248.69 | .00 | .40 | 29.73 | 99.000 | .000 | .00 | 0 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-

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T1 City of San Diego Group Job 828

T2 Olive Street Storm Drain

T3 CValdo Job# 17-002 10/7/19

SO	114.330	229.850	1					229.850		
R	118.260	229.880	1	.013					.000	.000 0
R	170.290	247.700	1	.013					.000	.000 0
WE	170.290	247.700	2	.500						
R	174.290	248.000	2	.013					8.500	.000 0
WX	174.290	248.000	3							
R	225.200	281.300	3	.013					.000	.000 0
WE	225.200	281.300	4	.500						
SH	225.200	281.300	4					281.300		
CD	1	4	1	.000	1.500	.000	.000	.000	.00	
CD	2	2	0	.000	6.000	4.000	.000	.000	.00	
CD	3	4	1	.000	1.500	.000	.000	.000	.00	
CD	4	4	1	.000	99.000	.000	.000	.000	.00	
Q		3.000	.0							

WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Olive Street Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:32:42

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
114.330 | 229.850 | .246 | 230.096 | 3.00 | 15.83 | 3.89 | 233.99 | .00 | .66 | 1.11 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.992 | .0076 | | | | | .2488 | .25 | .25 | 6.76 | .59 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
115.322 | 229.858 | .241 | 230.099 | 3.00 | 16.33 | 4.14 | 234.24 | .00 | .66 | 1.10 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.499 | .0076 | | | | | .2787 | .42 | .24 | 7.05 | .59 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
116.821 | 229.869 | .233 | 230.102 | 3.00 | 17.13 | 4.56 | 234.66 | .00 | .66 | 1.09 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.439 | .0076 | | | | | .3191 | .46 | .23 | 7.52 | .59 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
118.260 | 229.880 | .226 | 230.106 | 3.00 | 17.97 | 5.01 | 235.12 | .00 | .66 | 1.07 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
19.673 | .3425 | | | | | .3319 | 6.53 | .23 | 8.03 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
137.933 | 236.618 | .228 | 236.846 | 3.00 | 17.64 | 4.83 | 241.68 | .00 | .66 | 1.08 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
10.830 | .3425 | | | | | .3027 | 3.28 | .23 | 7.82 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
148.763 | 240.327 | .236 | 240.563 | 3.00 | 16.82 | 4.39 | 244.96 | .00 | .66 | 1.09 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
5.017 | .3425 | | | | | .2645 | 1.33 | .24 | 7.34 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
153.780 | 242.045 | .244 | 242.290 | 3.00 | 16.04 | 3.99 | 246.28 | .00 | .66 | 1.11 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.183 | .3425 | | | | | .2309 | .74 | .24 | 6.88 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
156.963 | 243.135 | .252 | 243.388 | 3.00 | 15.29 | 3.63 | 247.02 | .00 | .66 | 1.12 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
2.284 | .3425 | | | | | .2015 | .46 | .25 | 6.44 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
159.247 | 243.918 | .260 | 244.178 | 3.00 | 14.58 | 3.30 | 247.48 | .00 | .66 | 1.14 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.747 | .3425 | | | | | .1759 | .31 | .26 | 6.04 | .23 | .013 | .00 | .00 | PIPE |
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WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Olive Street Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:32:42

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | |
160.995 | 244.516 | .269 | 244.785 | 3.00 | 13.90 | 3.00 | 247.79 | .00 | .66 | 1.15 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.397 | .3425 | | | | | .1537 | .21 | .27 | 5.66 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
162.392 | 244.995 | .278 | 245.273 | 3.00 | 13.25 | 2.73 | 248.00 | .00 | .66 | 1.17 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.143 | .3425 | | | | | .1344 | .15 | .28 | 5.30 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
163.535 | 245.387 | .288 | 245.675 | 3.00 | 12.64 | 2.48 | 248.15 | .00 | .66 | 1.18 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.962 | .3425 | | | | | .1174 | .11 | .29 | 4.97 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
164.497 | 245.716 | .297 | 246.013 | 3.00 | 12.05 | 2.25 | 248.27 | .00 | .66 | 1.20 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.812 | .3425 | | | | | .1025 | .08 | .30 | 4.65 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
165.309 | 245.994 | .307 | 246.301 | 3.00 | 11.49 | 2.05 | 248.35 | .00 | .66 | 1.21 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.693 | .3425 | | | | | .0896 | .06 | .31 | 4.36 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
166.002 | 246.231 | .318 | 246.550 | 3.00 | 10.95 | 1.86 | 248.41 | .00 | .66 | 1.23 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.600 | .3425 | | | | | .0784 | .05 | .32 | 4.08 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
166.602 | 246.437 | .329 | 246.766 | 3.00 | 10.44 | 1.69 | 248.46 | .00 | .66 | 1.24 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.522 | .3425 | | | | | .0685 | .04 | .33 | 3.83 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
167.124 | 246.616 | .340 | 246.956 | 3.00 | 9.96 | 1.54 | 248.50 | .00 | .66 | 1.26 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.453 | .3425 | | | | | .0599 | .03 | .34 | 3.58 | .23 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | |
167.577 | 246.771 | .352 | 247.123 | 3.00 | 9.49 | 1.40 | 248.52 | .00 | .66 | 1.27 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.397 | .3425 | | | | | .0524 | .02 | .35 | 3.36 | .23 | .013 | .00 | .00 | PIPE |

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WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Olive Street Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:32:42

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
167.974 | 246.907 | .364 | 247.271 | 3.00 | 9.05 | 1.27 | 248.54 | .00 | .66 | 1.29 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.349 | .3425 | | | | | .0458 | .02 | .36 | 3.14 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
168.323 | 247.026 | .376 | 247.403 | 3.00 | 8.63 | 1.16 | 248.56 | .00 | .66 | 1.30 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.305 | .3425 | | | | | .0400 | .01 | .38 | 2.94 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
168.628 | 247.131 | .389 | 247.520 | 3.00 | 8.23 | 1.05 | 248.57 | .00 | .66 | 1.31 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.265 | .3425 | | | | | .0350 | .01 | .39 | 2.75 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
168.893 | 247.222 | .403 | 247.625 | 3.00 | 7.85 | .96 | 248.58 | .00 | .66 | 1.33 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.237 | .3425 | | | | | .0306 | .01 | .40 | 2.58 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
169.130 | 247.303 | .416 | 247.719 | 3.00 | 7.48 | .87 | 248.59 | .00 | .66 | 1.34 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.203 | .3425 | | | | | .0268 | .01 | .42 | 2.41 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
169.333 | 247.372 | .431 | 247.803 | 3.00 | 7.13 | .79 | 248.59 | .00 | .66 | 1.36 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.178 | .3425 | | | | | .0235 | .00 | .43 | 2.26 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
169.511 | 247.433 | .446 | 247.879 | 3.00 | 6.80 | .72 | 248.60 | .00 | .66 | 1.37 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.153 | .3425 | | | | | .0205 | .00 | .45 | 2.11 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
169.665 | 247.486 | .462 | 247.948 | 3.00 | 6.48 | .65 | 248.60 | .00 | .66 | 1.39 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.134 | .3425 | | | | | .0180 | .00 | .46 | 1.98 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
169.798 | 247.532 | .478 | 248.010 | 3.00 | 6.18 | .59 | 248.60 | .00 | .66 | 1.40 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.113 | .3425 | | | | | .0158 | .00 | .48 | 1.85 | .23 | .013 | .00 | .00 | PIPE |
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WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Olive Street Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:32:42

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
169.911 | 247.570 | .495 | 248.065 | 3.00 | 5.90 | .54 | 248.61 | .00 | .66 | 1.41 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.098 | .3425 | | | | | .0138 | .00 | .50 | 1.73 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.009 | 247.604 | .512 | 248.116 | 3.00 | 5.62 | .49 | 248.61 | .00 | .66 | 1.42 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.081 | .3425 | | | | | .0121 | .00 | .51 | 1.62 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.089 | 247.631 | .530 | 248.161 | 3.00 | 5.36 | .45 | 248.61 | .00 | .66 | 1.43 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.065 | .3425 | | | | | .0106 | .00 | .53 | 1.51 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.154 | 247.654 | .549 | 248.203 | 3.00 | 5.11 | .41 | 248.61 | .00 | .66 | 1.45 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.051 | .3425 | | | | | .0093 | .00 | .55 | 1.41 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.205 | 247.671 | .569 | 248.240 | 3.00 | 4.87 | .37 | 248.61 | .00 | .66 | 1.46 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.037 | .3425 | | | | | .0082 | .00 | .57 | 1.32 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.242 | 247.684 | .590 | 248.274 | 3.00 | 4.65 | .34 | 248.61 | .00 | .66 | 1.47 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.028 | .3425 | | | | | .0072 | .00 | .59 | 1.23 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.270 | 247.693 | .611 | 248.304 | 3.00 | 4.43 | .30 | 248.61 | .00 | .66 | 1.47 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.014 | .3425 | | | | | .0063 | .00 | .61 | 1.15 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.284 | 247.698 | .634 | 248.332 | 3.00 | 4.22 | .28 | 248.61 | .00 | .66 | 1.48 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.006 | .3425 | | | | | .0055 | .00 | .63 | 1.07 | .23 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
170.290 | 247.700 | .658 | 248.358 | 3.00 | 4.02 | .25 | 248.61 | .03 | .66 | 1.49 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

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WALL ENTRANCE

.265 .0750 2.0467 .54 1.59 16.02 .11 .013 .00 .00 RECTANG
 WARNING: POSSIBLE ERROR IN CALCULATIONS, PROGRAM USES MANNINGS, EQUATION, AVERAGE FRICTION SLOPE = 2.04668

FILE: olive.WSW

W S P G W - CIVILDESIGN Version 14.06
 Program Package Serial Number: 1701

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WATER SURFACE PROFILE LISTING
 City of San Diego Group Job 828
 Olive Street Storm Drain
 CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:32:42

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
173.594	247.948	.039	247.987	3.00	19.26	5.76	253.75	1.71	.26	4.00	6.000	4.000	.00	0 .0
.247	.0750					2.3961	.59	1.75	17.20	.11	.013	.00	.00	RECTANG
WARNING: POSSIBLE ERROR IN CALCULATIONS, PROGRAM USES MANNINGS, EQUATION, AVERAGE FRICTION SLOPE = 2.39614														
173.842	247.966	.037	248.004	3.00	20.20	6.34	254.34	1.88	.26	4.00	6.000	4.000	.00	0 .0
.231	.0750					2.8054	.65	1.92	18.48	.11	.013	.00	.00	RECTANG
WARNING: POSSIBLE ERROR IN CALCULATIONS, PROGRAM USES MANNINGS, EQUATION, AVERAGE FRICTION SLOPE = 2.80542														
174.073	247.984	.035	248.019	3.00	21.19	6.97	254.99	2.07	.26	4.00	6.000	4.000	.00	0 .0
.217	.0750					3.2848	.71	2.10	19.85	.11	.013	.00	.00	RECTANG
WARNING: POSSIBLE ERROR IN CALCULATIONS, PROGRAM USES MANNINGS, EQUATION, AVERAGE FRICTION SLOPE = 3.28478														
174.290	248.000	.034	248.034	3.00	22.22	7.67	255.70	.00	.26	4.00	6.000	4.000	.00	0 .0
WALL EXIT														
174.290	248.000	.193	248.193	3.00	22.59	7.92	256.12	.00	.66	1.00	1.500	.000	.00	1 .0
.939	.6541					.6544	.61	.19	10.95	.19	.013	.00	.00	PIPE
175.229	248.614	.193	248.807	3.00	22.59	7.92	256.73	.00	.66	1.00	1.500	.000	.00	1 .0
17.827	.6541					.6463	11.52	.19	10.95	.19	.013	.00	.00	PIPE
193.056	260.275	.194	260.469	3.00	22.39	7.78	268.25	.00	.66	1.01	1.500	.000	.00	1 .0
12.329	.6541					.5972	7.36	.19	10.81	.19	.013	.00	.00	PIPE
205.385	268.339	.200	268.539	3.00	21.35	7.08	275.61	.00	.66	1.02	1.500	.000	.00	1 .0

4.784	.6541					.5211	2.49	.20	10.13	.19	.013	.00	.00	PIPE
210.170	271.469	.207	271.676	3.00	20.35	6.43	278.11	.00	.66	1.03	1.500	.000	.00	1 .0
2.905	.6541					.4553	1.32	.21	9.50	.19	.013	.00	.00	PIPE

FILE: olive.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE 7

Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:32:42

City of San Diego Group Job 828

Olive Street Storm Drain

CValdo Job# 17-002 10/7/19

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Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/ or I.D.	No ZL	Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
213.075	273.369	.214	273.583	3.00	19.41	5.85	279.43	.00	.66	1.05	1.500	.000	.00	1 .0
2.044	.6541					.3974	.81	.21	8.91	.19	.013	.00	.00	PIPE
215.119	274.706	.221	274.927	3.00	18.50	5.32	280.24	.00	.66	1.06	1.500	.000	.00	1 .0
1.549	.6541					.3467	.54	.22	8.35	.19	.013	.00	.00	PIPE
216.668	275.719	.228	275.947	3.00	17.64	4.83	280.78	.00	.66	1.08	1.500	.000	.00	1 .0
1.227	.6541					.3027	.37	.23	7.82	.19	.013	.00	.00	PIPE
217.895	276.522	.236	276.758	3.00	16.82	4.39	281.15	.00	.66	1.09	1.500	.000	.00	1 .0
1.005	.6541					.2645	.27	.24	7.34	.19	.013	.00	.00	PIPE
218.900	277.179	.244	277.423	3.00	16.04	3.99	281.42	.00	.66	1.11	1.500	.000	.00	1 .0
.839	.6541					.2309	.19	.24	6.88	.19	.013	.00	.00	PIPE
219.739	277.728	.252	277.980	3.00	15.29	3.63	281.61	.00	.66	1.12	1.500	.000	.00	1 .0
.712	.6541					.2015	.14	.25	6.44	.19	.013	.00	.00	PIPE
220.451	278.193	.260	278.454	3.00	14.58	3.30	281.75	.00	.66	1.14	1.500	.000	.00	1 .0
.609	.6541					.1759	.11	.26	6.04	.19	.013	.00	.00	PIPE
221.059	278.592	.269	278.861	3.00	13.90	3.00	281.86	.00	.66	1.15	1.500	.000	.00	1 .0

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.527	.6541					.1537	.08	.27	5.66	.19	.013	.00	.00	PIPE
221.586	278.936	.278	279.215	3.00	13.25	2.73	281.94	.00	.66	1.17	1.500	.000	.00	1 .0
.458	.6541					.1344	.06	.28	5.30	.19	.013	.00	.00	PIPE

FILE: olive.WSW

W S P G W - CIVILDESIGN Version 14.06
 Program Package Serial Number: 1701
 WATER SURFACE PROFILE LISTING

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City of San Diego Group Job 828
 Olive Street Storm Drain
 CValdo Job# 17-002 10/7/19

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/or I.D.	No ZL	Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
222.044	279.236	.288	279.524	3.00	12.64	2.48	282.00	.00	.66	1.18	1.500	.000	.00	1 .0
.403	.6541					.1174	.05	.29	4.97	.19	.013	.00	.00	PIPE
222.448	279.500	.297	279.797	3.00	12.05	2.25	282.05	.00	.66	1.20	1.500	.000	.00	1 .0
.353	.6541					.1025	.04	.30	4.65	.19	.013	.00	.00	PIPE
222.801	279.731	.307	280.038	3.00	11.49	2.05	282.09	.00	.66	1.21	1.500	.000	.00	1 .0
.311	.6541					.0896	.03	.31	4.36	.19	.013	.00	.00	PIPE
223.112	279.934	.318	280.252	3.00	10.95	1.86	282.12	.00	.66	1.23	1.500	.000	.00	1 .0
.275	.6541					.0784	.02	.32	4.08	.19	.013	.00	.00	PIPE
223.387	280.114	.329	280.443	3.00	10.44	1.69	282.14	.00	.66	1.24	1.500	.000	.00	1 .0
.244	.6541					.0685	.02	.33	3.83	.19	.013	.00	.00	PIPE
223.631	280.274	.340	280.614	3.00	9.96	1.54	282.15	.00	.66	1.26	1.500	.000	.00	1 .0
.215	.6541					.0599	.01	.34	3.58	.19	.013	.00	.00	PIPE
223.846	280.415	.352	280.767	3.00	9.49	1.40	282.17	.00	.66	1.27	1.500	.000	.00	1 .0
.192	.6541					.0524	.01	.35	3.36	.19	.013	.00	.00	PIPE
224.038	280.540	.364	280.904	3.00	9.05	1.27	282.18	.00	.66	1.29	1.500	.000	.00	1 .0

.050	.6541					.0138	.00	.50	1.73	.19	.013	.00	.00	PIPE
225.055	281.205	.512	281.717	3.00	5.62	.49	282.21	.00	.66	1.42	1.500	.000	.00	1 .0
.041	.6541					.0121	.00	.51	1.62	.19	.013	.00	.00	PIPE

FILE: olive.WSW

W S P G W - CIVILDESIGN Version 14.06

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Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:32:42

City of San Diego Group Job 828

Olive Street Storm Drain

CValdo Job# 17-002 10/7/19

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/or I.D.	No ZL	Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
225.096	281.232	.530	281.762	3.00	5.36	.45	282.21	.00	.66	1.43	1.500	.000	.00	1 .0
.033	.6541					.0106	.00	.53	1.51	.19	.013	.00	.00	PIPE
225.130	281.254	.549	281.803	3.00	5.11	.41	282.21	.00	.66	1.45	1.500	.000	.00	1 .0
.026	.6541					.0093	.00	.55	1.41	.19	.013	.00	.00	PIPE
225.156	281.271	.569	281.840	3.00	4.87	.37	282.21	.00	.66	1.46	1.500	.000	.00	1 .0
.019	.6541					.0082	.00	.57	1.32	.19	.013	.00	.00	PIPE
225.175	281.284	.590	281.874	3.00	4.65	.34	282.21	.00	.66	1.47	1.500	.000	.00	1 .0
.015	.6541					.0072	.00	.59	1.23	.19	.013	.00	.00	PIPE
225.190	281.293	.611	281.904	3.00	4.43	.30	282.21	.00	.66	1.47	1.500	.000	.00	1 .0
.007	.6541					.0063	.00	.61	1.15	.19	.013	.00	.00	PIPE
225.197	281.298	.634	281.932	3.00	4.22	.28	282.21	.00	.66	1.48	1.500	.000	.00	1 .0
.003	.6541					.0055	.00	.63	1.07	.19	.013	.00	.00	PIPE
225.200	281.300	.658	281.958	3.00	4.02	.25	282.21	.00	.66	1.49	1.500	.000	.00	1 .0
WALL ENTRANCE														
225.200	281.300	1.024	282.324	3.00	.22	.00	282.33	.00	.22	20.04	99.000	.000	.00	0 .0

T1	City of San Diego Group Job 828									
T2	Palm Street East Storm Drain									
T3	CValdo	Job#	17-002	10/7/19						
SO	121.760	255.960	1					255.960		
R	126.520	255.990	1	.013					.000	.000 0
R	186.620	293.500	1	.013					.000	.000 0
WE	186.620	293.500	2	.500						
SH	186.620	293.500	2					293.500		
CD	1	4	1	.000	1.500	.000	.000	.000	.00	
CD	2	4	1	.000	99.000	.000	.000	.000	.00	
Q		3.500	.0							

Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:49:15

City of San Diego Group Job 828

Palm Street East Storm Drain

CValdo Job# 17-002 10/7/19

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
121.760 | 255.960 | .235 | 256.195 | 3.50 | 19.81 | 6.09 | 262.29 | .00 | .71 | 1.09 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.665 | .0063 | | | | | .4049 | .27 | .23 | 8.67 | .68 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
122.425 | 255.964 | .231 | 256.195 | 3.50 | 20.17 | 6.32 | 262.51 | .00 | .71 | 1.08 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.423 | .0063 | | | | | .4454 | .63 | .23 | 8.88 | .68 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
123.847 | 255.973 | .224 | 256.197 | 3.50 | 21.15 | 6.95 | 263.15 | .00 | .71 | 1.07 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.364 | .0063 | | | | | .5107 | .70 | .22 | 9.48 | .68 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
125.211 | 255.982 | .217 | 256.199 | 3.50 | 22.19 | 7.64 | 263.84 | .00 | .71 | 1.06 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.309 | .0063 | | | | | .5851 | .77 | .22 | 10.11 | .68 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
126.520 | 255.990 | .210 | 256.200 | 3.50 | 23.27 | 8.41 | 264.61 | .00 | .71 | 1.04 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
15.401 | .6241 | | | | | .6247 | 9.62 | .21 | 10.79 | .21 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
141.921 | 265.602 | .210 | 265.812 | 3.50 | 23.27 | 8.41 | 274.22 | .00 | .71 | 1.04 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
19.142 | .6241 | | | | | .5928 | 11.35 | .21 | 10.79 | .21 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
161.063 | 277.549 | .215 | 277.764 | 3.50 | 22.42 | 7.80 | 285.57 | .00 | .71 | 1.05 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
7.096 | .6241 | | | | | .5251 | 3.73 | .22 | 10.25 | .21 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
168.159 | 281.978 | .222 | 282.200 | 3.50 | 21.37 | 7.09 | 289.29 | .00 | .71 | 1.07 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.851 | .6241 | | | | | .4587 | 1.77 | .22 | 9.61 | .21 | .013 | .00 | .00 | PIPE |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
172.010 | 284.382 | .230 | 284.612 | 3.50 | 20.38 | 6.45 | 291.06 | .00 | .71 | 1.08 | 1.500 | .000 | .00 | 1 | .0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
2.591 | .6241 | | | | | .4005 | 1.04 | .23 | 9.01 | .21 | .013 | .00 | .00 | PIPE |

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WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Palm Street East Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:49:15

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | | |
174.601 | 285.999 | .237 | 286.236 | 3.50 | 19.43 | 5.86 | 292.10 | .00 | .71 | 1.09 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.911 | .6241 | | | | | .3494 | .67 | .24 | 8.44 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
176.512 | 287.191 | .245 | 287.436 | 3.50 | 18.53 | 5.33 | 292.77 | .00 | .71 | 1.11 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.492 | .6241 | | | | | .3054 | .46 | .25 | 7.91 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
178.004 | 288.122 | .254 | 288.377 | 3.50 | 17.66 | 4.85 | 293.22 | .00 | .71 | 1.13 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.211 | .6241 | | | | | .2669 | .32 | .25 | 7.42 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
179.215 | 288.878 | .262 | 289.140 | 3.50 | 16.84 | 4.40 | 293.55 | .00 | .71 | 1.14 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.001 | .6241 | | | | | .2330 | .23 | .26 | 6.95 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
180.215 | 289.503 | .271 | 289.774 | 3.50 | 16.06 | 4.00 | 293.78 | .00 | .71 | 1.15 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.844 | .6241 | | | | | .2035 | .17 | .27 | 6.51 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
181.059 | 290.030 | .280 | 290.310 | 3.50 | 15.31 | 3.64 | 293.95 | .00 | .71 | 1.17 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.719 | .6241 | | | | | .1779 | .13 | .28 | 6.10 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
181.779 | 290.478 | .290 | 290.769 | 3.50 | 14.60 | 3.31 | 294.08 | .00 | .71 | 1.18 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.623 | .6241 | | | | | .1554 | .10 | .29 | 5.72 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
182.401 | 290.867 | .299 | 291.166 | 3.50 | 13.92 | 3.01 | 294.17 | .00 | .71 | 1.20 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.538 | .6241 | | | | | .1358 | .07 | .30 | 5.36 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
182.939 | 291.203 | .310 | 291.513 | 3.50 | 13.27 | 2.74 | 294.25 | .00 | .71 | 1.21 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.472 | .6241 | | | | | .1187 | .06 | .31 | 5.02 | .21 | .013 | .00 | .00 | PIPE |

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Program Package Serial Number: 1701

WATER SURFACE PROFILE LISTING

Date:10- 7-2019 Time:11:49:15

City of San Diego Group Job 828

Palm Street East Storm Drain

CValdo Job# 17-002 10/7/19

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
| | | | | | | | | | | | | | | | | |
183.411 | 291.497 | .320 | 291.817 | 3.50 | 12.65 | 2.49 | 294.30 | .00 | .71 | 1.23 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.413 | .6241 | | | | | | .1037 | .04 | .32 | 4.70 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
183.824 | 291.755 | .331 | 292.086 | 3.50 | 12.07 | 2.26 | 294.35 | .00 | .71 | 1.24 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.365 | .6241 | | | | | | .0906 | .03 | .33 | 4.40 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
184.189 | 291.983 | .342 | 292.325 | 3.50 | 11.50 | 2.05 | 294.38 | .00 | .71 | 1.26 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.321 | .6241 | | | | | | .0792 | .03 | .34 | 4.12 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
184.510 | 292.183 | .354 | 292.537 | 3.50 | 10.97 | 1.87 | 294.41 | .00 | .71 | 1.27 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.284 | .6241 | | | | | | .0693 | .02 | .35 | 3.86 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
184.794 | 292.360 | .366 | 292.726 | 3.50 | 10.46 | 1.70 | 294.42 | .00 | .71 | 1.29 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.251 | .6241 | | | | | | .0606 | .02 | .37 | 3.62 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
185.045 | 292.517 | .379 | 292.896 | 3.50 | 9.97 | 1.54 | 294.44 | .00 | .71 | 1.30 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.223 | .6241 | | | | | | .0530 | .01 | .38 | 3.39 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
185.268 | 292.656 | .392 | 293.048 | 3.50 | 9.51 | 1.40 | 294.45 | .00 | .71 | 1.32 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.198 | .6241 | | | | | | .0464 | .01 | .39 | 3.17 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
185.466 | 292.780 | .405 | 293.185 | 3.50 | 9.06 | 1.28 | 294.46 | .00 | .71 | 1.33 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.175 | .6241 | | | | | | .0405 | .01 | .41 | 2.97 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
185.641 | 292.889 | .419 | 293.308 | 3.50 | 8.64 | 1.16 | 294.47 | .00 | .71 | 1.35 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.154 | .6241 | | | | | | .0355 | .01 | .42 | 2.78 | .21 | .013 | .00 | .00 | PIPE |

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WATER SURFACE PROFILE LISTING
City of San Diego Group Job 828
Palm Street East Storm Drain
CValdo Job# 17-002 10/7/19

Date:10- 7-2019 Time:11:49:15

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth |
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem |Ch Slope | | | | | SF Ave | HF |SE Dpth|Froude N|Norm Dp | "N" | X-Fall | ZR |Type Ch |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
| | | | | | | | | | | | | | | | | |
185.795 | 292.985 | .434 | 293.419 | 3.50 | 8.24 | 1.05 | 294.47 | .00 | .71 | 1.36 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.136 | .6241 | | | | | .0311 | .00 | .43 | 2.60 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
185.931 | 293.070 | .449 | 293.519 | 3.50 | 7.86 | .96 | 294.48 | .00 | .71 | 1.37 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.119 | .6241 | | | | | .0272 | .00 | .45 | 2.43 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.050 | 293.144 | .465 | 293.609 | 3.50 | 7.49 | .87 | 294.48 | .00 | .71 | 1.39 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.105 | .6241 | | | | | .0238 | .00 | .47 | 2.28 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.156 | 293.210 | .481 | 293.691 | 3.50 | 7.14 | .79 | 294.48 | .00 | .71 | 1.40 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.091 | .6241 | | | | | .0209 | .00 | .48 | 2.13 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.247 | 293.267 | .498 | 293.765 | 3.50 | 6.81 | .72 | 294.49 | .00 | .71 | 1.41 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.078 | .6241 | | | | | .0183 | .00 | .50 | 1.99 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.325 | 293.316 | .516 | 293.832 | 3.50 | 6.49 | .65 | 294.49 | .00 | .71 | 1.43 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.068 | .6241 | | | | | .0160 | .00 | .52 | 1.86 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.393 | 293.359 | .534 | 293.893 | 3.50 | 6.19 | .60 | 294.49 | .00 | .71 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.058 | .6241 | | | | | .0140 | .00 | .53 | 1.74 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.451 | 293.394 | .553 | 293.948 | 3.50 | 5.90 | .54 | 294.49 | .00 | .71 | 1.45 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.048 | .6241 | | | | | .0123 | .00 | .55 | 1.63 | .21 | .013 | .00 | .00 | PIPE |
| | | | | | | | | | | | | | | | | |
186.499 | 293.424 | .573 | 293.997 | 3.50 | 5.63 | .49 | 294.49 | .00 | .71 | 1.46 | 1.500 | .000 | .00 | 1 | .0 |
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.039 | .6241 | | | | | .0108 | .00 | .57 | 1.52 | .21 | .013 | .00 | .00 | PIPE |

```


APPENDIX E
OLIVE STREET STORM DRAIN DIVERSION ANALYSIS

Analysis

This section explores the feasibility of diverting flows from Site 2 to Site 6 via an underground storm drain system extending from the easterly end of Olive Street where it meets Switzer Canyon, westerly within Olive Street to 30th Street, then southerly within 30th Street to join an existing storm drain system within 30th Street, that collects runoff from the north and south at a sag location (Site 6). This alternative was deemed feasible, but not desirable, as it was determined that the system at Site 6 is undersized in the existing condition, and thus, this option would trigger additional improvements at Site 6. Specifically, it was concluded that:

1. The tributary 100-year surface flow at node 74 (30th Street east side sag inlet) is approximately 15.7 cfs. The existing 7-foot opening inlet has capacity for approximately 14.3 cfs, and thus is not adequately sized. Note that the depth from the manhole rim to the storm drain invert at this inlet is approximately 9 feet.
2. The tributary 100-year surface flow at node 64 (30th Street west side sag inlet) is approximately 27.4 cfs. The existing 7-foot opening inlet has capacity for approximately 14.3 cfs and thus is not adequately sized. During our field visit conducted in September of 2017, we observed erosion of the hillside below the jute matting adjacent to the westerly inlet and believe that this was caused by surface runoff overtopping the curb at the inlet during the winter of 2016-17, when heavy rains fell in San Diego. Note that the depth from the manhole rim to the storm drain invert at this inlet is approximately 12 feet.
3. The tributary 100-year flow from Site 2 is approximately 3.0 cfs. This flow could either enter the 30th Street storm drain system at a new manhole between nodes 74 and 64 (shown as node 76 on the hydrology workmap) or flows could enter the westerly inlet from a new opening on the north side. For purposes of this analysis, it was assumed that flows would enter the system from a new manhole between nodes 74 and 64.

4. The existing storm drain crossing 30th Street from node 74 to node 64, and the existing storm drain conveying flows from node 64 to the canyon, each appears to be 18-inch diameter facilities based upon field observation. Note that we did not enter the catch basins but popped the lid at each location and used a tape to measure the openings to the best of our ability from the surface. The required pipe size for each of these facilities, based on inlet control and normal depth assuming 4% slope (the slope of the existing facility across 30th Street is approximately 7%), and the tributary peak flow rate is shown below. The capacity of each facility based on is also provided.

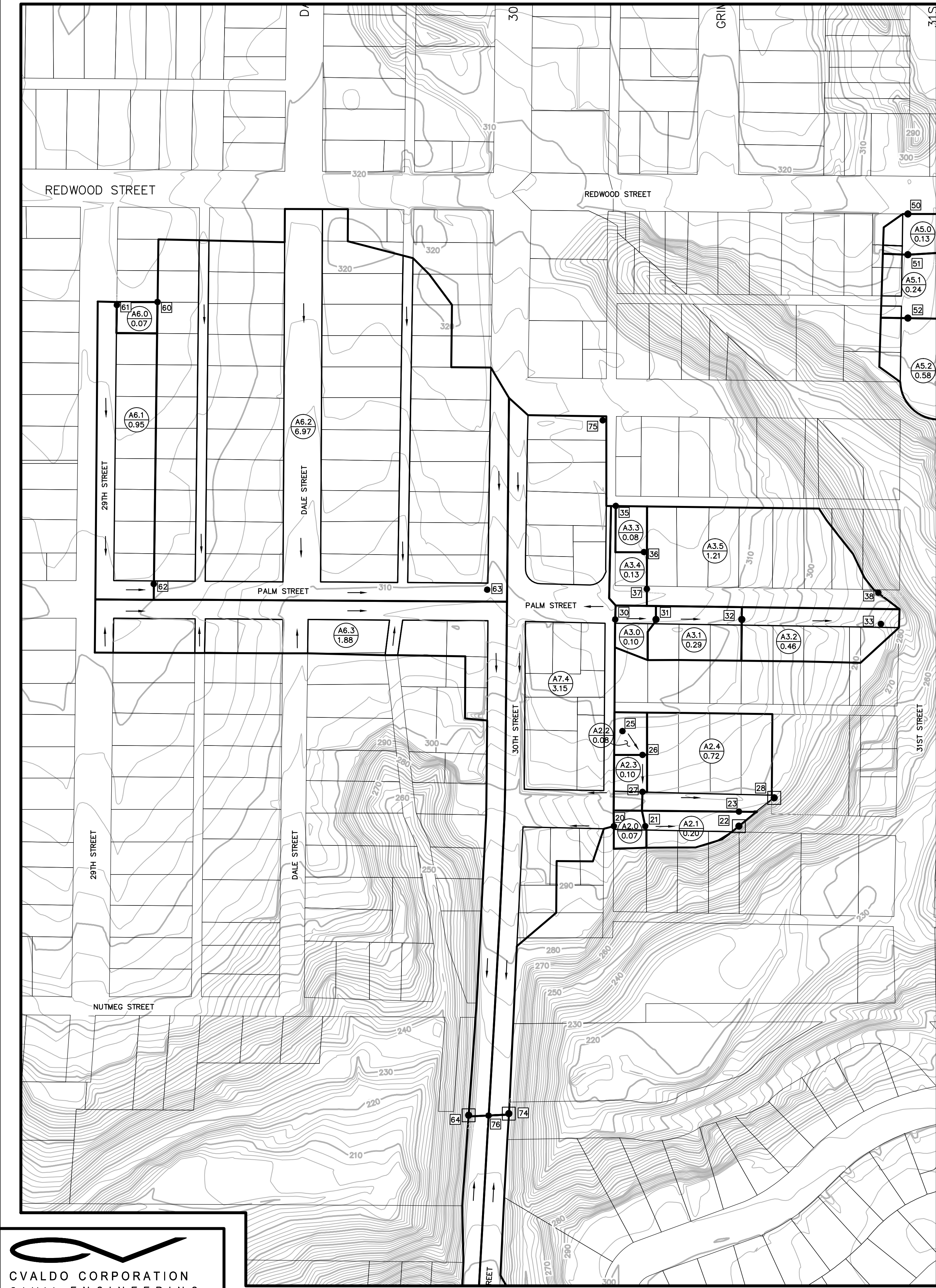
Hydrology Workmap Node Number		Q (cfs)	Existing Pipe Diameter (in)*	Required Pipe Diameter (in) based on Inlet Control	Required Pipe Diameter (in) based on Normal Depth**
Upstream	Downstream				
74	76	15.7	18	18	18
76	64	18.0	18	18	18
64	N/A - Canyon Bottom	44.4	18	24	24

* Existing pipe diameter estimated by dipping manhole from surface

** 4% slope assumed for normal depth analysis

Conclusion

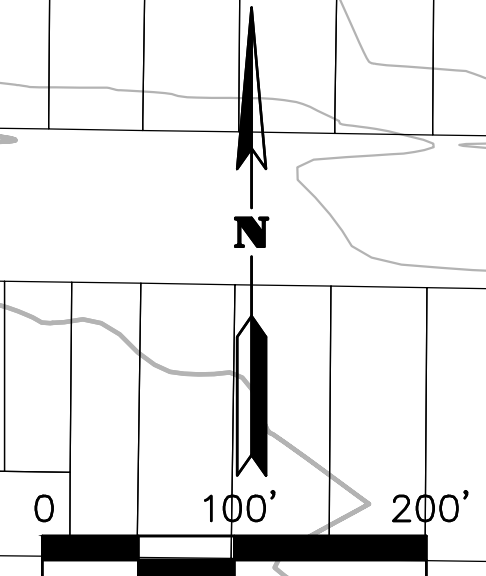
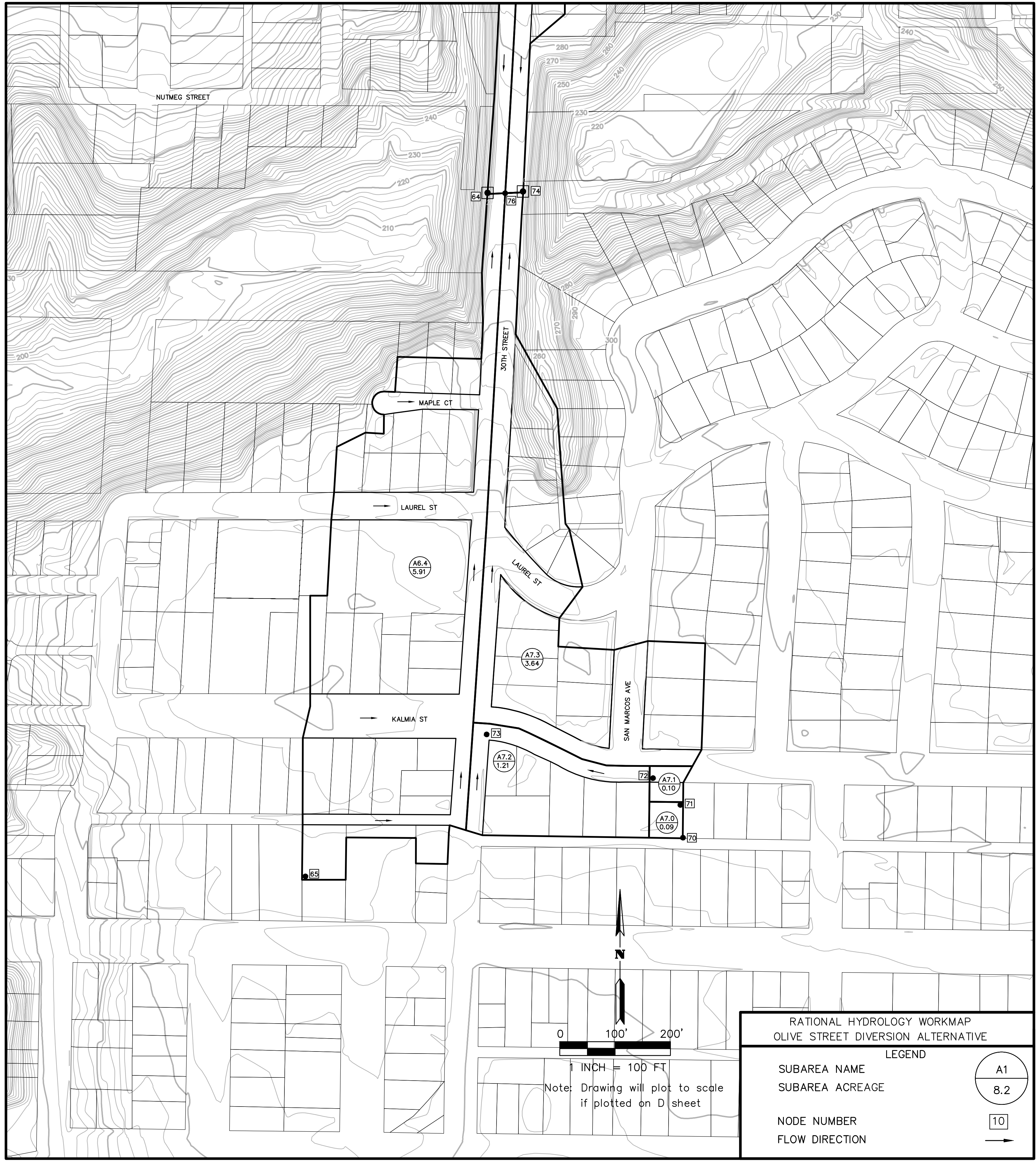
As shown in the table above, the existing storm drain between node 64 and the canyon would require upsizing from 18" to 24" to accommodate diversion of Site 2 runoff to the Site 6 storm drain system. Note that in the existing condition, without the addition of Site 2 flows, the Site 6 system is still undersized based on both inlet control at node 64, and surface flow capture at both nodes 74 and 64.



SEE FIGURE AT RIGHT

CVALDO CORPORATION
 CIVIL ENGINEERING
 4901 MORENA BOULEVARD, SUITE 1110
 SAN DIEGO, CA 92117
 (P) 858-866-0128

SEE FIGURE AT LEFT



1 INCH = 100 FT
 Note: Drawing will plot to scale
 if plotted on D sheet

RATIONAL HYDROLOGY WORKMAP OLIVE STREET DIVERSION ALTERNATIVE	
LEGEND	
SUBAREA NAME	A1
SUBAREA ACREAGE	8.2
NODE NUMBER	10
FLOW DIRECTION	→

City of San Diego Group Job 828

Composite C Value Calculations

CValdo Job 17-002

October 2, 2017

Subarea		A2.0		A2.1	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA
SFR	0.55	0.04	0.02	0.08	0.04
Asphalt/Concrete	0.95	0.03	0.03	0.12	0.11
Sum		0.07	0.05	0.20	0.16
Composite C		0.72		0.79	

Subarea		A2.2		A2.3		A2.4	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.08	0.04	0.07	0.04	0.59	0.32
Asphalt/Concrete	0.95			0.03	0.03	0.13	0.12
Sum		0.08	0.04	0.10	0.07	0.72	0.45
Composite C		0.55		0.67		0.62	

Subarea		A6.0		A6.1		A6.2		A6.3		A6.4	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.07	0.04	0.58	0.32	5.16	2.84	0.75	0.41	4.11	2.26
Asphalt/Concrete	0.95			0.37	0.35	1.81	1.72	1.13	1.07	1.80	1.71
Sum		0.07	0.04	0.95	0.67	6.97	4.56	1.88	1.49	5.91	3.97
Composite C		0.55		0.71		0.65		0.79		0.67	

Subarea		A7.0		A7.1		A7.2		A7.3		A7.4	
Land Use	Runoff Coefficient C	Acres	CA	Acres	CA	Acres	CA	Acres	CA	Acres	CA
SFR	0.55	0.09	0.05	0.05	0.03	0.87	0.48	2.18	1.20	1.85	1.02
Asphalt/Concrete	0.95			0.05	0.05	0.34	0.32	1.46	1.39	1.30	1.24
Sum		0.09	0.05	0.10	0.08	1.21	0.80	3.64	2.59	3.15	2.25
Composite C		0.55		0.75		0.66		0.71		0.72	

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2014 Advanced Engineering Software (aes)
Ver. 21.0 Release Date: 06/01/2014 License ID 1575

***** DESCRIPTION OF STUDY *****

- * GROUP JOB 828
- * 100-YEAR STORM EVENT
- * CVALDO JOB 17-002 -- OCTOBER 2, 2017

FILE NAME: GJ828R.DAT
TIME/DATE OF STUDY: 15:20 10/02/2017

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 = 10

- 1) 5.000; 4.400
- 2) 10.000; 3.450
- 3) 15.000; 2.900
- 4) 20.000; 2.500
- 5) 25.000; 2.200
- 6) 30.000; 2.000
- 7) 40.000; 1.700
- 8) 50.000; 1.500
- 9) 60.000; 1.300
- 10) 120.000; 0.860

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
WIDTH CROSSFALL IN- /OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR

NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)

=== =====

1	20.0	10.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0180
2	18.0	9.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0180

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

- 1. Relative Flow-Depth = 0.50 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 70.00 TO NODE 71.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
UPSTREAM ELEVATION(FEET) = 298.70
DOWNSTREAM ELEVATION(FEET) = 298.05
ELEVATION DIFFERENCE(FEET) = 0.65
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.982
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.834
SUBAREA RUNOFF(CFS) = 0.19
TOTAL AREA(ACRES) = 0.09 TOTAL RUNOFF(CFS) = 0.19

FLOW PROCESS FROM NODE 71.00 TO NODE 72.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 298.05 DOWNSTREAM(FEET) = 297.40
CHANNEL LENGTH THRU SUBAREA(FEET) = 65.00 CHANNEL SLOPE = 0.0100
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.746
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.33
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.37
AVERAGE FLOW DEPTH(FEET) = 0.26 TRAVEL TIME(MIN.) = 0.46
Tc(MIN.) = 8.44
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.28
AREA-AVERAGE RUNOFF COEFFICIENT = 0.655
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.47

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.30 FLOW VELOCITY(FEET/SEC.) = 2.58
LONGEST FLOWPATH FROM NODE 70.00 TO NODE 72.00 = 130.00 FEET.

FLOW PROCESS FROM NODE 72.00 TO NODE 73.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

UPSTREAM ELEVATION(FEET) = 297.40 DOWNSTREAM ELEVATION(FEET) = 296.00
STREET LENGTH(FEET) = 310.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.74

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.35

HALFSTREET FLOOD WIDTH(FEET) = 10.98

AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.32

PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.46

STREET FLOW TRAVEL TIME(MIN.) = 3.92 Tc(MIN.) = 12.36

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.191

*USER SPECIFIED(SUBAREA):

RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6600

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.659

SUBAREA AREA(ACRES) = 1.21 SUBAREA RUNOFF(CFS) = 2.55

TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 2.95

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.40 HALFSTREET FLOOD WIDTH(FEET) = 13.63

FLOW VELOCITY(FEET/SEC.) = 1.49 DEPTH*VELOCITY(FT*FT/SEC.) = 0.59

LONGEST FLOWPATH FROM NODE 70.00 TO NODE 73.00 = 440.00 FEET.

FLOW PROCESS FROM NODE 73.00 TO NODE 74.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 296.00 DOWNSTREAM ELEVATION(FEET) = 276.00

STREET LENGTH(FEET) = 972.00 CURB HEIGHT(INCHES) = 6.0

STREET HALFWIDTH(FEET) = 20.00

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 = 1

STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180

Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 6.45

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.40

HALFSTREET FLOOD WIDTH(FEET) = 13.71

AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.23

PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.29
STREET FLOW TRAVEL TIME(MIN.) = 5.02 Tc(MIN.) = 17.38
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.710
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.696
SUBAREA AREA(ACRES) = 3.64 SUBAREA RUNOFF(CFS) = 7.00
TOTAL AREA(ACRES) = 5.0 PEAK FLOW RATE(CFS) = 9.51

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.45 HALFSTREET FLOOD WIDTH(FEET) = 16.05
FLOW VELOCITY(FEET/SEC.) = 3.53 DEPTH*VELOCITY(FT*FT/SEC.) = 1.58
LONGEST FLOWPATH FROM NODE 70.00 TO NODE 74.00 = 1412.00 FEET.

FLOW PROCESS FROM NODE 75.00 TO NODE 74.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.710
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7200
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7052
SUBAREA AREA(ACRES) = 3.15 SUBAREA RUNOFF(CFS) = 6.15
TOTAL AREA(ACRES) = 8.2 TOTAL RUNOFF(CFS) = 15.65
TC(MIN.) = 17.38

FLOW PROCESS FROM NODE 74.00 TO NODE 76.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 268.00 DOWNSTREAM(FEET) = 267.50
FLOW LENGTH(FEET) = 20.50 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 10.45
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 15.65
PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 17.41
LONGEST FLOWPATH FROM NODE 70.00 TO NODE 76.00 = 1432.50 FEET.

FLOW PROCESS FROM NODE 76.00 TO NODE 76.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7200
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 50.00
UPSTREAM ELEVATION(FEET) = 298.50
DOWNSTREAM ELEVATION(FEET) = 298.00
ELEVATION DIFFERENCE(FEET) = 0.50
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.837
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.400
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) = 0.22
TOTAL AREA(ACRES) = 0.07 TOTAL RUNOFF(CFS) = 0.22

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 298.00 DOWNSTREAM ELEVATION(FEET) = 296.00
STREET LENGTH(FEET) = 150.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.55
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.22
HALFSTREET FLOOD WIDTH(FEET) = 4.72
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.61
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.35
STREET FLOW TRAVEL TIME(MIN.) = 1.56 Tc(MIN.) = 6.39
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.136

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.772
SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.65
TOTAL AREA(ACRES) = 0.3 PEAK FLOW RATE(CFS) = 0.86

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.25 HALFSTREET FLOOD WIDTH(FEET) = 6.18
FLOW VELOCITY(FEET/SEC.) = 1.72 DEPTH*VELOCITY(FT*FT/SEC.) = 0.43
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 200.00 FEET.

FLOW PROCESS FROM NODE 22.00 TO NODE 23.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	288.00	DOWNSTREAM(FEET) =	287.50
FLOW LENGTH(FEET) =	25.00	MANNING'S N =	0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO	18.000		
DEPTH OF FLOW IN 18.0 INCH PIPE IS	3.0 INCHES		
PIPE-FLOW VELOCITY(FEET/SEC.) =	4.40		
ESTIMATED PIPE DIAMETER(INCH) =	18.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	0.86		
PIPE TRAVEL TIME(MIN.) =	0.09	Tc(MIN.) =	6.49
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 23.00 =	225.00 FEET.		

FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 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.) =	6.49		
RAINFALL INTENSITY(INCH/HR) =	4.12		
TOTAL STREAM AREA(ACRES) =	0.27		
PEAK FLOW RATE(CFS) AT CONFLUENCE =	0.86		

FLOW PROCESS FROM NODE 25.00 TO NODE 26.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):

RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT =	.5500		
S.C.S. CURVE NUMBER (AMC II) =	0		
INITIAL SUBAREA FLOW-LENGTH(FEET) =	65.00		
UPSTREAM ELEVATION(FEET) =	308.00		
DOWNSTREAM ELEVATION(FEET) =	306.00		
ELEVATION DIFFERENCE(FEET) =	2.00		
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =	5.488		
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	4.307		
SUBAREA RUNOFF(CFS) =	0.19		
TOTAL AREA(ACRES) =	0.08	TOTAL RUNOFF(CFS) =	0.19

FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	306.00	DOWNSTREAM(FEET) =	302.00
----------------------------------	--------	--------------------	--------

CHANNEL LENGTH THRU SUBAREA(FEET) = 60.00 CHANNEL SLOPE = 0.0667
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.268
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6700
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.33
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.81
AVERAGE FLOW DEPTH(FEET) = 0.19 TRAVEL TIME(MIN.) = 0.21
Tc(MIN.) = 5.70
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.29
AREA-AVERAGE RUNOFF COEFFICIENT = 0.617
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.47

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.21 FLOW VELOCITY(FEET/SEC.) = 5.33
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 27.00 = 125.00 FEET.

FLOW PROCESS FROM NODE 27.00 TO NODE 28.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 302.00 DOWNSTREAM ELEVATION(FEET) = 299.00
STREET LENGTH(FEET) = 215.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.35
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.28
HALFSTREET FLOOD WIDTH(FEET) = 7.64
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.92
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.54
STREET FLOW TRAVEL TIME(MIN.) = 1.87 Tc(MIN.) = 7.56
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.913
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6200
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.619
SUBAREA AREA(ACRES) = 0.72 SUBAREA RUNOFF(CFS) = 1.75
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 2.18

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.32 HALFSTREET FLOOD WIDTH(FEET) = 9.50
FLOW VELOCITY(FEET/SEC.) = 2.14 DEPTH*VELOCITY(FT*FT/SEC.) = 0.68
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 28.00 = 340.00 FEET.

FLOW PROCESS FROM NODE 28.00 TO NODE 23.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 291.00 DOWNSTREAM(FEET) = 287.50
FLOW LENGTH(FEET) = 55.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.74
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.18
PIPE TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = 7.67
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 23.00 = 395.00 FEET.

FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 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.) = 7.67
RAINFALL INTENSITY(INCH/HR) = 3.89
TOTAL STREAM AREA(ACRES) = 0.90
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.18

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	0.86	6.49	4.118	0.27
2	2.18	7.67	3.893	0.90

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

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	2.71	6.49	4.118
2	3.00	7.67	3.893

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 3.00 Tc(MIN.) = 7.67
TOTAL AREA(ACRES) = 1.2
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 23.00 = 395.00 FEET.

FLOW PROCESS FROM NODE 23.00 TO NODE 76.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====
ELEVATION DATA: UPSTREAM(FEET) = 287.50 DOWNSTREAM(FEET) = 267.50
FLOW LENGTH(FEET) = 840.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 5.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.76
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.00
PIPE TRAVEL TIME(MIN.) = 2.07 Tc(MIN.) = 9.74
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 76.00 = 1235.00 FEET.

FLOW PROCESS FROM NODE 76.00 TO NODE 76.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 3.00 9.74 3.500 1.17
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 76.00 = 1235.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 15.65 17.41 2.707 8.19
LONGEST FLOWPATH FROM NODE 70.00 TO NODE 76.00 = 1432.50 FEET.

** PEAK FLOW RATE TABLE **

STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HOUR)
1 11.75 9.74 3.500
2 17.97 17.41 2.707

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 17.97 Tc(MIN.) = 17.41
TOTAL AREA(ACRES) = 9.4

FLOW PROCESS FROM NODE 76.00 TO NODE 76.00 IS CODE = 12

>>>>CLEAR MEMORY BANK # 1 <<<<<

FLOW PROCESS FROM NODE 76.00 TO NODE 64.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 267.50 DOWNSTREAM(FEET) = 267.00
FLOW LENGTH(FEET) = 25.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 14.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.93
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 17.97
PIPE TRAVEL TIME(MIN.) = 0.04 Tc(MIN.) = 17.45
LONGEST FLOWPATH FROM NODE 70.00 TO NODE 64.00 = 1457.50 FEET.

FLOW PROCESS FROM NODE 64.00 TO NODE 64.00 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.) = 17.45
RAINFALL INTENSITY(INCH/HR) = 2.70
TOTAL STREAM AREA(ACRES) = 9.36
PEAK FLOW RATE(CFS) AT CONFLUENCE = 17.97

FLOW PROCESS FROM NODE 60.00 TO NODE 61.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
UPSTREAM ELEVATION(FEET) = 325.00
DOWNSTREAM ELEVATION(FEET) = 324.35
ELEVATION DIFFERENCE(FEET) = 0.65
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.982
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 65.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.833
SUBAREA RUNOFF(CFS) = 0.15
TOTAL AREA(ACRES) = 0.07 TOTAL RUNOFF(CFS) = 0.15

FLOW PROCESS FROM NODE 61.00 TO NODE 62.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 324.35 DOWNSTREAM ELEVATION(FEET) = 321.00

STREET LENGTH(FEET) = 508.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.16

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.30
HALFSTREET FLOOD WIDTH(FEET) = 8.44
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.40
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.41
STREET FLOW TRAVEL TIME(MIN.) = 6.07 Tc(MIN.) = 14.05
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.005

*USER SPECIFIED(SUBAREA):

RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.699
SUBAREA AREA(ACRES) = 0.95 SUBAREA RUNOFF(CFS) = 2.03
TOTAL AREA(ACRES) = 1.0 PEAK FLOW RATE(CFS) = 2.14

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.35 HALFSTREET FLOOD WIDTH(FEET) = 11.05
FLOW VELOCITY(FEET/SEC.) = 1.60 DEPTH*VELOCITY(FT*FT/SEC.) = 0.56
LONGEST FLOWPATH FROM NODE 60.00 TO NODE 62.00 = 573.00 FEET.

FLOW PROCESS FROM NODE 62.00 TO NODE 63.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>(STREET TABLE SECTION # 1 USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 321.00 DOWNSTREAM ELEVATION(FEET) = 309.00
STREET LENGTH(FEET) = 533.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 8.44

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.43
HALFSTREET FLOOD WIDTH(FEET) = 15.04
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.55
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.51
STREET FLOW TRAVEL TIME(MIN.) = 2.50 Tc(MIN.) = 16.55
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.776
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.656
SUBAREA AREA(ACRES) = 6.97 SUBAREA RUNOFF(CFS) = 12.58
TOTAL AREA(ACRES) = 8.0 PEAK FLOW RATE(CFS) = 14.56

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.50 HALFSTREET FLOOD WIDTH(FEET) = 18.63
FLOW VELOCITY(FEET/SEC.) = 4.05 DEPTH*VELOCITY(FT*FT/SEC.) = 2.02
*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
AND L = 533.0 FT WITH ELEVATION-DROP = 12.0 FT, IS 19.4 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 63.00
LONGEST FLOWPATH FROM NODE 60.00 TO NODE 63.00 = 1106.00 FEET.

FLOW PROCESS FROM NODE 63.00 TO NODE 64.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<<

UPSTREAM ELEVATION(FEET) = 309.00 DOWNSTREAM ELEVATION(FEET) = 276.00
STREET LENGTH(FEET) = 840.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 20.00

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 = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 16.45
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.48
HALFSTREET FLOOD WIDTH(FEET) = 17.54
AVERAGE FLOW VELOCITY(FEET/SEC.) = 5.15
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 2.46
STREET FLOW TRAVEL TIME(MIN.) = 2.72 Tc(MIN.) = 19.27
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.558
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.682
SUBAREA AREA(ACRES) = 1.88 SUBAREA RUNOFF(CFS) = 3.80

TOTAL AREA(ACRES) = 9.9 PEAK FLOW RATE(CFS) = 17.21

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.48 HALFSTREET FLOOD WIDTH(FEET) = 17.85

FLOW VELOCITY(FEET/SEC.) = 5.21 DEPTH*VELOCITY(FT*FT/SEC.) = 2.52

LONGEST FLOWPATH FROM NODE 60.00 TO NODE 64.00 = 1946.00 FEET.

FLOW PROCESS FROM NODE 65.00 TO NODE 64.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.558

*USER SPECIFIED(SUBAREA):

RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .6700

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.6773

SUBAREA AREA(ACRES) = 5.91 SUBAREA RUNOFF(CFS) = 10.13

TOTAL AREA(ACRES) = 15.8 TOTAL RUNOFF(CFS) = 27.35

TC(MIN.) = 19.27

FLOW PROCESS FROM NODE 64.00 TO NODE 64.00 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.) = 19.27

RAINFALL INTENSITY(INCH/HR) = 2.56

TOTAL STREAM AREA(ACRES) = 15.78

PEAK FLOW RATE(CFS) AT CONFLUENCE = 27.35

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	17.97	17.45	2.704	9.36
2	27.35	19.27	2.558	15.78

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO

CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	42.73	17.45	2.704
2	44.35	19.27	2.558

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 44.35 Tc(MIN.) = 19.27

TOTAL AREA(ACRES) = 25.1

LONGEST FLOWPATH FROM NODE 60.00 TO NODE 64.00 = 1946.00 FEET.

=====
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 25.1 TC(MIN.) = 19.27

PEAK FLOW RATE(CFS) = 44.35
=====

=====
END OF RATIONAL METHOD ANALYSIS

City of San Diego Group Job 828
 Inlet Sizing Calculations
 CValdo Job 17-002
 2-Oct-17

Note Figure, equation and page references are to City of San Diego Drainage Design Manual dated January 2017

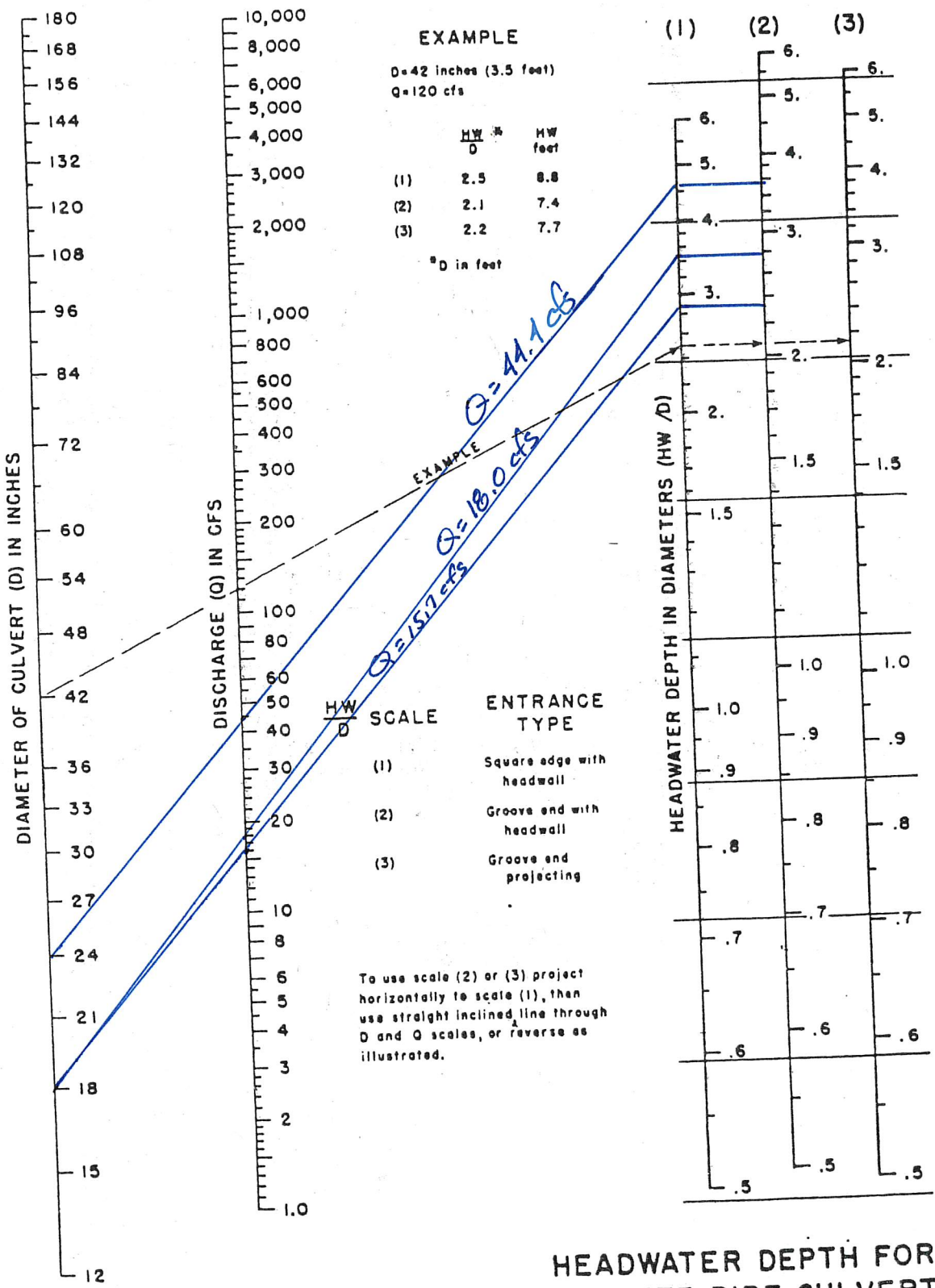
Inlet on grade Equation 3-2
 $LT = Q / (0.7 * ((a + y)^{1.5}))$
 LT = inlet length, a = depression, y = gutter depth at approach, Q = flow rate

Inlet in sag Equation 3-4 (higher flow depth = orifice flow)
 $L = Q / ((0.67 * h) * ((2 * g * do)^{0.5}))$
 where $do = (y + a) - 0.26$
 L = inlet length, h = inlet opening height, do = effective depth at opening, g = gravity constant, Q = flow rate, y = gutter depth at approach, a = depression

Node	Grade or Sag	Street Slope (estimated)	Gutter Depth at Approach (ft) *	Depression (ft)	do (ft)	Q (cfs)	Opening Length Required (ft)	Existing Inlet	Existing Inlet Satisfactory
22	Sag	0	0.50	0.33	0.57	0.9	0.4	6' curb opening	yes
28	Sag	0	0.50	0.33	0.57	2.2	1.1	6' curb opening	yes
74	Sag	0	0.50	0.33	0.57	15.7	7.7	7' curb opening	no
64	Sag	0	0.50	0.33	0.57	27.4	13.5	7' curb opening	no

* Flow depth per Figure 3-2 for inlets on grade
 Flow depth = to top of 6" curb for inlets in sag

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
 REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HYDRAULIC ELEMENTS - I PROGRAM PACKAGE
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Ver. 21.0 Release Date: 06/01/2014 License ID 1575

Analysis prepared by:

TIME/DATE OF STUDY: 17:55 10/02/2017

=====

Problem Descriptions:
City of San Diego Group Job 828
Site 6 Storm Drain Capacity Analysis from Node 64 to Canyon
CValdo Job 17-002

>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<

PIPE SLOPE(FEET/FEET) = 0.0400
PIPEFLOW(CFS) = 44.40
MANNINGS FRICTION FACTOR = 0.013000
>>>>SOFFIT-FLOW PIPE DIAMETER(FEET) = 1.986

=====