Preliminary Hydrology & Hydraulics Report

For

UNIVERSITY CROSSINGS

Multi-Family Residential Project

Redlands, California

March, 2012

Prepared For

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Submitted By
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ENGINEERING SOLUTIONS
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Canyon Lake, CA 92587
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Project Description

The proposed project is for 306 apartment units, a clubhouse and recreation area on 12.3 acres.

The location map and a vicinity map for this project can be found in Attachment A.

Site Description

This site is currently bounded on the north by orchards and farm land. The orchards and farmland does not appear be well maintained or in commercial use. On the East, the project is bounded by an existing commercial development including restaurants, retail shopping and department stores. To the south the project is bounded by Lugonia Avenue, a major thoroughfare for the City of Redlands. Across the avenue are several small shops, the DMV and vacant fields. To the West the site is bounded by vacant fields.

This project drains to a City of Redlands storm drain pipe in Lugonia Avenue and then to the Mission Channel and finally into the Santa Ana River.

There are three flow courses leaving the existing project site. The first is along the north property line and the second occurs near the middle of the project and the third is along the east site of the site.

There is an existing detention basin on the site that was constructed for the purpose of mitigating increase in peak runoff from the Redlands Town Center east of this project. This project will de-commission that basin as demonstrated in Exhibit C. To replace the existing basin and to mitigate for project on-site increase in runoff, this project will construct the un-built segments of storm drain in Lugonia from the project to Zanja Creek.

A summary of the existing onsite flows is provided in Table 1.

A summary of the proposed flow to the storm drain in Lugonia Avenue is provided in Table 2.

It should be noted that there are six water quality basins located throughout the site. Five of these are typical infiltration trenches of varying depths and are provided for water quality but also function as flood control measures. The sixth water quality basin is composed of under ground chambers, in the form of large diameter pipe. Its primary function is also that of water quality. For the purposes of hydraulic analysis, these water quality basins were ignored. The purpose of the 100 year hydraulic study to provide documentation that a 100 year storm can pass safety through the site without flooding. For this reason, it was assumed that the water quality basins were available to help mitigate the 100 year storm.

There is an existing storm drain in Lugonia Avenue that the proposed on-site storm drain will connect to. As of the date of this study the storm drain in Lugonia Avenue is only

partially completed. As part of this project, the storm drain in Lugonia Avenue will be reviewed, the surrounding developments considered and the storm drain in Lugonia Avenue completed as shown in Exhibit A.

Summary Of The Existing Offsite Flow		
10 Year	25 Year	100 Year
11.34 CFS	14.66 CFS	24.95 CFS

Table 1

Summary Of The Proposed Flow		
10 Year	25 Year	100 Year
11.08 CFS	16.52 CFS	18.76 CFS

Table 2

APPENDIX A
Maps

Location Map

Vicinity Map

Conceptual Grading Map

Exhibit A

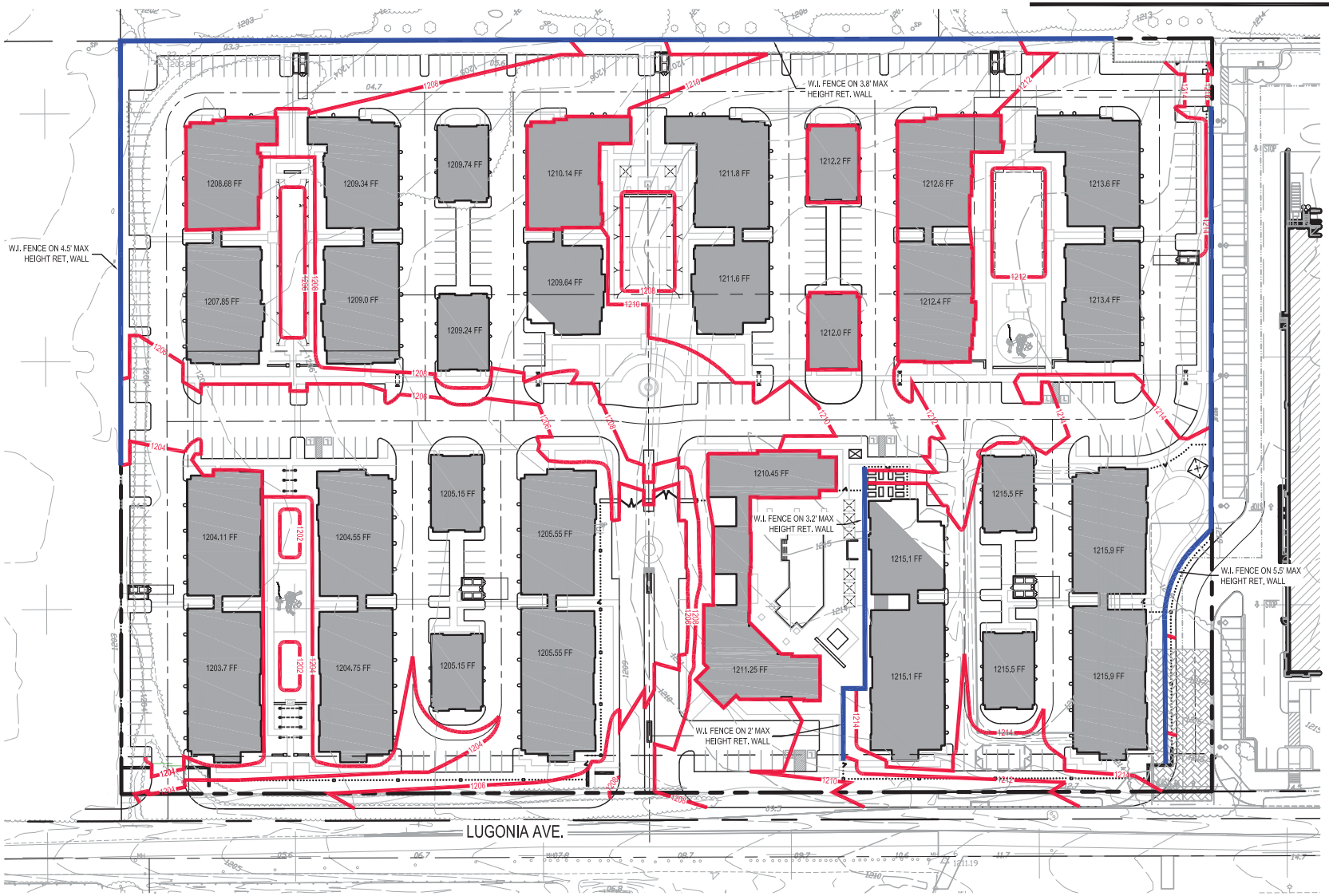
Exhibit C

University Crossing
Location Map

University Crossing
Site Map

University Crossings

Exhibit E-3



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0 40 80 160 320

Legend
Proposed Contours
W.I. Fence on Retaining Wall
Existing Contours

University Crossings
Drainage Cost Comparison Exhibit A

LEGEND

- Existing 48" Storm Drain
- Proposed 48" Storm Drain
- Proposed 54" Storm Drain
- Proposed 66" Storm Drain
- Existing 51" Storm Drain
- Existing 66" Storm Drain

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0 200 400 800 1600

Off-Site Storm Drain Improvements

University Crossings
Exhibit B

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University Crossings/Town Center
Exhibit C

N89°52'27"E 330.05'

EX. M.H.

EX. M.H.

EX. 30" INLET

REMOVE & DISPOSE OF EXIST. STORMDRAIN FACILITIES LAT "D"

INSTALL CONC. BULKHEAD

PROP. 15' DRAINAGE EASEMENT

EXIST. STORMDRAIN LINE "A"

PL

J.C. PENNEY

OVEREX AND FILL EXIST DETENTION BASIN

PROP. 15' EASEMENT

PROP. CURB RE-ALIGNMENT

PROP. 15' STORM DRAIN EASEMENT

PROP. REVISED ACCESS EASEMENT

7.5'

7.5'

EX. M.H. 1210.27 INV.

PROP. 15' DRAINAGE EASEMENT

REMOVE EXIST. 48" SD.

INSTALL CONC. BULKHEADS

30'

EXIST. FLARED END

EXIST. 48" STORMDRAIN LATERAL PER TRACT 16896 STREET PLANS SHEET 8 OF 8

REMOVE EXIST. 30" SD.

EXIST. 60" CSP RISER

DEMOLISH & DISPOSE OF EXIST. EMERGENCY SPILLWAY

EXIST. STORMDRAIN CATCH BASIN & LATERAL PER TRACT 16896 STREET PLANS SHEET 8 OF 8

EX. M.H. 1208.01 INV.

LUGONIA AVE.

EX. 42" SD. 1207.40 INV.

N89°51'46"E 1991.73'

Existing & Proposed Drainage Improvements

ENGINEERING SOLUTIONS

0 25 50 100

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Legend

- Proposed Curb
- Exist. Stormdrain
- Proposed Bulkhead
- Prop. Revised Access Easement

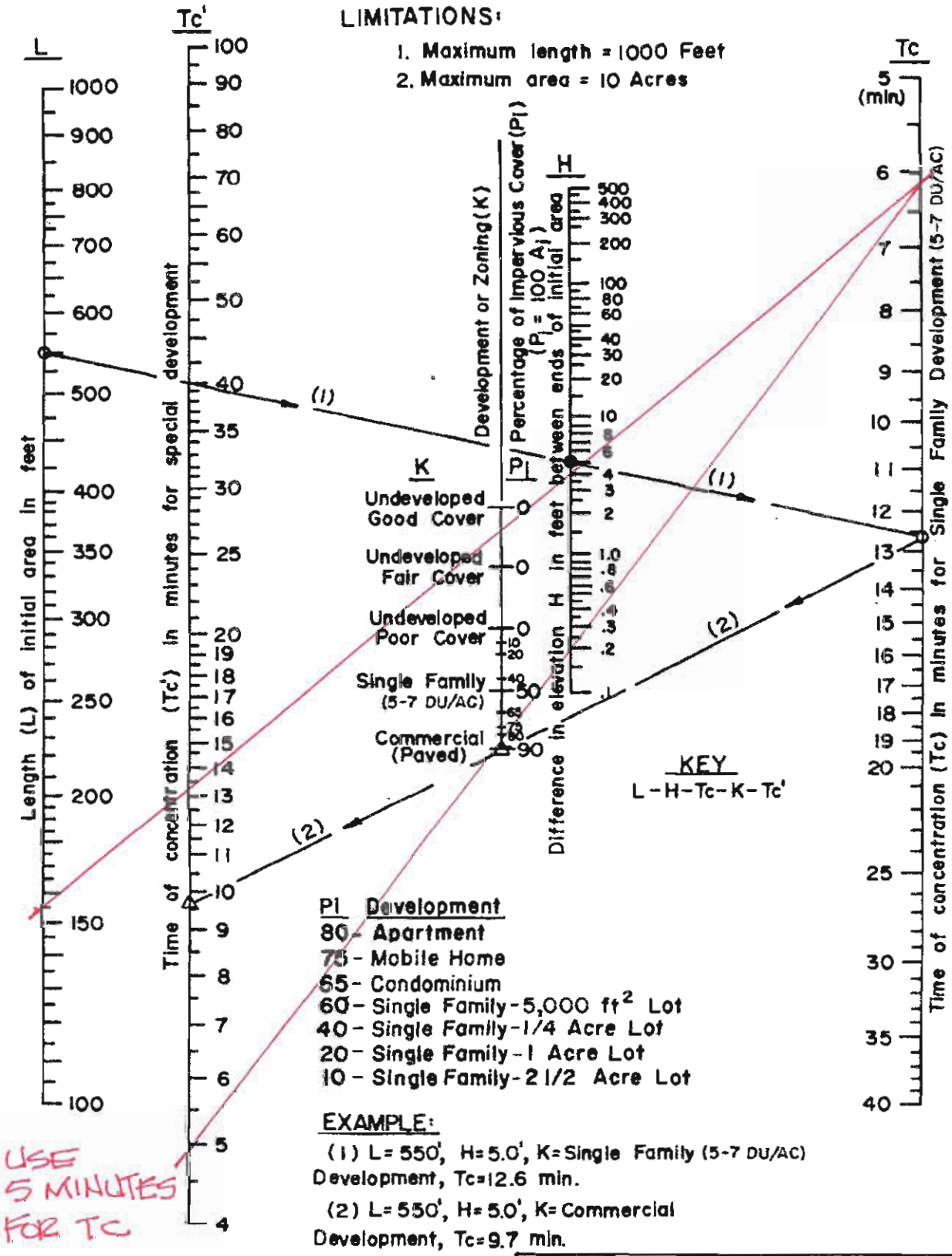
APPENDIX B
Forms

Rainfall Depth / Return Period

Intensity Curve 10 Year

Intensity Curve 25 Year

Intensity Curve 100 Year



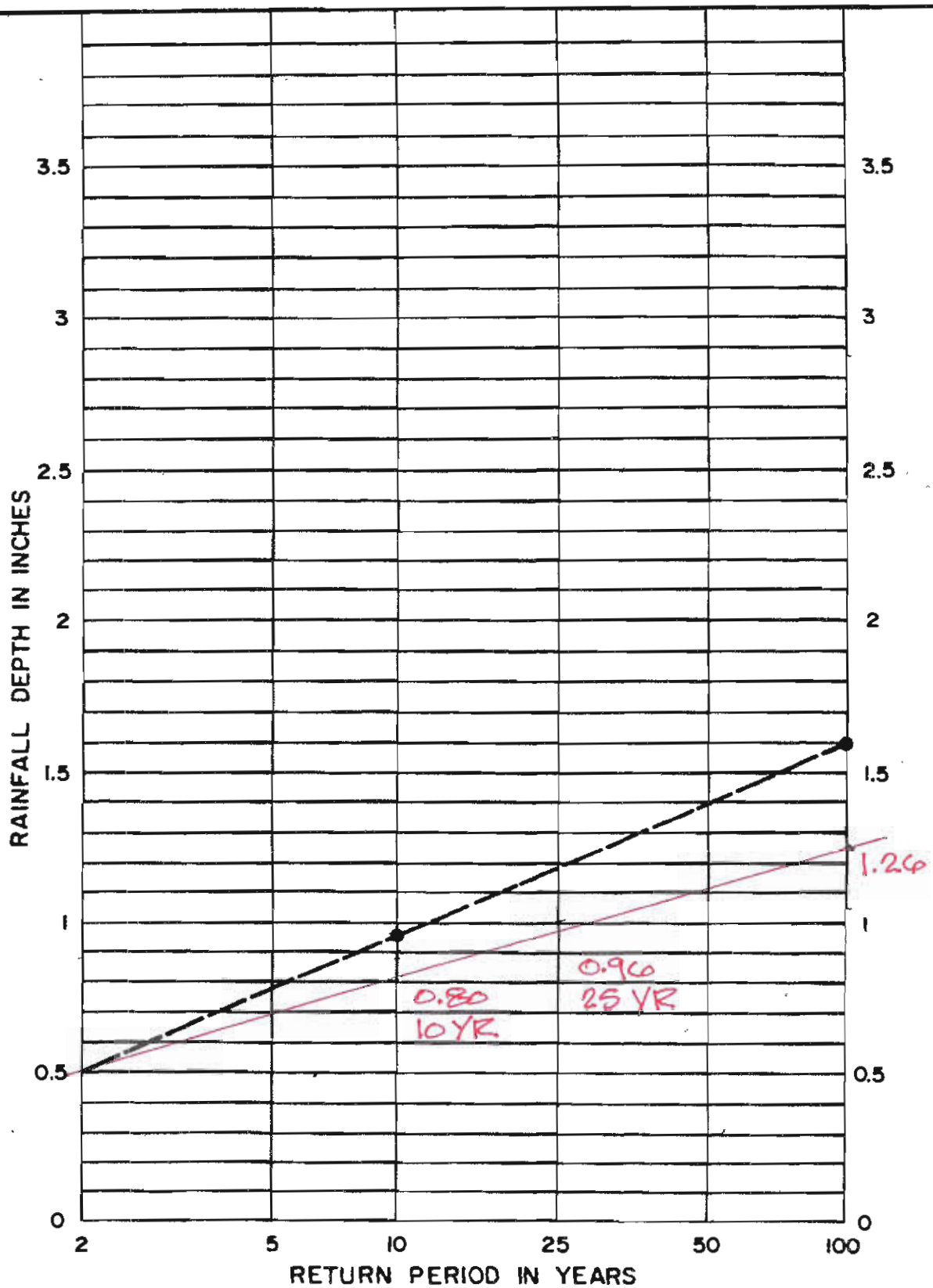
SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

NODE 1 TO NODE 2



NOTE:

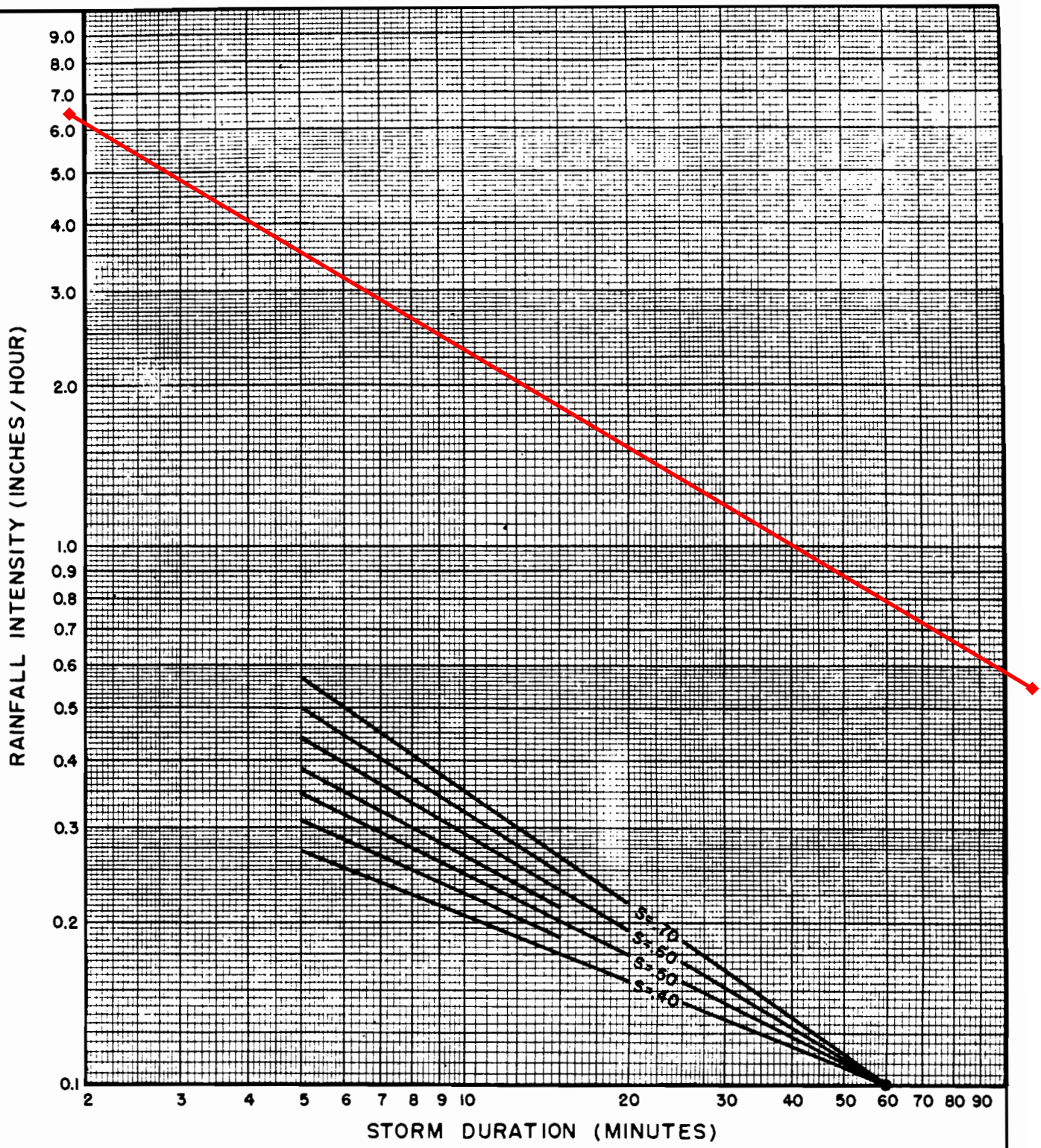
1. FOR INTERMEDIATE RETURN PERIODS PLOT 10-YEAR AND 100-YEAR ONE HOUR VALUES FROM MAPS, THEN CONNECT POINTS AND READ VALUE FOR DESIRED RETURN PERIOD. FOR EXAMPLE GIVEN 10-YEAR ONE HOUR = 0.95" AND 100-YEAR ONE HOUR = 1.60", 25-YEAR ONE HOUR = 1.18".

REFERENCE: NOAA ATLAS 2, VOLUME XI - CAL., 1973

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

FIGURE D-2



DESIGN STORM FREQUENCY = 10 YEARS

ONE HOUR POINT RAINFALL = _____ INCHES

LOG-LOG SLOPE = _____

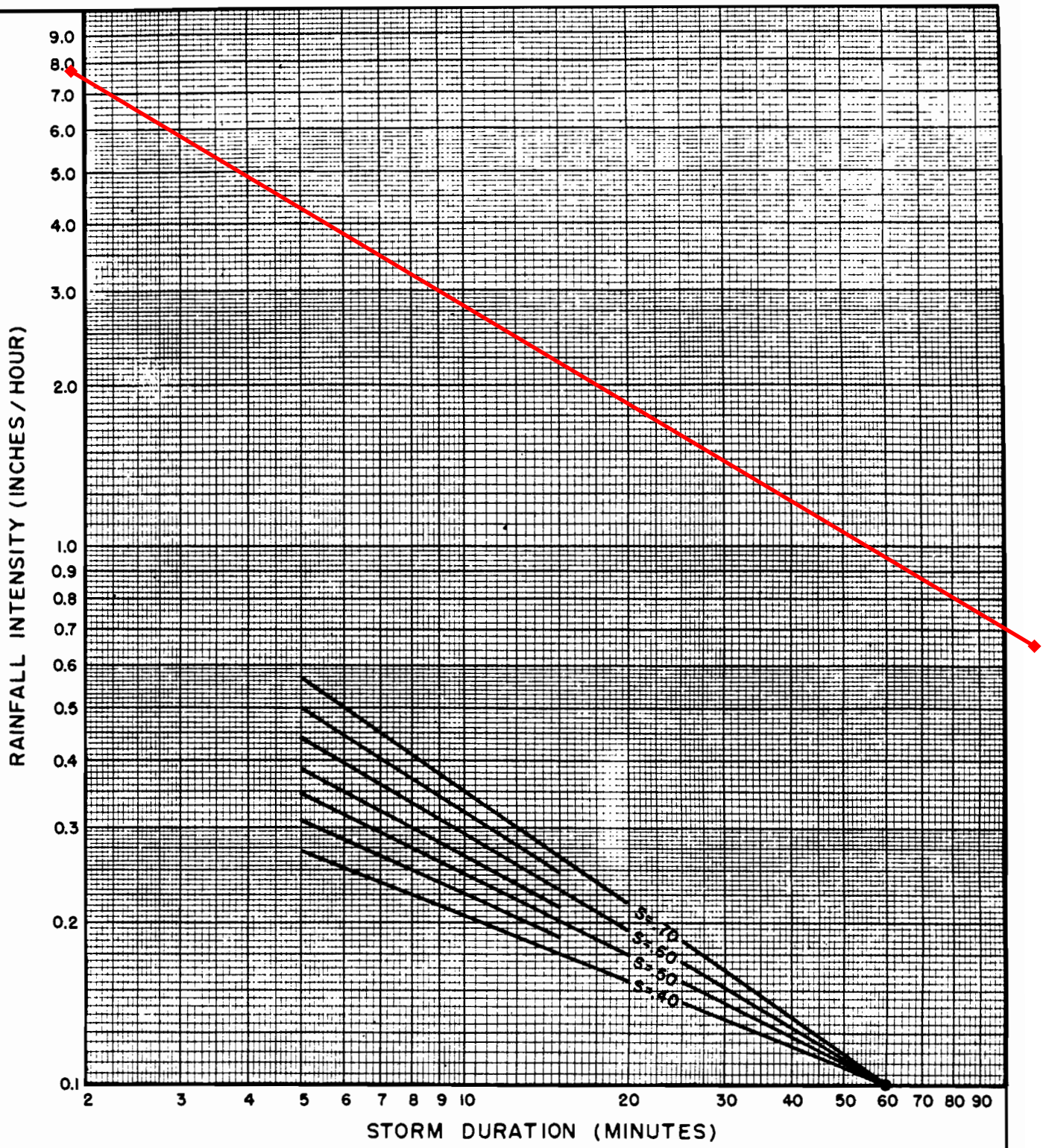
PROJECT LOCATION = _____

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3



DESIGN STORM FREQUENCY = 25 YEARS

ONE HOUR POINT RAINFALL = _____ INCHES

LOG-LOG SLOPE = _____

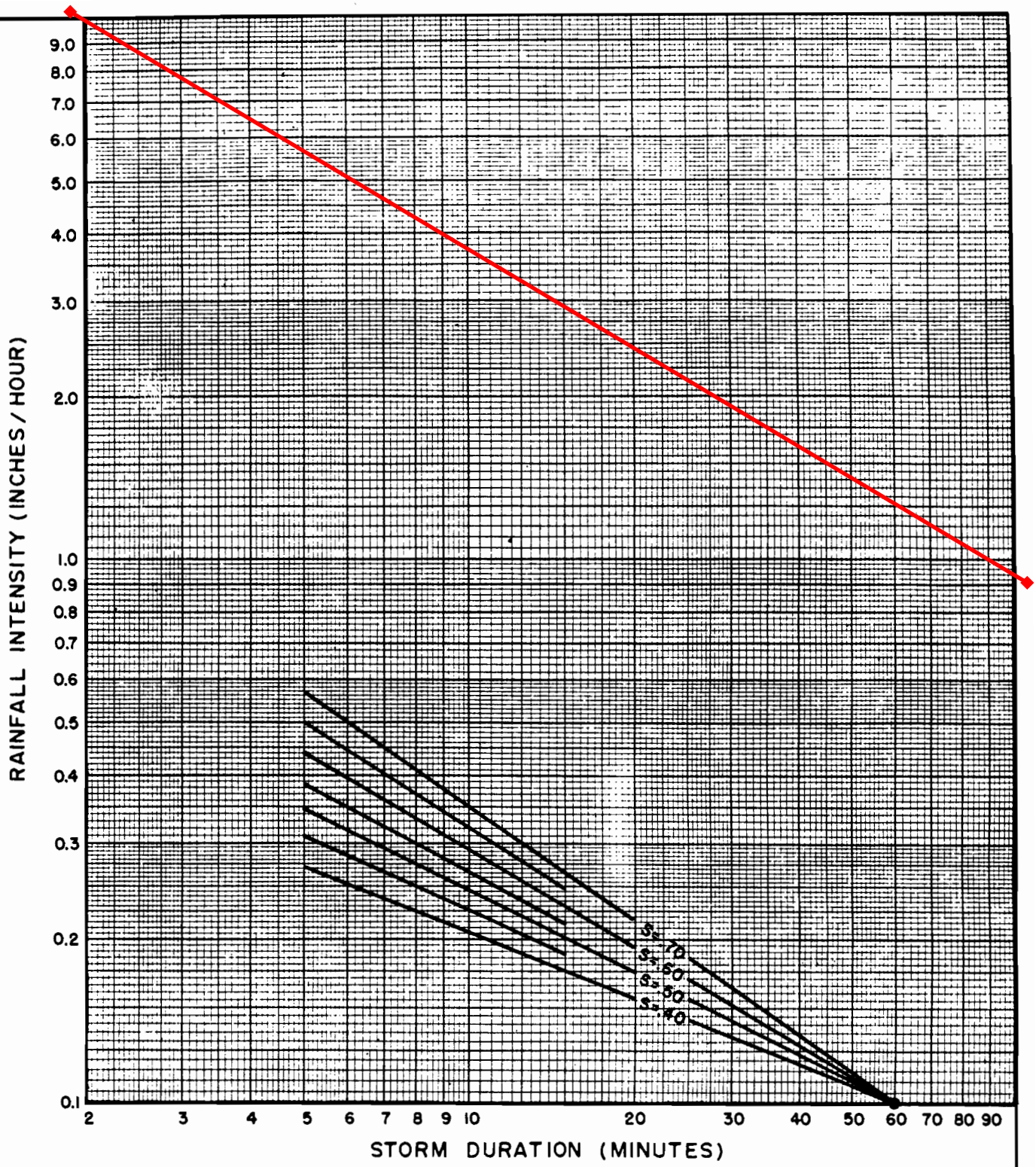
PROJECT LOCATION = _____

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3



DESIGN STORM FREQUENCY = 100 YEARS

ONE HOUR POINT RAINFALL = _____ INCHES

LOG-LOG SLOPE = _____

PROJECT LOCATION = _____

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3

APPENDIX C
Basins

Water Quality Basin Analysis – For Reference

Underground Retention Basin

Water Quality Basin Location Map

University Crossings

Time of Conectration STUDY FORM

Concentration Point	Area	UPSTREAM ELEVATION	DOWNSTREAM ELEVATION	Flow Path Length ft.	Slope ft./ft.	"N"	WIDTH	DEPTH	WETTED PERIMETER	CROSS SECTION AREA	HYDRAULIC RADIUS	V ft./sec.	Tt Min
BASIN 1	0.660	1212.400	1212.000	105.0000	0.0038	0.017	10.000	0.050	10.000	0.250	0.025	0.46	3.830541
BASIN 2	0.640	1209.600	1209.000	86.7000	0.0069	0.017	10.000	0.050	10.000	0.250	0.025	0.62	2.346709
BASIN 3	0.550	1207.850	1207.000	63.0000	0.0135	0.017	10.000	0.050	10.000	0.250	0.025	0.86	1.221258
BASIN 4	0.270	1204.110	1203.500	35.0000	0.0174	0.017	10.000	0.050	10.000	0.250	0.025	0.98	0.596957
BASIN 5	0.350	1203.700	1203.200	63.0000	0.0079	0.017	10.000	0.050	10.000	0.250	0.025	0.66	1.592326

University Crossings

DATE 20-May-12

Water Qualitiy Basins

100 YEAR - 1 HOUR STORM

Water Quality Basin 1

DATA INPUT
TRIANGULAR HYDROGRAPH

Tc = Flow Distance / Velocity

Flow Distance = 105 ft
Velocity = 0.46 fps

Tc = 3.80 min
If Tc is less than 5 min, use 5 Min. intensity (5.6 in/hr)

Q = C*I*A

C = 0.55
I = 5.6
A = 0.66

Q = 2.03

FLOW 2.03

Tc 5

T (max) 15
m1 0.006776 0.003388
m2 -0.003388 -0.001694
y-int 3.0492

VOL 914.76

Volume provided in surface basin for water quality purposes = 3768 cf

Excess storage = 2853 cf

no discharge form 100 year storm

TIME (min)		Q (cfs)	VOLUME (cf)	TOTAL VOLUME (cf)
0	1	0.41	24	24
1	2	0.81	49	73
2	3	1.22	73	146
3	4	1.63	98	244
4	5	2.03	122	366
5	6	1.83	110	476
6	7	1.63	98	573
7	8	1.42	85	659
8	9	1.22	73	732
9	10	1.02	61	793
10	11	0.81	49	842
11	12	0.61	37	878
12	13	0.41	24	903
13	14	0.20	12	915
14	15	0.00	0	915

University Crossings

DATE 20-May-12

Water Qualitiy Basins

100 YEAR - 1 HOUR STORM

Water Quality Basin 2

DATA INPUT
TRIANGULAR HYDROGRAPH

Tc = Flow Distance / Velocity

Flow Distance = 86.7 ft
Velocity = 0.62 fps

Tc = 2.33 min
If Tc is less than 5 min, use 5 Min.

Q = C*I*A

C = 0.55
I = 5.6
A = 0.64

Q = 1.97

FLOW 1.97

Tc 5

T (max) 15
m1 0.0065667 0.0032833
m2 -0.003283 -0.001642
y-int 2.955

VOL 886.5

Volume provided in surface basin for water quality purposes = 4518 cf

Excess storage = 3632 cf

no discharge form 100 year storm

TIME (min)		Q (cfs)	VOLUME (cf)	TOTAL VOLUME (cf)
0	1	0.39	24	24
1	2	0.79	47	71
2	3	1.18	71	142
3	4	1.58	95	236
4	5	1.97	118	355
5	6	1.77	106	461
6	7	1.58	95	556
7	8	1.38	83	638
8	9	1.18	71	709
9	10	0.99	59	768
10	11	0.79	47	816
11	12	0.59	35	851
12	13	0.39	24	875
13	14	0.20	12	887
14	15	0.00	0	887

University Crossings

DATE 20-May-12

Water Qualitiy Basins

100 YEAR - 1 HOUR STORM

Water Quality Basin 3

DATA INPUT
TRIANGULAR HYDROGRAPH

Tc = Flow Distance / Velocity

Flow Distance = 63 ft
Velocity = 0.86 fps

Tc = 1.22 min
If Tc is less than 5 min, use 5 Min.

Q = C*I*A

C = 0.55
I = 5.6
A = 0.55

Q = 1.69

FLOW 1.69

Tc 5

T (max) 15
m1 0.0056333 0.0028167
m2 -0.002817 -0.001408
y-int 2.535

VOL 760.5

Volume provided in surface basin for water quality purposes = 4140 cf

Excess storage = 3380 cf

no discharge form 100 year storm

TIME (min)		Q (cfs)	VOLUME (cf)	TOTAL VOLUME (cf)
0	1	0.34	20	20
1	2	0.68	41	61
2	3	1.01	61	122
3	4	1.35	81	203
4	5	1.69	101	304
5	6	1.52	91	395
6	7	1.35	81	477
7	8	1.18	71	548
8	9	1.01	61	608
9	10	0.85	51	659
10	11	0.68	41	700
11	12	0.51	30	730
12	13	0.34	20	750
13	14	0.17	10	761
14	15	0.00	0	761

University Crossings

DATE 20-May-12

Water Qualitiy Basins

100 YEAR - 1 HOUR STORM

Water Quality Basin 4

DATA INPUT
TRIANGULAR HYDROGRAPH

Tc = Flow Distance / Velocity

Flow Distance = 35 ft
Velocity = 0.98 fps

Tc = 0.60 min
If Tc is less than 5 min, use 5 Min.

Q = C*I*A

C = 0.55
I = 5.6
A = 0.27

Q = 0.83

FLOW 0.83

Tc 5

T (max) 15
m1 0.0027667 0.0013833
m2 -0.001383 -0.000692
y-int 1.245

VOL 373.5

Volume provided in surface basin for water quality purposes = 1317 cf

Excess storage = 944 cf

no discharge form 100 year storm

TIME (min)		Q (cfs)	VOLUME (cf)	TOTAL VOLUME (cf)
0	1	0.17	10	10
1	2	0.33	20	20
2	3	0.50	30	30
3	4	0.66	40	40
4	5	0.83	50	50
5	6	0.75	45	45
6	7	0.66	40	40
7	8	0.58	35	35
8	9	0.50	30	30
9	10	0.42	25	25
10	11	0.33	20	20
11	12	0.25	15	15
12	13	0.17	10	10
13	14	0.08	5	5
14	15	0.00	0	0

University Crossings

DATE 20-May-12

Water Qualitiy Basins

100 YEAR - 1 HOUR STORM

Water Quality Basin 5

DATA INPUT
TRIANGULAR HYDROGRAPH

Tc = Flow Distance / Velocity

Flow Distance = 63 ft
Velocity = 0.66 fps

Tc = 1.59 min
If Tc is less than 5 min, use 5 Min.

Q = C*I*A

C = 0.55
I = 5.6
A = 0.35

Q = 1.08

FLOW 1.08

Tc 5

T (max) 15
m1 0.0036 0.0018
m2 -0.0018 -0.0009
y-int 1.62

VOL 486

Volume provided in surface basin for water quality purposes = 1602 cf

Excess storage = 1116 cf

no discharge form 100 year storm

TIME (min)		Q (cfs)	VOLUME (cf)	TOTAL VOLUME (cf)
0	1	0.22	13	13
1	2	0.43	26	39
2	3	0.65	39	78
3	4	0.86	52	130
4	5	1.08	65	194
5	6	0.97	58	253
6	7	0.86	52	305
7	8	0.76	45	350
8	9	0.65	39	389
9	10	0.54	32	421
10	11	0.43	26	447
11	12	0.32	19	467
12	13	0.22	13	480
13	14	0.11	6	486
14	15	0.00	0	486

University Crossings

DATE 20-May-12

Water Qualitiy Basins

100 YEAR - 1 HOUR STORM

Water Quality Basin 6

DATA INPUT
TRIANGULAR HYDROGRAPH

Tc determined by confluences
in hydrology study

Tc = 5.33 min
If Tc is less than 5 min, use 5 Min.

Q = C*I*A

C = 0.85
I = 5.45
A = 2.1

Q = 9.73

FLOW 9.73

Tc 5

T (max) 15
m1 0.0324333 0.0162167
m2 -0.016217 -0.008108
y-int 14.595

VOL 4378.5

Volume provided in surface basin for water
quality purposes = 4795 cf

Excess storage = 416 cf

no discharge form 100 year storm

TIME (min)		Q (cfs)	VOLUME (cf)	TOTAL VOLUME (cf)
0	1	1.95	117	117
1	2	3.89	234	350
2	3	5.84	350	701
3	4	7.78	467	1,168
4	5	9.73	584	1,751
5	6	8.76	525	2,277
6	7	7.78	467	2,744
7	8	6.81	409	3,153
8	9	5.84	350	3,503
9	10	4.87	292	3,795
10	11	3.89	234	4,028
11	12	2.92	175	4,203
12	13	1.95	117	4,320
13	14	0.97	58	4,379
14	15	0.00	0	4,379

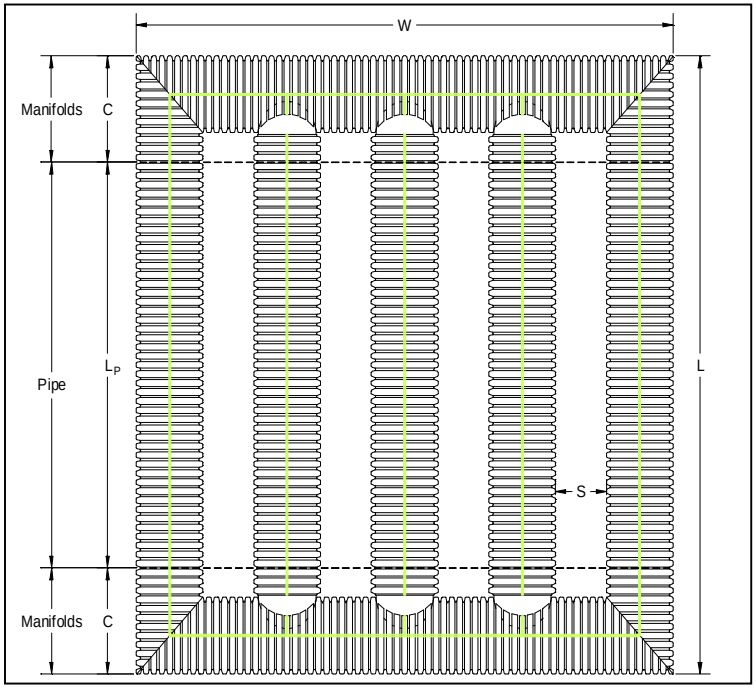
Stormwater Retention System Worksheet

Project University Crossings
Location Lugonia Avenue
Engineer
Date Mar-12

Pipe Dia. D (in)	Outside Dia. OD (ft)	C (ft)	Clr. Span S (ft)	Ret. Area Factor (ft2/ft3)
12	1.20	1.75	1.10	1.25
15	1.46	2.00	1.07	1.04
18	1.77	2.36	1.19	0.90
24	2.32	2.97	1.57	0.71
30	2.93	4.04	2.23	0.64
36	3.48	4.52	2.09	0.52
42	3.98	5.44	2.92	0.43
42HC	3.90	4.95	2.10	0.45
48HC	4.39	5.45	2.11	0.39
60HC	5.46	5.91	2.87	0.31

1.) Design Storage Volume **Vst=** 6888 **ft3**
2.) Surface Area Available **Ad=** 3200 **ft2**
3.) Maximum Retention Area Factor (RAF) **RAF=** 0.464576 **ft2/ft3**
4.) Minimum Pipe Diameter to Satisfy Design **D=** 42 **in**
5.) Actual RAF for Selected Pipe Size **RAFact=** 0.45 **ft2/ft3**

Pipe OD= 3.9 **Clear span (S)=** 2.1 **C=** 4.95



A. If Width (W) Controls **Wmax=** 35 **ft**

Number of Pipe Runs Required (Npr): **Npr=** 6 **pipe runs**

Actual Width (Wact): **Wact=** 33.9 **ft**

System Length (L): **L=** 92 **ft**

Pipe Length Between Manifolds (Lp): **Lp=** 82 **ft**

Estimated Storage Provided **Vp=** 7439 **ft3**

Vp must be greater than Vst OK? ___yes ___no

B. If Length (L) Controls **Lmax=** 95 **ft**

Number of Pipe Runs Required (Npr): **Npr=** 6 **pipe runs**

Actual Width (Wact): **Wact=** 33.9 **ft**

System Length (L): **L=** 91 **ft**

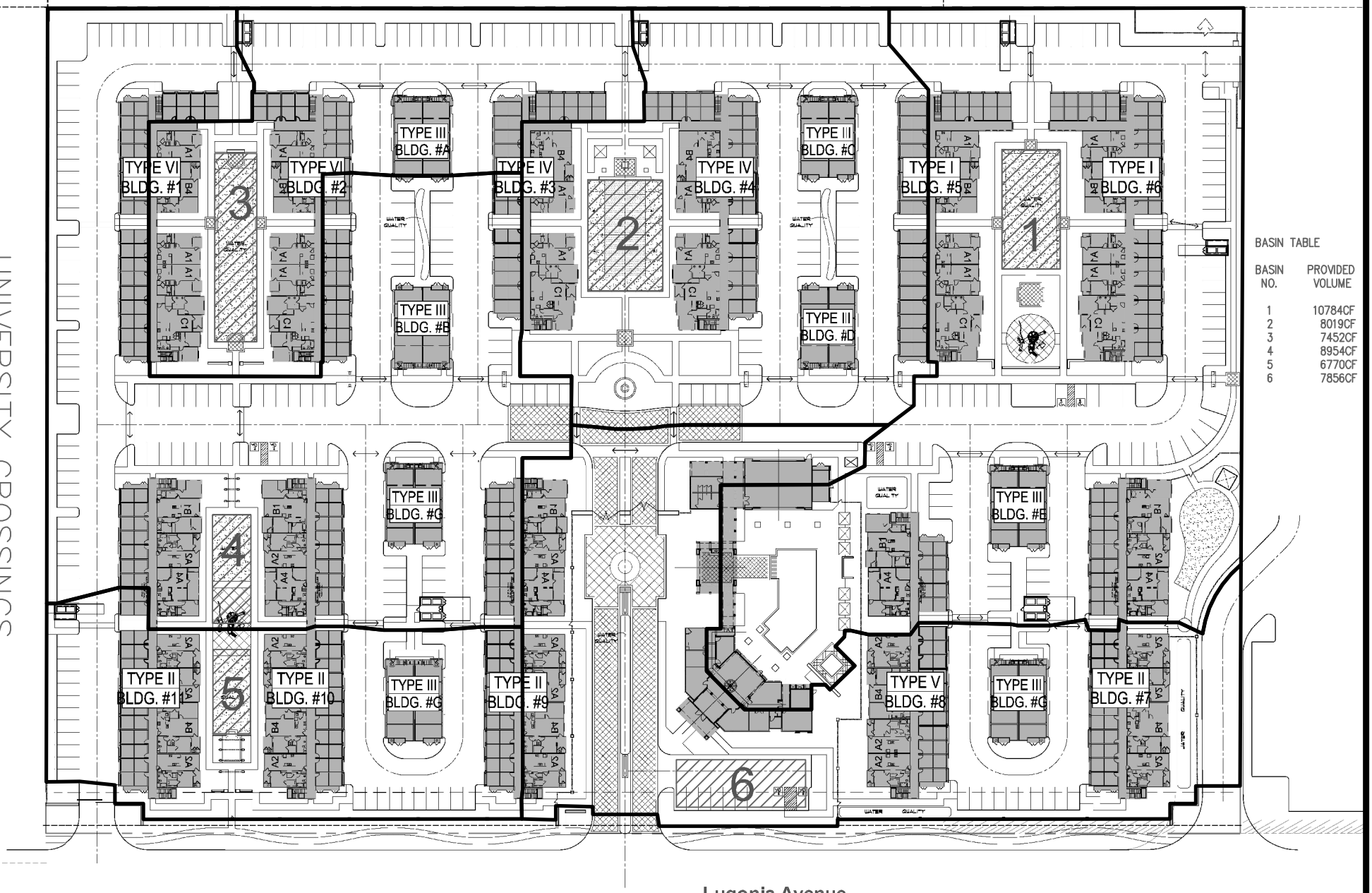
Pipe Length Between Manifolds (Lp): **Lp=** 81 **ft**

Estimated Storage Provided **Vp=** 7360 **ft3**

Vp must be greater than Vst OK? ___yes ___no

1.) This worksheet is for estimations purposes only and should not take the place of a comprehensive engineering design.
2.) Estimated volumes are based on a flat detention system.

UNIVERSITY CROSSINGS
WATER QUALITY BASINS



BASIN TABLE

BASIN NO.	PROVIDED VOLUME
1	10784CF
2	8019CF
3	7452CF
4	8954CF
5	6770CF
6	7856CF

Lugonia Avenue

BASIN DRAINAGE AREA

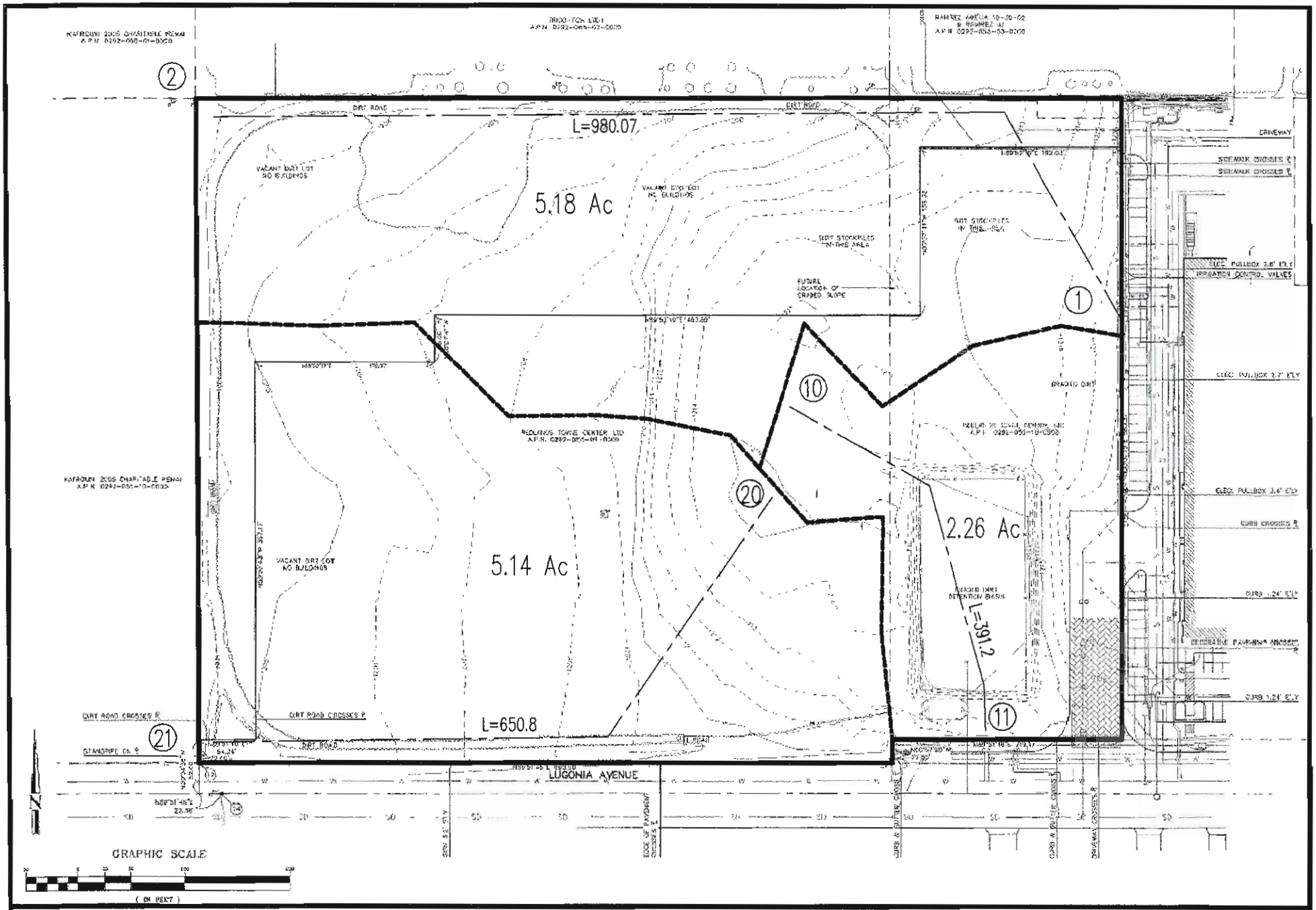
APPENDIX D
Existing Condition Rational Runs

Existing Condition Node Map

10 Year Run

25 Year Run

100 Year Run



University Crossings
Existing Hydrology Map

University Crossings Existing

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 10 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
1	5.180	5.180	B	Grass fair		31.51	1.15	0.56	0.56	2.75				
											980.70	0.0153	0.52	SHEET FLOW SPARSE VEG
2														
10	2.260	2.260	B	Grass fair		15.36	1.75	0.56	0.56	2.42				
											391.12	0.0102	0.42	SHEET FLOW SPARSE VEG
11														
20	5.140	5.140	B	Grass fair		19.89	1.50	0.56	0.56	4.35				
											650.80	0.0169	0.55	SHEET FLOW SPARSE VEG
21														

University Crossings Existing

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 25 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
1	5.180	5.180	B	Grass fair		31.51	1.40	0.56	0.56	3.92				
											980.70	0.0153	0.52	SHEET FLOW SPARSE VEG
2														
10	2.260	2.260	B	Grass fair		15.36	2.20	0.56	0.56	3.34				
											391.12	0.0102	0.42	SHEET FLOW SPARSE VEG
11														
20	5.140	5.140	B	Grass fair		19.89	1.77	0.56	0.56	5.60				
											650.80	0.0169	0.55	SHEET FLOW SPARSE VEG
21														

University Crossings Existing

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 100 -YEAR STORM 1-HOUR RAINFALL (INCH)= 1.26 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
1	5.180	5.180	B	Grass fair		31.51	1.80	0.10	0.10	7.93				
											980.70	0.0153	0.52	SHEET FLOW SPARSE VEG
2														
10	2.260	2.260	B	Grass fair		15.36	2.90	0.10	0.10	5.70				
											391.12	0.0102	0.42	SHEET FLOW SPARSE VEG
11														
20	5.140	5.140	B	Grass fair		19.89	2.40	0.10	0.10	10.64				
											650.80	0.0169	0.55	SHEET FLOW SPARSE VEG
21														

APPENDIX E
Proposed Condition Rational Runs

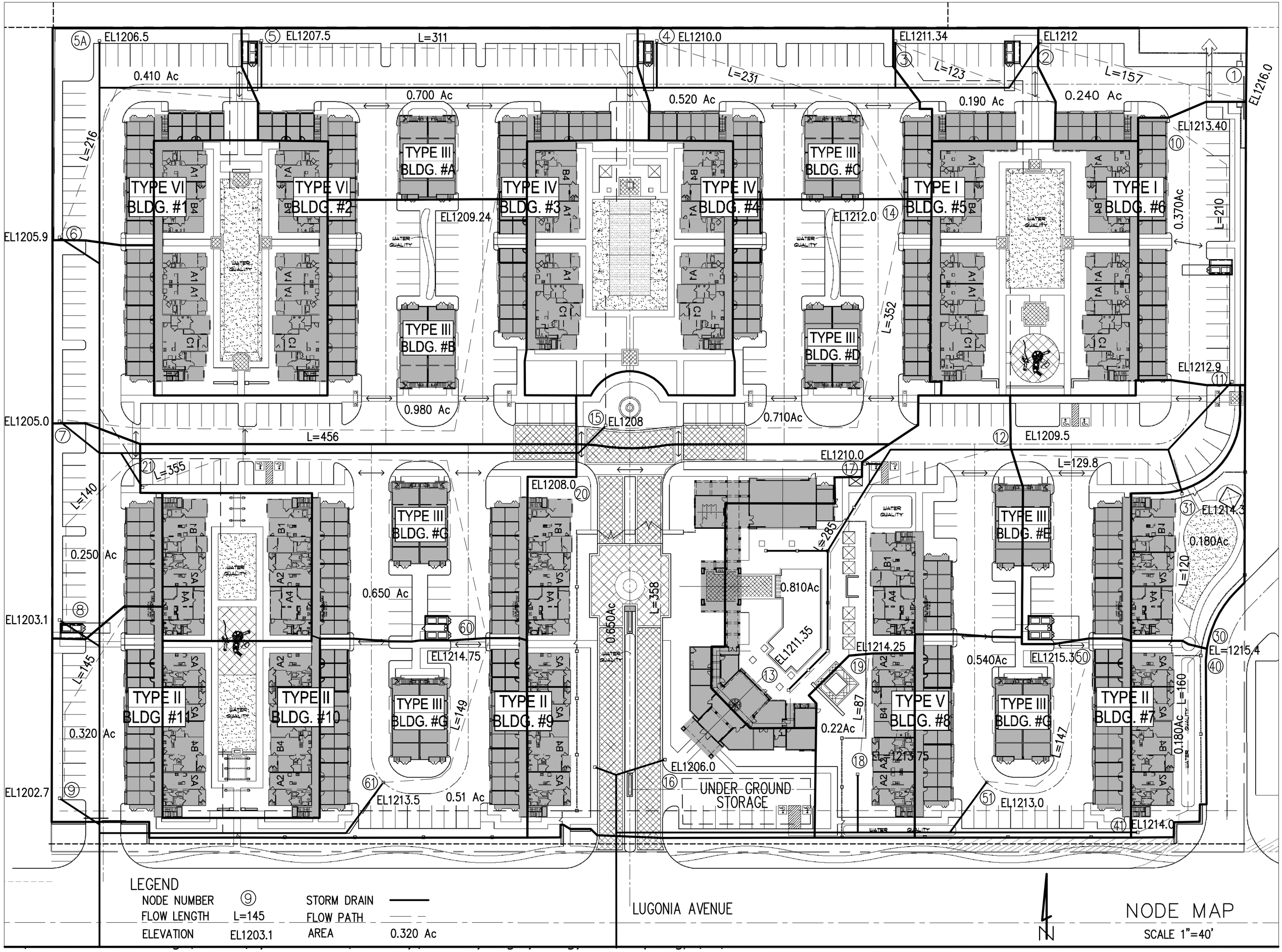
Proposed Condition Node Map

10 Year Run

25 Year Run

100 Year Run

Confluences


TYPE VI BLDG. #1
TYPE VI BLDG. #2
TYPE III BLDG. #A
TYPE III BLDG. #B
TYPE IV BLDG. #3
TYPE IV BLDG. #4
TYPE III BLDG. #C
TYPE III BLDG. #D
TYPE I BLDG. #5
TYPE I BLDG. #6
TYPE III BLDG. #G
TYPE III BLDG. #E
TYPE II BLDG. #11
TYPE II BLDG. #10
TYPE III BLDG. #G
TYPE II BLDG. #9
TYPE V BLDG. #8
TYPE III BLDG. #G
TYPE II BLDG. #7
UNDER GROUND STORAGE
WATER QUALITY
LUGONIA AVENUE
N
LEGEND
NODE NUMBER 9
FLOW LENGTH L=145
ELEVATION EL1203.1
STORM DRAIN
FLOW PATH
AREA 0.320 Ac
NODE MAP
SCALE 1"=40'

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL

STUDY NAME: University Crossings

10 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.8 SLOPE= 0.6

Calculated by _____ Date 5/20/2012

Checked by _____ Date _____

Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
1	0.240	0.240	B	COM		5.00	3.50	0.04	0.04	0.75				
					1.50						157.00	0.0255	2.88	APARTMENT COMPLEX SURFACE FLOW
2	0.190	0.430	B	COM		6.50	3.00	0.04	0.04	1.15				
					2.54						123.00	0.0054	1.37	APARTMENT COMPLEX SURFACE FLOW
3	0.520	0.950	B	COM		9.04	2.65	0.04	0.04	2.23				
					2.60						231.00	0.0058	1.52	APARTMENT COMPLEX SURFACE FLOW
4	0.700	1.650	B	COM		11.64	2.00	0.04	0.04	2.91				
					1.84						311.00	0.0080	1.99	APARTMENT COMPLEX SURFACE FLOW
5	0.410	2.060	B	COM		13.48	1.85	0.04	0.04	3.36				
					7.33						216.00	0.0074	1.96	APARTMENT COMPLEX SURFACE FLOW
6	0.980	3.040	B	COM		20.81	1.25	0.04	0.04	3.31				
											456.00	0.0020	1.04	APARTMENT COMPLEX SURFACE FLOW
7														
CONFLUENCE														
14	0.710	0.710	B	COM		5.00	3.50	0.04	0.04	2.21				
					0.13						352.00	0.0114	1.25	APARTMENT COMPLEX SURFACE FLOW
15	0.000	0.710	B	COM		5.13	3.45	0.00	0.00	2.20				
					2.79						28.00	0.0179	6.53	APARTMENT COMPLEX PIPE FLOW
20	0.650	1.360	B	COM		7.92	2.60	0.04	0.04	3.13				
					0.19						355.00	0.0113	2.12	APARTMENT COMPLEX SURFACE FLOW
21	0.000	1.360	B	COM		8.11	2.65	0.04	0.04	3.19				
											82.00	0.0122	7.08	APARTMENT COMPLEX PIPE FLOW
7														
CONFLUENCE at NODE 7		4.400	B	COM		20.81	1.25			4.81				

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 10 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.8 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
7	0.250	4.650	B	COM		20.81	1.25	0.04	0.04	4.81				
					1.72						140.00	0.0136	3.11	
8	0.320	4.970	B	COM		22.53	1.15	0.04	0.04	4.97				
											145.00	0.0028	1.40	APARTMENT COMPLEX SURFACE FLOW
9														
														APARTMENT COMPLEX SURFACE FLOW
CONFLUENCE														
60	0.510	0.510	B	COM		5.00	3.50	0.04	0.04	1.59				
					0.92						149.00	0.0084	0.97	APARTMENT COMPLEX SURFACE FLOW
61	0.000	0.510	B	COM		5.92	-	0.04	0.04	1.59				
											270.00	0.0400	4.90	APARTMENT COMPLEX PIPE FLOW
9														
CONFLUENCE		5.230				22.53	1.15			5.49				
FLOW TO LUGONIA														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 10 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.8 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
10	0.370	0.370	B	COM		5.00	3.50	0.04	0.04	1.15				
					0.64						210.00	0.0024	0.91	APARTMENT COMPLEX SURFACE FLOW
11	0.000	0.370	B	COM		5.64	-	0.04	0.04	1.15				
											171.10	0.0199	4.48	APARTMENT COMPLEX PIPE FLOW
12														
CONFLUENCE														
13	0.810	0.810	B	COM		5.00	3.50	0.04	0.04	2.52				
					3.25						285.00	0.0061	3.59	APARTMENT COMPLEX PIPE FLOW
12	0.000	0.810	B	COM		8.25	-	0.04	0.04	2.52				
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
30	0.180	0.180	B	COM		5.00	3.50	0.04	0.04	0.56				
					0.87						120.00	0.0092	1.02	APARTMENT COMPLEX SURFACE FLOW
31	0.000	0.180	B	COM		5.87	-	0.04	0.04	0.56				
											129.80	0.0385	2.48	APARTMENT COMPLEX PIPE FLOW
12														
CONFLUENCE														
CONFLUENCE		1.360				8.25	3.50			4.23				
Flow at node 12 drains to Water Quality Basin 1via pipe. Overflow at node 17 to node 16.														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 10 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.8 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
19	0.220	0.220	B	COM		5.00	3.50	0.04	0.04	0.69				
					0.25						87.00	0.0230	2.83	APARTMENT COMPLEX SURFACE FLOW
18	0.000	0.220	B	COM		5.25	3.25	0.04	0.04	0.64				
					0.25						42.65	0.0010	2.87	APARTMENT COMPLEX PIPE FLOW
18A	0.000	0.220	B	COM		5.49	-	0.04	0.04	0.64				
CONFLUENCE														
CONFLUENCE		0.940				7.61	3.45			2.89				
18A	0.000	0.940	B	COM		7.61	2.75	0.04	0.04	2.89				
					0.16						129.08	0.0230	13.78	APARTMENT COMPLEX PIPE FLOW
BASIN	0.000	0.940	B	COM		7.77	-	0.04	0.04	2.89				
CONFLUENCE														
					0.81									
17	1.160	1.160	B	COM		5.00	3.50	0.04	0.04	3.61				
					0.33						358.00	0.0112	7.34	APARTMENT COMPLEX SURFACE FLOW
16	0.000	1.160	B	COM		5.33	-	0.04	0.04	3.61				
											126.10	0.0050	6.43	APARTMENT COMPLEX PIPE FLOW
BASIN														
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
CONFLUENCE & TO LUGONIA ST		2.100				5.33	3.50			5.59				

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 10 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.8 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
40	0.180	0.180	B	COM		5.00	3.50	0.04	0.04	0.56				
					0.47						160.00	0.0088	1.63	APARTMENT COMPLEX SURFACE FLOW
41	0.000	0.180	B	COM		5.47	-	0.04	0.04	0.56				
											137.90	0.0230	4.88	APARTMENT COMPLEX PIPE FLOW
51A	0.000	0.180	B	COM										
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
50	0.540	0.540	B	COM		5.00	3.50	0.04	0.04	1.68				
					0.11						147.00	0.0156	2.50	APARTMENT COMPLEX SURFACE FLOW
51	0.000	0.540	B	COM		5.11	3.45	0.04	0.04	1.66				
											45.18	0.0230	6.68	APARTMENT COMPLEX PIPE FLOW
51A	0.000	0.540	B	COM		7.50	-	0.04	0.04	1.66				
CONFLUENCE														
51A	0.000	0.720	B	COM		7.50	3.45	0.04	0.04	2.21				
					0.11						67.14	0.0230	10.14	APARTMENT COMPLEX PIPE FLOW
18A	0.000	0.720	B	COM		7.61	-	0.04	0.04	2.21				
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
to underground basin 6														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL

STUDY NAME: University Crossings

25 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6

Calculated by _____ Date 5/20/2012

Checked by _____ Date _____

Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
1	0.240	0.240	B	COM		5.00	4.80	0.04	0.04	1.03				
					1.50						157.00	0.0255	2.88	APARTMENT COMPLEX SURFACE FLOW
2	0.190	0.430	B	COM		6.50	3.60	0.04	0.04	1.38				
					2.54						123.00	0.0054	1.37	APARTMENT COMPLEX SURFACE FLOW
3	0.520	0.950	B	COM		9.04	2.98	0.04	0.04	2.51				
					2.60						231.00	0.0058	1.52	APARTMENT COMPLEX SURFACE FLOW
4	0.700	1.650	B	COM		11.64	2.75	0.04	0.04	4.02				
					1.84						311.00	0.0080	1.99	APARTMENT COMPLEX SURFACE FLOW
5	0.410	2.060	B	COM		13.48	2.25	0.04	0.04	4.10				
					7.33						216.00	0.0074	1.96	APARTMENT COMPLEX SURFACE FLOW
6	0.980	3.040	B	COM		20.81	1.80	0.04	0.04	4.82				
											456.00	0.0020	1.04	APARTMENT COMPLEX SURFACE FLOW
7														
CONFLUENCE														
14	0.710	0.710	B	COM		5.00	4.80	0.04	0.04	3.04				
					0.13						352.00	0.0114	1.25	APARTMENT COMPLEX SURFACE FLOW
15	0.000	0.710	B	COM		5.13	4.20	0.00	0.00	2.68				
					2.79						28.00	0.0179	6.53	APARTMENT COMPLEX PIPE FLOW
20	0.650	1.360	B	COM		7.92	3.15	0.04	0.04	3.81				
					0.19						355.00	0.0113	2.12	APARTMENT COMPLEX SURFACE FLOW
21	0.000	1.360	B	COM		8.11	3.10	0.04	0.04	3.75				
											82.00	0.0122	7.08	APARTMENT COMPLEX PIPE FLOW
7														
CONFLUENCE at NODE 7		4.400	B	COM		20.81	1.80			7.00				

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 25 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
7	0.250	4.650	B	COM		20.81	1.80	0.04	0.04	7.00				
					1.72						140.00	0.0136	3.11	
8	0.320	4.970	B	COM		22.53	1.75	0.04	0.04	7.65				
											145.00	0.0028	1.40	APARTMENT COMPLEX SURFACE FLOW
9														
														APARTMENT COMPLEX SURFACE FLOW
CONFLUENCE														
60	0.510	0.510	B	COM		5.00	4.80	0.04	0.04	2.18				
					0.92						149.00	0.0084	0.97	APARTMENT COMPLEX SURFACE FLOW
61	0.000	0.510	B	COM		5.92	-	0.04	0.04	2.18				
											270.00	0.0400	4.90	APARTMENT COMPLEX PIPE FLOW
9														
CONFLUENCE		5.230				22.53	1.75			8.44				
FLOW TO LUGONIA														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 25 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

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10	0.370	0.370	B	COM		5.00	4.80	0.04	0.04	1.59				
					0.64						210.00	0.0024	0.91	APARTMENT COMPLEX SURFACE FLOW
11	0.000	0.370	B	COM		5.64	-	0.04	0.04	1.59				
											171.10	0.0199	4.48	APARTMENT COMPLEX PIPE FLOW
12														
CONFLUENCE														
13	0.810	0.810	B	COM		5.00	4.80	0.04	0.04	3.47				
					3.25						285.00	0.0061	3.59	APARTMENT COMPLEX PIPE FLOW
12	0.000	0.810	B	COM		8.25	-	0.04	0.04	3.47				
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
30	0.180	0.180	B	COM		5.00	4.80	0.04	0.04	0.77				
					0.87						120.00	0.0092	1.02	APARTMENT COMPLEX SURFACE FLOW
31	0.000	0.180	B	COM		5.87	-	0.04	0.04	0.77				
											129.80	0.0385	2.48	APARTMENT COMPLEX PIPE FLOW
12														
CONFLUENCE														
CONFLUENCE		1.360				8.25	4.80			5.83				
Flow at node 12 drains to Water Quality Basin 1via pipe. Overflow at node 17 to node 16.														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 25 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

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19	0.220	0.220	B	COM		5.00	4.80	0.04	0.04	0.94				
					0.25						87.00	0.0230	2.83	APARTMENT COMPLEX SURFACE FLOW
18	0.000	0.220	B	COM		5.25	4.20	0.04	0.04	0.82				
					0.25						42.65	0.0010	2.87	APARTMENT COMPLEX PIPE FLOW
18A	0.000	0.220	B	COM		5.49	-	0.04	0.04	0.82				
CONFLUENCE														
CONFLUENCE		0.940				7.61	3.30			2.71				
18A	0.000	0.940	B	COM		7.61	3.30	0.04	0.04	2.76				
					0.16						129.08	0.0230	13.78	APARTMENT COMPLEX PIPE FLOW
BASIN	0.000	0.940	B	COM		7.77	-	0.04	0.04	2.76				
CONFLUENCE														
17	1.160	1.160	B	COM		5.00	4.80	0.04	0.04	4.97				
					0.33						358.00	0.0112	7.34	APARTMENT COMPLEX SURFACE FLOW
16	0.000	1.160	B	COM		5.33	-	0.04	0.04	4.97				
											126.10	0.0050	6.43	APARTMENT COMPLEX PIPE FLOW
BASIN														
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
CONFLUENCE & TO LUGONIA ST		2.100				5.33	5.45			8.11				

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 25 -YEAR STORM 1-HOUR RAINFALL (INCH)= 0.84 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

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40	0.180	0.180	B	COM		5.00	4.80	0.04	0.04	0.77				
					0.47						160.00	0.0088	1.63	APARTMENT COMPLEX SURFACE FLOW
41	0.000	0.180	B	COM		5.47	4.35	0.04	0.04	0.70				
											137.90	0.0230	4.88	APARTMENT COMPLEX PIPE FLOW
51A	0.000	0.180	B	COM										
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
50	0.540	0.540	B	COM		5.00	4.80	0.04	0.04	2.31				
					0.11						147.00	0.0156	2.50	APARTMENT COMPLEX SURFACE FLOW
51	0.000	0.540	B	COM		5.11	4.40	0.04	0.04	2.12				
											45.18	0.0230	6.68	APARTMENT COMPLEX PIPE FLOW
51A	0.000	0.540	B	COM		7.50	-	0.04	0.04	2.12				
CONFLUENCE														
51A	0.000	0.720	B	COM		7.50	3.25	0.04	0.04	2.08				
					0.11						67.14	0.0230	10.14	APARTMENT COMPLEX PIPE FLOW
18A	0.000	0.720	B	COM		7.61	-	0.04	0.04	2.08				
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
to underground basin 6														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 100 -YEAR STORM 1-HOUR RAINFALL (INCH)= 1.26 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

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1	0.240	0.240	B	COM		5.00	5.60	0.04	0.04	1.20				
					1.50						157.00	0.0255	2.88	APARTMENT COMPLEX SURFACE FLOW
2	0.190	0.430	B	COM		6.50	4.80	0.04	0.04	1.84				
					2.54						123.00	0.0054	1.37	APARTMENT COMPLEX SURFACE FLOW
3	0.520	0.950	B	COM		9.04	3.80	0.04	0.04	3.21				
					2.60						231.00	0.0058	1.52	APARTMENT COMPLEX SURFACE FLOW
4	0.700	1.650	B	COM		11.64	3.08	0.04	0.04	4.51				
					1.84						311.00	0.0080	1.99	APARTMENT COMPLEX SURFACE FLOW
5	0.410	2.060	B	COM		13.48	3.10	0.04	0.04	5.67				
					7.33						216.00	0.0074	1.96	APARTMENT COMPLEX SURFACE FLOW
6	0.980	3.040	B	COM		20.81	2.40	0.04	0.04	6.46				
											456.00	0.0020	1.04	APARTMENT COMPLEX SURFACE FLOW
7														
CONFLUENCE														
14	0.710	0.710	B	COM		5.00	5.60	0.04	0.04	3.55				
					0.13						352.00	0.0114	1.25	APARTMENT COMPLEX SURFACE FLOW
15	0.000	0.710	B	COM		5.13	5.50	0.00	0.00	3.55				
					2.79						28.00	0.0179	6.53	APARTMENT COMPLEX PIPE FLOW
20	0.650	1.360	B	COM		7.92	4.40	0.04	0.04	5.34				
					0.19						355.00	0.0113	2.12	APARTMENT COMPLEX SURFACE FLOW
21	0.000	1.360	B	COM		8.11	4.10	0.04	0.04	5.09				
											82.00	0.0122	7.08	APARTMENT COMPLEX PIPE FLOW
7														
CONFLUENCE at NODE 7		4.400	B	COM		20.81	2.40			9.91				

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 100 -YEAR STORM 1-HOUR RAINFALL (INCH)= 1.26 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
7	0.250	4.650	B	COM		20.81	2.40	0.04	0.04	9.90				
					1.72						140.00	0.0136	3.11	
8	0.320	4.970	B	COM		22.53	2.30	0.04	0.04	10.11				
											145.00	0.0028	1.40	APARTMENT COMPLEX SURFACE FLOW
9														
														APARTMENT COMPLEX SURFACE FLOW
CONFLUENCE														
60	0.510	0.510	B	COM		5.00	5.60	0.04	0.04	2.55				
					0.92						149.00	0.0084	0.97	APARTMENT COMPLEX SURFACE FLOW
61	0.000	0.510	B	COM		5.92	-	0.04	0.04	2.55				
											270.00	0.0400	4.90	APARTMENT COMPLEX PIPE FLOW
9														
CONFLUENCE		5.230				22.53	2.30			10.65				
FLOW TO LUGONIA														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 100 -YEAR STORM 1-HOUR RAINFALL (INCH)= 1.26 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
10	0.370	0.370	B	COM		5.00	5.60	0.04	0.04	1.85				
					0.64						210.00	0.0024	0.91	APARTMENT COMPLEX SURFACE FLOW
11	0.000	0.370	B	COM		5.64	5.00	0.04	0.04	1.85				
											171.10	0.0199	4.48	APARTMENT COMPLEX PIPE FLOW
12														
CONFLUENCE														
13	0.810	0.810	B	COM		5.00	5.60	0.04	0.04	4.05				
					3.25						285.00	0.0061	3.59	APARTMENT COMPLEX PIPE FLOW
12	0.000	0.810	B	COM		8.25	4.20	0.04	0.04	4.05				APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
30	0.180	0.180	B	COM		5.00	5.60	0.04	0.04	0.90				
					0.87						120.00	0.0092	1.02	APARTMENT COMPLEX SURFACE FLOW
31	0.000	0.180	B	COM		5.87	5.50	0.04	0.04	0.90				
											129.80	0.0385	2.48	APARTMENT COMPLEX PIPE FLOW
12														
CONFLUENCE														
CONFLUENCE		1.360				8.25	5.60			6.80				
Flow at node 12 drains to Water Quality Basin 1via pipe. Overflow at node 17 to node 16.														

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 100 -YEAR STORM 1-HOUR RAINFALL (INCH)= 1.26 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
19	0.220	0.220	B	COM		5.00	5.60	0.04	0.04	1.10				
					0.25						87.00	0.0230	2.83	APARTMENT COMPLEX SURFACE FLOW
18	0.000	0.220	B	COM		5.25	5.40	0.04	0.04	1.06				
					0.25						42.65	0.0010	2.87	APARTMENT COMPLEX PIPE FLOW
18A	0.000	0.220	B	COM		5.49	5.35	0.04	0.04	1.06				
CONFLUENCE														
CONFLUENCE		0.940				7.61	4.30			3.59				
18A	0.000	0.940	B	COM		7.61	4.30	0.04	0.04	3.59				
					0.16						129.08	0.0230	13.78	APARTMENT COMPLEX PIPE FLOW
BASIN	0.000	0.940	B	COM		7.77	4.28	0.04	0.04	3.59				
CONFLUENCE														
					0.81									
17	1.160	1.160	B	COM		5.00	5.60	0.04	0.04	5.80				
					0.33						358.00	0.0112	7.34	APARTMENT COMPLEX SURFACE FLOW
16	0.000	1.160	B	COM		5.33	5.45	0.04	0.04	5.65				
											126.10	0.0050	6.43	APARTMENT COMPLEX PIPE FLOW
BASIN														
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
CONFLUENCE & TO LUGONIA ST		2.100				5.33	5.45			8.11				

University Crossings

RATIONAL METHOD STUDY FORM

SAN BERNARDINO COUNTY HYDROLOGY MANUAL	STUDY NAME: University Crossings 100 -YEAR STORM 1-HOUR RAINFALL (INCH)= 1.26 SLOPE= 0.6	Calculated by _____ Date 5/20/2012 Checked by _____ Date _____ Page of

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm in/hr	Fm avg.	Q Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
40	0.180	0.180	B	COM		5.00	5.60	0.04	0.04	0.90				
					0.47						160.00	0.0088	1.63	APARTMENT COMPLEX SURFACE FLOW
41	0.000	0.180	B	COM		5.47	-	0.04	0.04	0.90				
											137.90	0.0230	4.88	APARTMENT COMPLEX PIPE FLOW
51A	0.000	0.180	B	COM										
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
50	0.540	0.540	B	COM		5.00	5.60	0.04	0.04	2.70				
					0.11						147.00	0.0156	2.50	APARTMENT COMPLEX SURFACE FLOW
51	0.000	0.540	B	COM		5.11	5.50	0.04	0.04	2.65				
											45.18	0.0230	6.68	APARTMENT COMPLEX PIPE FLOW
51A	0.000	0.540	B	COM		7.50	-	0.04	0.04	2.65				
CONFLUENCE														
51A	0.000	0.720	B	COM		7.50	4.50	0.04	0.04	2.98				
					0.11						67.14	0.0230	10.14	APARTMENT COMPLEX PIPE FLOW
18A	0.000	0.720	B	COM		7.61	-	0.04	0.04	2.98				
														APARTMENT COMPLEX PIPE FLOW
CONFLUENCE														
to underground basin 6														

University Crossings

Node Data

Concentration Point	Area	UPSTREAM ELEVATION	DOWNSTREAM ELEVATION	Flow Path Length ft.	Slope ft./ft.	"N"	WIDTH	DEPTH	WETTED PERIMETER	CROSS SECTION AREA	HYDRAULIC RADIUS	V ft./sec.	Tt Min
1	0.240	1216.000	1212.000	157.0000	0.0255	0.017	4.000	0.190	4.018	0.380	0.095	2.88	0.908162
2	0.190	1212.000	1211.340	123.0000	0.0054	0.017	4.000	0.200	4.020	0.400	0.100	1.37	1.498459
3	0.520	1211.340	1210.000	231.0000	0.0058	0.017	4.000	0.220	4.024	0.440	0.109	1.52	2.540936
4	0.700	1210.000	1207.500	311.0000	0.0080	0.017	4.000	0.260	4.034	0.520	0.129	1.99	2.602425
5	0.410	1207.500	1205.900	216.0000	0.0074	0.017	4.000	0.270	4.036	0.540	0.134	1.96	1.836691
6	0.980	1205.900	1205.000	456.0000	0.0020	0.017	4.000	0.280	4.039	0.560	0.139	1.04	7.334248
7	0.250	1205.000	1203.100	140.0000	0.0136	0.017	4.000	0.200	4.020	0.400	0.170	3.11	0.749076
8	0.320	1203.100	1202.700	145.0000	0.0028	0.017	4.000	0.200	4.020	0.400	0.170	1.40	1.720809
9		1202.700											
14	0.710	1212.000	1208.000	352.0000	0.0114	0.017	2.000	0.100	2.010	0.100	0.050	1.25	4.688492
15	0.000	1204.500	1204.000	28.0000	0.0179	0.013			0.000	0.000	0.280	6.53	0.13
20	0.650	1208.000	1204.000	355.0000	0.0113	0.017	4.000	2.000	5.657	4.000	0.110	2.12	2.790557
21	0.000	1201.000	1200.000	82.0000	0.0122	0.013			0.000	0.000	0.420	7.08	0.193085

University Crossings

Node Data

Concentration Point	Area	UPSTREAM ELEVATION	DOWNSTREAM ELEVATION	Flow Path Length ft.	Slope ft./ft.	"N"	WIDTH	DEPTH	WETTED PERIMETER	CROSS SECTION AREA	HYDRAULIC RADIUS	V ft./sec.	Tt Min
10	0.370	1213.400	1212.900	210.0000	0.0024	0.017	4.000	0.200	4.020	0.400	0.100	0.91	3.840635
11	0.000	1212.900	1209.500	171.1000	0.0199	0.017	4.000	0.200	4.020	0.400	0.220	4.48	0.636537
12		1209.500											
13	0.810	1211.250	1209.500	285.0000	0.0061	0.017	4.000	0.200	4.020	0.400	0.380	3.59	1.322527
12		1209.500											
30	0.180	1215.400	1214.300	120.0000	0.0092	0.030	10.000	0.200	10.008	1.000	0.100	1.02	1.968303
31	0.000	1214.500	1209.500	129.8000	0.0385	0.030	4.000	1.000	4.472	2.000	0.130	2.48	0.8707
12		1209.500		28.0000	43.1964								
19	0.220	1214.250	1213.750	87.0000	0.0230	0.017	4.000	0.200	4.020	0.400	0.100	2.83	0.511934
18		1213.750											
17	1.160	1210.000	1206.000	358.0000	0.0112	0.017	4.000	2.000	5.657	4.000	0.707	7.34	0.812365
16		1206.000											

University Crossings

Node Data

Concentration Point	Area	UPSTREAM ELEVATION	DOWNSTREAM ELEVATION	Flow Path Length ft.	Slope ft./ft.	"N"	WIDTH	DEPTH	WETTED PERIMETER	CROSS SECTION AREA	HYDRAULIC RADIUS	V ft./sec.	Tt Min
40	0.180	1215.400	1214.000	160.0000	0.0088	0.017	4.000	0.200	4.020	0.400	0.090	1.63	1.632619
41		1214.000											
50	0.540	1215.300	1213.000	147.0000	0.0156	0.017	4.000	0.200	4.020	0.400	0.110	2.50	0.980597
51		1213.000											
60	0.51	1214.75	1213.50	149.00	0.01	0.03	4.00	0.20	4.02	0.40	0.10	0.97	2.561862
61	0.000	1213.500	1202.700	270.0000	0.0400	0.013	4.000	1.000	4.472	2.000	0.100	4.90	0.918205
9													

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
1 - 7	3.31	20.81	1.25	3.04
14 - 7	3.19	8.11	2.65	1.36

Storm Year:	10
Confluence Name:	7

RESULTS

Confluenced Q=	4.81	cfs
Time of Concentration=	20.81	minutes
Rainfall Intensity=	1.25	In/Hr
Area=	4.40	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
7-9	4.97	22.53	1.15	4.97
60-9	1.59	5.92	3.50	0.51

Storm Year:	10
Confluence Name:	9

RESULTS

Confluenced Q=	5.49	cfs
Time of Concentration=	22.53	minutes
Rainfall Intensity=	1.15	In/Hr
Area=	5.48	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
10-12	1.15	5.64	3.50	0.37
13-12	2.52	8.25	3.50	0.81
30-12	0.56	5.87	3.50	0.18

Storm Year:	10
Confluence Name:	12

RESULTS

Confluenced Q=	4.23	cfs
Time of Concentration=	8.25	minutes
Rainfall Intensity=	3.50	In/Hr
Area=	1.36	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
19 - 18A	0.64	5.49	3.25	0.22
51A - 18A	2.21	7.61	3.45	0.72

Storm Year:	10
Confluence Name:	18A

RESULTS

Confluenced Q=	2.89	cfs
Time of Concentration=	7.61	minutes
Rainfall Intensity=	3.45	In/Hr
Area=	0.94	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
18A-BASIN	2.89	7.77	2.75	0.94
17-BASIN	3.61	5.33	3.50	1.16

Storm Year:	10
Confluence Name:	18A

RESULTS

Confluenced Q=	5.59	cfs
Time of Concentration=	5.33	minutes
Rainfall Intensity=	3.50	In/Hr
Area=	2.10	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
40 - 51A	0.56	5.47	3.50	0.18
50 - 51A	1.66	7.50	3.45	0.54

Storm Year:	10
Confluence Name:	51A

RESULTS

Confluenced Q=	2.21	cfs
Time of Concentration=	7.50	minutes
Rainfall Intensity=	3.45	In/Hr
Area=	0.72	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
1 - 7	4.82	20.81	1.80	3.04
14 - 7	3.75	8.11	3.10	1.36

Storm Year:	25
Confluence Name:	7

RESULTS

Confluenced Q=	7.00	cfs
Time of Concentration=	20.81	minutes
Rainfall Intensity=	1.80	In/Hr
Area=	4.40	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
7-9	7.65	22.53	1.75	4.97
60-9	2.18	5.92	4.80	0.51

Storm Year:	25
Confluence Name:	9

RESULTS

Confluenced Q=	8.44	cfs
Time of Concentration=	22.53	minutes
Rainfall Intensity=	1.75	In/Hr
Area=	5.48	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
10-12	1.59	5.64	4.80	0.37
13-12	3.47	8.25	4.80	0.81
30-12	0.77	5.87	4.80	0.18

Storm Year:	25
Confluence Name:	12

RESULTS

Confluenced Q=	5.83	cfs
Time of Concentration=	8.25	minutes
Rainfall Intensity=	4.80	In/Hr
Area=	1.36	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
19 - 18A	0.82	5.49	4.20	0.22
51A - 18A	2.08	7.61	3.30	0.72

Storm Year:	25
Confluence Name:	18A

RESULTS

Confluenced Q=	2.72	cfs
Time of Concentration=	7.61	minutes
Rainfall Intensity=	3.30	In/Hr
Area=	0.94	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
18A-BASIN	2.76	7.77	3.30	0.94
17-BASIN	4.97	5.33	4.10	1.16

Storm Year:	25
Confluence Name:	18A

RESULTS

Confluenced Q=	6.86	cfs
Time of Concentration=	5.33	minutes
Rainfall Intensity=	4.10	In/Hr
Area=	2.10	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
40 - 51A	0.70	5.47	4.35	0.18
50 - 51A	2.12	7.50	4.40	0.54

Storm Year:	25
Confluence Name:	51A

RESULTS

Confluenced Q=	2.83	cfs
Time of Concentration=	7.50	minutes
Rainfall Intensity=	4.40	In/Hr
Area=	0.72	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
1 - 7	6.46	20.81	2.40	3.04
14 - 7	5.90	8.11	4.10	1.36

Storm Year:	100
Confluence Name:	7

RESULTS

Confluenced Q=	9.91	cfs
Time of Concentration=	20.81	minutes
Rainfall Intensity=	2.40	In/Hr
Area=	4.40	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
7-9	9.60	22.53	2.30	4.97
60-9	2.55	5.92	5.60	0.51

Storm Year:	100
Confluence Name:	9

RESULTS

Confluenced Q=	10.65	cfs
Time of Concentration=	22.53	minutes
Rainfall Intensity=	2.30	In/Hr
Area=	5.48	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
10-12	1.85	5.64	5.60	0.37
13-12	4.05	8.25	5.60	0.81
30-12	0.90	5.87	5.60	0.18

Storm Year:	100
Confluence Name:	12

RESULTS

Confluenced Q=	6.80	cfs
Time of Concentration=	8.25	minutes
Rainfall Intensity=	5.60	In/Hr
Area=	1.36	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
18A-BASIN	3.59	7.77	4.28	0.94
17-BASIN	5.65	5.33	5.45	1.16

Storm Year:	100
Confluence Name:	18A

RESULTS

Confluenced Q=	8.11	cfs
Time of Concentration=	5.33	minutes
Rainfall Intensity=	5.45	In/Hr
Area=	2.10	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
19 - 18A	1.06	5.49	5.49	0.22
51A - 18A	2.76	7.61	4.30	0.72

Storm Year:	100
Confluence Name:	18A

RESULTS

Confluenced Q=	3.59	cfs
Time of Concentration=	7.61	minutes
Rainfall Intensity=	4.30	In/Hr
Area=	0.94	acres

Project Notes:

Storm Water Confluence

Project:	University Crossings	Streets:	Lugonia
Location:	San Bernardino County	Date:	03/12/12
Calc. By:		Chk By:	

INPUT

Stream Name	Flow (cfs)	TC (minutes)	Rainfal Intensity	Area acres
40 - 51A	0.85	5.47	5.30	0.18
50 - 51A	2.17	7.50	4.50	0.54

Storm Year:	100
Confluence Name:	51A

RESULTS

Confluenced Q=	2.89	cfs
Time of Concentration=	7.50	minutes
Rainfall Intensity=	4.50	In/Hr
Area=	0.72	acres

Project Notes:

APPENDIX F
Hydraulic Analysis

100 Year Run

Storm Drain Map

DATE: 3/18/2012
TIME: 13:11

F0515P

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			3.00														
CD	2	4			2.00														
CD	3	4			1.50														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

UNIVERSITY CROSSINGS NODES 1-9 MAINLINE

HEADING LINE NO 2 IS -

HYDRAULIC STUDY 100 YEAR STORM

HEADING LINE NO 3 IS -

MARCH 2012

LINE DESCRIPTION –

Nodes 1 to 9 along north and west side of property. Main line.

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                             1000.00 1197.02    1                                      1201.02

ELEMENT NO   2 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                             1094.00 1198.70    1             0.014                                  0.00   0.00    0.00     0

ELEMENT NO   3 IS A JUNCTION          *         *     *     *                 *                 *              *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             1098.00 1198.80    1     2     2  0.014      0.6      2.5  1198.90  1198.90  60.00   90.00

ELEMENT NO   4 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                             1229.00 1199.10    1             0.014                                  0.00   0.00    0.00     0

ELEMENT NO   5 IS A JUNCTION          *         *     *     *                 *                 *              *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             1233.00 1199.20    1     2     0  0.014      0.5      0.0  1199.30     0.00  60.00    0.00

ELEMENT NO   6 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                             1376.00 1201.00    1             0.014                                  0.00   0.00    0.00     0

ELEMENT NO   7 IS A JUNCTION          *         *     *     *                 *                 *              *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             1380.00 1201.10    1     1     1  0.014      1.9      4.5  1201.20     0.00  60.00   60.00

ELEMENT NO   8 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                             1516.00 1201.90    2             0.014                                  0.00   0.00    0.00     0

ELEMENT NO   9 IS A JUNCTION          *         *     *     *                 *                 *              *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             1520.00 1202.00    2     1     0  0.014      1.9      0.0  1202.10     0.00  60.00    0.00

ELEMENT NO  10 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                             1649.00 1202.50    2             0.014                                  0.00   0.00    0.00     0

ELEMENT NO  11 IS A JUNCTION          *         *     *     *                 *                 *              *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             1653.00 1202.60    2     1     0  0.014      1.0      0.0  1202.70     0.00  90.00    0.00

ELEMENT NO  12 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                             1768.00 1203.50    2             0.014                                  0.00   0.00    0.00     0
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WATER SURFACE PROFILE - ELEMENT CARD LISTING

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ELEMENT NO  13 IS A JUNCTION          *         *     *     *                  *                   *               *
                   U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                1772.00 1203.60    3     1     0  0.014      1.7      0.0  1203.70     0.00  90.00    0.00

 ELEMENT NO  14 IS A REACH            *         *     *
                   U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                2059.00 1206.00    3             0.014                                  0.00   0.00    0.00     0

 ELEMENT NO  15 IS A JUNCTION          *         *     *     *                  *                   *               *
                   U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                2063.00 1206.10    3     1     0  0.014      1.6      0.0  1206.20     0.00  90.00    0.00

 ELEMENT NO  16 IS A REACH            *         *     *
                   U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                2234.00 1207.30    3             0.014                                  0.00   0.00    0.00     0

 ELEMENT NO  17 IS A JUNCTION          *         *     *     *                  *                   *               *
                   U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                2238.00 1207.40    3     1     0  0.014      0.7      0.0  1207.50     0.00  90.00    0.00

 ELEMENT NO  18 IS A REACH            *         *     *
                   U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                2362.00 1208.00    3             0.014                                  0.00   0.00    0.00     0

 ELEMENT NO  19 IS A SYSTEM HEADWORKS                 *                     *
                   U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                                2362.00 1208.00    3                                        1211.00
```

WATER SURFACE PROFILE - ELEMENT CARD LISTING

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1000.00	1197.02	4.000	1201.020	18.0	2.55	0.101	1201.121	0.00	1.358	3.00	0.00	0.00	0	0.00
58.73	0.01787					.000839	0.05		0.950			0.00		
1058.73	1198.07	3.000	1201.070	18.0	2.55	0.101	1201.171	0.00	1.358	3.00	0.00	0.00	0	0.00
15.67	0.01787					.000785	0.01		0.950			0.00		
1074.40	1198.35	2.721	1201.071	18.0	2.67	0.111	1201.182	0.00	1.358	3.00	0.00	0.00	0	0.00
8.77	0.01787					.000765	0.01		0.950			0.00		
1083.17	1198.51	2.560	1201.066	18.0	2.80	0.122	1201.188	0.00	1.358	3.00	0.00	0.00	0	0.00
7.09	0.01787					.000828	0.01		0.950			0.00		
1090.26	1198.63	2.427	1201.060	18.0	2.94	0.134	1201.194	0.00	1.358	3.00	0.00	0.00	0	0.00
3.74	0.01787					.000891	0.00		0.950			0.00		
1094.00	1198.70	2.356	1201.056	18.0	3.02	0.142	1201.198	0.00	1.358	3.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.000776	0.00					0.00		
1098.00	1198.80	2.347	1201.147	14.9	2.51	0.098	1201.245	0.00	1.231	3.00	0.00	0.00	0	0.00
61.28	0.00229					.000669	0.04		1.504			0.00		
1159.28	1198.94	2.238	1201.178	14.9	2.63	0.108	1201.286	0.00	1.231	3.00	0.00	0.00	0	0.00
57.11	0.00229					.000745	0.04		1.504			0.00		
1216.39	1199.07	2.139	1201.210	14.9	2.76	0.118	1201.328	0.00	1.231	3.00	0.00	0.00	0	0.00
12.61	0.00229					.000797	0.01		1.504			0.00		
1229.00	1199.10	2.118	1201.218	14.9	2.79	0.121	1201.339	0.00	1.231	3.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.000828	0.00					0.00		
1233.00	1199.20	2.026	1201.226	14.4	2.84	0.125	1201.351	0.00	1.209	3.00	0.00	0.00	0	0.00

6.10	0.01259	.000902	0.01	0.925	0.00

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1239.10	1199.28	1.942	1201.219	14.4	2.97	0.137	1201.356	0.00	1.209	3.00	0.00	0.00	0	0.00
5.56	0.01259					.001015	0.01		0.925			0.00		
1244.66	1199.35	1.864	1201.211	14.4	3.12	0.151	1201.362	0.00	1.209	3.00	0.00	0.00	0	0.00
5.06	0.01259					.001146	0.01		0.925			0.00		
1249.72	1199.41	1.791	1201.201	14.4	3.27	0.166	1201.367	0.00	1.209	3.00	0.00	0.00	0	0.00
4.72	0.01259					.001295	0.01		0.925			0.00		
1254.44	1199.47	1.721	1201.191	14.4	3.43	0.183	1201.374	0.00	1.209	3.00	0.00	0.00	0	0.00
4.21	0.01259					.001466	0.01		0.925			0.00		
1258.65	1199.52	1.656	1201.179	14.4	3.60	0.201	1201.380	0.00	1.209	3.00	0.00	0.00	0	0.00
3.92	0.01259					.001661	0.01		0.925			0.00		
1262.57	1199.57	1.593	1201.165	14.4	3.77	0.221	1201.386	0.00	1.209	3.00	0.00	0.00	0	0.00
3.01	0.01259					.001884	0.01		0.925			0.00		
1265.58	1199.61	1.534	1201.144	14.4	3.96	0.244	1201.388	0.00	1.209	3.00	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
1265.58	1199.61	0.925	1200.535	14.4	7.77	0.938	1201.473	0.00	1.209	3.00	0.00	0.00	0	0.00
52.53	0.01259					.012178	0.64		0.925			0.00		
1318.11	1200.27	0.945	1201.216	14.4	7.55	0.884	1202.100	0.00	1.209	3.00	0.00	0.00	0	0.00
28.95	0.01259					.010950	0.32		0.925			0.00		
1347.06	1200.64	0.978	1201.614	14.4	7.20	0.804	1202.418	0.00	1.209	3.00	0.00	0.00	0	0.00
13.03	0.01259					.009589	0.12		0.925			0.00		
1360.09	1200.80	1.012	1201.812	14.4	6.86	0.731	1202.543	0.00	1.209	3.00	0.00	0.00	0	0.00
7.27	0.01259					.008400	0.06		0.925			0.00		

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1367.36	1200.89	1.048	1201.939	14.4	6.54	0.664	1202.603	0.00	1.209	3.00	0.00	0.00	0	0.00
4.29	0.01259					.007364	0.03		0.925			0.00		
1371.65	1200.94	1.086	1202.031	14.4	6.24	0.604	1202.635	0.00	1.209	3.00	0.00	0.00	0	0.00
2.59	0.01259					.006459	0.02		0.925			0.00		
1374.24	1200.98	1.125	1202.103	14.4	5.95	0.549	1202.652	0.00	1.209	3.00	0.00	0.00	0	0.00
1.44	0.01259					.005664	0.01		0.925			0.00		
1375.68	1201.00	1.165	1202.161	14.4	5.67	0.499	1202.660	0.00	1.209	3.00	0.00	0.00	0	0.00
0.32	0.01259					.004962	0.00		0.925			0.00		
1376.00	1201.00	1.209	1202.209	14.4	5.40	0.453	1202.662	0.00	1.209	3.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.002554	0.01					0.00		
1380.00	1201.10	1.660	1202.760	8.0	2.87	0.128	1202.888	0.00	1.007	2.00	0.00	0.00	0	0.00
15.90	0.00588					.001491	0.02		0.993			0.00		
1395.90	1201.19	1.577	1202.771	8.0	3.01	0.141	1202.912	0.00	1.007	2.00	0.00	0.00	0	0.00
14.16	0.00588					.001648	0.02		0.993			0.00		
1410.06	1201.28	1.503	1202.780	8.0	3.16	0.155	1202.935	0.00	1.007	2.00	0.00	0.00	0	0.00
12.73	0.00588					.001835	0.02		0.993			0.00		
1422.79	1201.35	1.436	1202.788	8.0	3.31	0.170	1202.958	0.00	1.007	2.00	0.00	0.00	0	0.00
11.48	0.00588					.002052	0.02		0.993			0.00		
1434.27	1201.42	1.375	1202.794	8.0	3.47	0.187	1202.981	0.00	1.007	2.00	0.00	0.00	0	0.00
10.69	0.00588					.002303	0.02		0.993			0.00		
1444.96	1201.48	1.318	1202.800	8.0	3.64	0.206	1203.006	0.00	1.007	2.00	0.00	0.00	0	0.00

10.15	0.00588	.002590	0.03	0.993	0.00

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1455.11	1201.54	1.264	1202.806	8.0	3.82	0.227	1203.033	0.00	1.007	2.00	0.00	0.00	0	0.00
9.22	0.00588					.002920	0.03		0.993			0.00		
1464.33	1201.60	1.214	1202.810	8.0	4.01	0.249	1203.059	0.00	1.007	2.00	0.00	0.00	0	0.00
8.55	0.00588					.003299	0.03		0.993			0.00		
1472.88	1201.65	1.167	1202.813	8.0	4.20	0.274	1203.087	0.00	1.007	2.00	0.00	0.00	0	0.00
8.17	0.00588					.003731	0.03		0.993			0.00		
1481.05	1201.69	1.122	1202.816	8.0	4.41	0.302	1203.118	0.00	1.007	2.00	0.00	0.00	0	0.00
7.73	0.00588					.004223	0.03		0.993			0.00		
1488.78	1201.74	1.079	1202.819	8.0	4.62	0.332	1203.151	0.00	1.007	2.00	0.00	0.00	0	0.00
6.23	0.00588					.004786	0.03		0.993			0.00		
1495.01	1201.78	1.039	1202.815	8.0	4.85	0.365	1203.180	0.00	1.007	2.00	0.00	0.00	0	0.00
2.84	0.00588					.005377	0.02		0.993			0.00		
1497.85	1201.79	1.007	1202.800	8.0	5.05	0.396	1203.196	0.00	1.007	2.00	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
1497.85	1201.79	0.993	1202.786	8.0	5.14	0.410	1203.196	0.00	1.007	2.00	0.00	0.00	0	0.00
12.90	0.00588					.005942	0.08		0.993			0.00		
1510.75	1201.87	0.993	1202.862	8.0	5.14	0.410	1203.272	0.00	1.007	2.00	0.00	0.00	0	0.00
5.25	0.00588					.005804	0.03		0.993			0.00		
1516.00	1201.90	1.007	1202.907	8.0	5.05	0.396	1203.303	0.00	1.007	2.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.003586	0.01					0.00		
1520.00	1202.00	1.290	1203.290	6.1	2.85	0.126	1203.416	0.00	0.874	2.00	0.00	0.00	0	0.00
17.41	0.00388					.001602	0.03		0.960			0.00		

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1537.41	1202.07	1.238	1203.305	6.1	2.99	0.138	1203.443	0.00	0.874	2.00	0.00	0.00	0	0.00
16.99	0.00388					.001806	0.03		0.960			0.00		
1554.40	1202.13	1.189	1203.322	6.1	3.13	0.152	1203.474	0.00	0.874	2.00	0.00	0.00	0	0.00
16.78	0.00388					.002041	0.03		0.960			0.00		
1571.18	1202.20	1.143	1203.341	6.1	3.28	0.167	1203.508	0.00	0.874	2.00	0.00	0.00	0	0.00
16.78	0.00388					.002311	0.04		0.960			0.00		
1587.96	1202.26	1.100	1203.363	6.1	3.44	0.184	1203.547	0.00	0.874	2.00	0.00	0.00	0	0.00
17.97	0.00388					.002620	0.05		0.960			0.00		
1605.93	1202.33	1.059	1203.392	6.1	3.61	0.203	1203.595	0.00	0.874	2.00	0.00	0.00	0	0.00
21.79	0.00388					.002970	0.06		0.960			0.00		
1627.72	1202.42	1.019	1203.437	6.1	3.79	0.223	1203.660	0.00	0.874	2.00	0.00	0.00	0	0.00
21.28	0.00388					.003319	0.07		0.960			0.00		
1649.00	1202.50	0.991	1203.491	6.1	3.93	0.240	1203.731	0.00	0.874	2.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.002688	0.01					0.00		
1653.00	1202.60	1.068	1203.668	5.1	2.99	0.139	1203.807	0.00	0.796	2.00	0.00	0.00	0	0.00
4.61	0.00783					.002020	0.01		0.713			0.00		
1657.61	1202.64	1.027	1203.663	5.1	3.13	0.153	1203.816	0.00	0.796	2.00	0.00	0.00	0	0.00
3.93	0.00783					.002293	0.01		0.713			0.00		
1661.54	1202.67	0.990	1203.657	5.1	3.29	0.168	1203.825	0.00	0.796	2.00	0.00	0.00	0	0.00
3.68	0.00783					.002605	0.01		0.713			0.00		
1665.22	1202.70	0.954	1203.650	5.1	3.45	0.185	1203.835	0.00	0.796	2.00	0.00	0.00	0	0.00

3.40	0.00783	.002960	0.01	0.713	0.00

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1668.62	1202.72	0.919	1203.641	5.1	3.62	0.203	1203.844	0.00	0.796	2.00	0.00	0.00	0	0.00
2.84	0.00783					.003370	0.01		0.713			0.00		
1671.46	1202.74	0.886	1203.630	5.1	3.80	0.224	1203.854	0.00	0.796	2.00	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
1671.46	1202.74	0.713	1203.457	5.1	5.07	0.400	1203.857	0.00	0.796	2.00	0.00	0.00	0	0.00
55.02	0.00783					.007955	0.44		0.713			0.00		
1726.48	1203.17	0.713	1203.888	5.1	5.07	0.400	1204.288	0.00	0.796	2.00	0.00	0.00	0	0.00
11.22	0.00783					.007913	0.09		0.713			0.00		
1737.70	1203.26	0.715	1203.978	5.1	5.05	0.397	1204.375	0.00	0.796	2.00	0.00	0.00	0	0.00
25.10	0.00783					.007384	0.19		0.713			0.00		
1762.80	1203.46	0.740	1204.199	5.1	4.82	0.361	1204.560	0.00	0.796	2.00	0.00	0.00	0	0.00
4.30	0.00783					.006475	0.03		0.713			0.00		
1767.10	1203.49	0.767	1204.260	5.1	4.59	0.328	1204.588	0.00	0.796	2.00	0.00	0.00	0	0.00
0.90	0.00783					.005670	0.01		0.713			0.00		
1768.00	1203.50	0.796	1204.296	5.1	4.37	0.297	1204.593	0.00	0.796	2.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.003515	0.01					0.00		
1772.00	1203.60	1.048	1204.648	3.4	2.58	0.103	1204.751	0.00	0.703	1.50	0.00	0.00	0	0.00
5.17	0.00836					.001849	0.01		0.640			0.00		
1777.17	1203.64	1.004	1204.647	3.4	2.70	0.114	1204.761	0.00	0.703	1.50	0.00	0.00	0	0.00
4.72	0.00836					.002078	0.01		0.640			0.00		
1781.89	1203.68	0.963	1204.646	3.4	2.84	0.125	1204.771	0.00	0.703	1.50	0.00	0.00	0	0.00
4.40	0.00836					.002340	0.01		0.640			0.00		

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1786.29	1203.72	0.924	1204.643	3.4	2.97	0.137	1204.780	0.00	0.703	1.50	0.00	0.00	0	0.00
3.89	0.00836					.002641	0.01		0.640			0.00		
1790.18	1203.75	0.888	1204.640	3.4	3.12	0.151	1204.791	0.00	0.703	1.50	0.00	0.00	0	0.00
3.51	0.00836					.002987	0.01		0.640			0.00		
1793.69	1203.78	0.854	1204.635	3.4	3.27	0.166	1204.801	0.00	0.703	1.50	0.00	0.00	0	0.00
3.29	0.00836					.003380	0.01		0.640			0.00		
1796.98	1203.81	0.821	1204.630	3.4	3.43	0.183	1204.813	0.00	0.703	1.50	0.00	0.00	0	0.00
2.80	0.00836					.003828	0.01		0.640			0.00		
1799.78	1203.83	0.790	1204.622	3.4	3.60	0.201	1204.823	0.00	0.703	1.50	0.00	0.00	0	0.00
1.66	0.00836					.004346	0.01		0.640			0.00		
1801.44	1203.85	0.761	1204.607	3.4	3.78	0.222	1204.829	0.00	0.703	1.50	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
1801.44	1203.85	0.640	1204.486	3.4	4.73	0.347	1204.833	0.00	0.703	1.50	0.00	0.00	0	0.00
221.79	0.00836					.008467	1.88		0.640			0.00		
2023.23	1205.70	0.640	1206.341	3.4	4.73	0.347	1206.688	0.00	0.703	1.50	0.00	0.00	0	0.00
28.74	0.00836					.008179	0.24		0.640			0.00		
2051.97	1205.94	0.652	1206.593	3.4	4.61	0.330	1206.923	0.00	0.703	1.50	0.00	0.00	0	0.00
6.30	0.00836					.007413	0.05		0.640			0.00		
2058.27	1205.99	0.676	1206.670	3.4	4.39	0.300	1206.970	0.00	0.703	1.50	0.00	0.00	0	0.00
0.73	0.00836					.006504	0.00		0.640			0.00		
2059.00	1206.00	0.703	1206.703	3.4	4.18	0.272	1206.975	0.00	0.703	1.50	0.00	0.00	0	0.00
JUNCT STR	0.02500					.003338	0.01					0.00		

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2063.00	1206.10	0.970	1207.070	1.8	1.49	0.034	1207.104	0.00	0.505	1.50	0.00	0.00	0	0.00
5.67	0.00702					.000643	0.00		0.480			0.00		
2068.67	1206.14	0.930	1207.070	1.8	1.56	0.038	1207.108	0.00	0.505	1.50	0.00	0.00	0	0.00
5.11	0.00702					.000726	0.00		0.480			0.00		
2073.78	1206.18	0.894	1207.070	1.8	1.64	0.042	1207.112	0.00	0.505	1.50	0.00	0.00	0	0.00
4.98	0.00702					.000820	0.00		0.480			0.00		
2078.76	1206.21	0.859	1207.070	1.8	1.72	0.046	1207.116	0.00	0.505	1.50	0.00	0.00	0	0.00
4.66	0.00702					.000927	0.00		0.480			0.00		
2083.42	1206.24	0.826	1207.069	1.8	1.80	0.050	1207.119	0.00	0.505	1.50	0.00	0.00	0	0.00
4.35	0.00702					.001050	0.00		0.480			0.00		
2087.77	1206.27	0.795	1207.069	1.8	1.89	0.056	1207.125	0.00	0.505	1.50	0.00	0.00	0	0.00
4.03	0.00702					.001191	0.00		0.480			0.00		
2091.80	1206.30	0.766	1207.068	1.8	1.98	0.061	1207.129	0.00	0.505	1.50	0.00	0.00	0	0.00
4.04	0.00702					.001352	0.01		0.480			0.00		
2095.84	1206.33	0.737	1207.067	1.8	2.08	0.067	1207.134	0.00	0.505	1.50	0.00	0.00	0	0.00
3.52	0.00702					.001537	0.01		0.480			0.00		
2099.36	1206.36	0.711	1207.066	1.8	2.18	0.074	1207.140	0.00	0.505	1.50	0.00	0.00	0	0.00
3.53	0.00702					.001747	0.01		0.480			0.00		
2102.89	1206.38	0.685	1207.065	1.8	2.29	0.081	1207.146	0.00	0.505	1.50	0.00	0.00	0	0.00
3.35	0.00702					.001986	0.01		0.480			0.00		
2106.24	1206.40	0.660	1207.063	1.8	2.40	0.089	1207.152	0.00	0.505	1.50	0.00	0.00	0	0.00
2.96	0.00702					.002260	0.01		0.480			0.00		

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2109.20	1206.42	0.637	1207.061	1.8	2.52	0.098	1207.159	0.00	0.505	1.50	0.00	0.00	0	0.00
2.96	0.00702					.002573	0.01		0.480			0.00		
2112.16	1206.44	0.614	1207.059	1.8	2.64	0.108	1207.167	0.00	0.505	1.50	0.00	0.00	0	0.00
2.49	0.00702					.002931	0.01		0.480			0.00		
2114.65	1206.46	0.593	1207.055	1.8	2.77	0.119	1207.174	0.00	0.505	1.50	0.00	0.00	0	0.00
2.48	0.00702					.003340	0.01		0.480			0.00		
2117.13	1206.48	0.572	1207.052	1.8	2.90	0.131	1207.183	0.00	0.505	1.50	0.00	0.00	0	0.00
2.15	0.00702					.003807	0.01		0.480			0.00		
2119.28	1206.49	0.552	1207.047	1.8	3.05	0.144	1207.191	0.00	0.505	1.50	0.00	0.00	0	0.00
1.72	0.00702					.004354	0.01		0.480			0.00		
2121.00	1206.51	0.533	1207.040	1.8	3.20	0.159	1207.199	0.00	0.505	1.50	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
2121.00	1206.51	0.480	1206.987	1.8	3.70	0.212	1207.199	0.00	0.505	1.50	0.00	0.00	0	0.00
105.28	0.00702					.006925	0.73		0.480			0.00		
2226.28	1207.25	0.480	1207.726	1.8	3.70	0.212	1207.938	0.00	0.505	1.50	0.00	0.00	0	0.00
7.01	0.00702					.006740	0.05		0.480			0.00		
2233.29	1207.30	0.486	1207.781	1.8	3.62	0.204	1207.985	0.00	0.505	1.50	0.00	0.00	0	0.00
0.71	0.00702					.006131	0.00		0.480			0.00		
2234.00	1207.30	0.505	1207.805	1.8	3.44	0.184	1207.989	0.00	0.505	1.50	0.00	0.00	0	0.00
JUNCT STR	0.02500					.003287	0.01					0.00		
2238.00	1207.40	0.644	1208.044	1.1	1.52	0.036	1208.080	0.00	0.392	1.50	0.00	0.00	0	0.00
5.10	0.00484					.000928	0.00		0.410			0.00		

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L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2243.10	1207.42	0.620	1208.045	1.1	1.59	0.039	1208.084	0.00	0.392	1.50	0.00	0.00	0	0.00
4.51	0.00484					.001057	0.00		0.410			0.00		
2247.61	1207.45	0.599	1208.046	1.1	1.67	0.043	1208.089	0.00	0.392	1.50	0.00	0.00	0	0.00
4.59	0.00484					.001205	0.01		0.410			0.00		
2252.20	1207.47	0.578	1208.047	1.1	1.75	0.048	1208.095	0.00	0.392	1.50	0.00	0.00	0	0.00
4.40	0.00484					.001374	0.01		0.410			0.00		
2256.60	1207.49	0.558	1208.048	1.1	1.84	0.052	1208.100	0.00	0.392	1.50	0.00	0.00	0	0.00
4.51	0.00484					.001566	0.01		0.410			0.00		
2261.11	1207.51	0.538	1208.050	1.1	1.93	0.058	1208.108	0.00	0.392	1.50	0.00	0.00	0	0.00
4.00	0.00484					.001786	0.01		0.410			0.00		
2265.11	1207.53	0.520	1208.051	1.1	2.02	0.063	1208.114	0.00	0.392	1.50	0.00	0.00	0	0.00
4.17	0.00484					.002038	0.01		0.410			0.00		
2269.28	1207.55	0.502	1208.053	1.1	2.12	0.070	1208.123	0.00	0.392	1.50	0.00	0.00	0	0.00
3.99	0.00484					.002326	0.01		0.410			0.00		
2273.27	1207.57	0.485	1208.056	1.1	2.22	0.077	1208.133	0.00	0.392	1.50	0.00	0.00	0	0.00
4.27	0.00484					.002654	0.01		0.410			0.00		
2277.54	1207.59	0.468	1208.059	1.1	2.33	0.084	1208.143	0.00	0.392	1.50	0.00	0.00	0	0.00
4.17	0.00484					.003030	0.01		0.410			0.00		
2281.71	1207.61	0.452	1208.064	1.1	2.44	0.093	1208.157	0.00	0.392	1.50	0.00	0.00	0	0.00
4.15	0.00484					.003461	0.01		0.410			0.00		
2285.86	1207.63	0.437	1208.069	1.1	2.56	0.102	1208.171	0.00	0.392	1.50	0.00	0.00	0	0.00
5.41	0.00484					.003953	0.02		0.410			0.00		

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2291.27	1207.66	0.422	1208.080	1.1	2.69	0.112	1208.192	0.00	0.392	1.50	0.00	0.00	0	0.00
5.44	0.00484					.004487	0.02		0.410			0.00		
2296.71	1207.68	0.410	1208.094	1.1	2.81	0.122	1208.216	0.00	0.392	1.50	0.00	0.00	0	0.00
65.29	0.00484					.004758	0.31		0.410			0.00		
2362.00	1208.00	0.410	1208.410	1.1	2.81	0.122	1208.532	0.00	0.392	1.50	0.00	0.00	0	0.00

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1000.00   .I        C            H       X                                                                .    R
1006.05   .                                                                                               .
1012.11   .                                                                                               .
1018.16   .                                                                                               .
1024.21   .                                                                                               .
1030.27   .                                                                                               .
1036.32   .                                                                                               .
1042.37   .                                                                                               .
1048.43   .                                                                                               .
1054.48   .                                                                                               .
1060.53   .        I          C            XE                                                             .    R
1066.59   .                                                                                               .
1072.64   .                                                                                               .
1078.69   .          I          C          WEH                                                            .    R
1084.75   .           I          C         WE H                                                           .    R
1090.80   .            I          C        WE  H                                                          .    R
1096.85   .             I          C       WE   H                                                          .    JX
1102.91   .              I         C        X    H                                                         .    R
1108.96   .                                                                                               .
1115.01   .                                                                                               .
1121.07   .                                                                                               .
1127.12   .                                                                                               .
1133.17   .                                                                                               .
1139.23   .                                                                                               .
1145.28   .                                                                                               .
1151.33   .                                                                                               .
1157.39   .                                                                                               .
1163.44   .               I         C       WE    H                                                         .    R
1169.49   .                                                                                               .
1175.55   .                                                                                               .
1181.60   .                                                                                               .
1187.65   .                                                                                               .
1193.71   .                                                                                               .
1199.76   .                                                                                               .
1205.81   .                                                                                               .
1211.87   .                                                                                               .
1217.92   .                I         C      WE     H                                                       .    R
1223.97   .                                                                                               .
1230.03   .                I         C      WE     H                                                       .    JX
1236.08   .                 I         C     WE      H                                                      .    R
1242.13   .                  I        C     WE       H                                                     .    R
1248.19   .                  I         C    WE       H                                                     .    R
1254.24   .                   I        C    WE        H                                                    .    R
1260.29   .                   I         C   WE        H                                                    .    R
1266.35   .                    I        C   WE         H                                                   .    R
1272.40   .                    I         C  WE         H                                                   .    R
1278.45   .                    I         C  WE         H                                                   .    R
1284.51   .                    I       W C    E        H                                                   .    R
1290.56   .                                                                                               .
1296.61   .                                                                                               .
1302.67   .                                                                                               .
1308.72   .                                                                                               .
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1314.77    .                                                                                  .
1320.83    .                          I      W C    E         H                              .    R
1326.88    .                                                                                  .
1332.93    .                                                                                  .
1338.99    .                                                                                  .
1345.04    .                                                                                  .
1351.09    .                             I      W C    E         H                            .    R
1357.15    .                                                                                  .
1363.20    .                              I       WC    E         H                           .    R
1369.25    .                               I       WC   E          H                          .    R
1375.31    .                               I        WC  E          H                          .    R
1381.36    .                               I        WC   E         H                          .    R
1387.41    .                               I         X   E         H                          .    R
1393.47    .                               I         X   E         H                          .    JX
1399.52    .                                I       C    W EH                                .    R
1405.57    .                                 I       C    WE H                               .    R
1411.63    .                                  I       C   WE  H                               .    R
1417.68    .                                                                                  .
1423.73    .                                  I       C   WE  H                               .    R
1429.79    .                                                                                  .
1435.84    .                                   I       C  WE   H                              .    R
1441.89    .                                                                                  .
1447.95    .                                   I       C  WE   H                              .    R
1454.00    .                                                                                  .
1460.05    .                                    I       C W E   H                             .    R
1466.11    .                                    I       C W E   H                             .    R
1472.16    .                                                                                  .
1478.21    .                                     I       CW E    H                            .    R
1484.27    .                                     I       CW E    H                            .    R
1490.32    .                                     I       CW  E   H                            .    R
1496.37    .                                      I       X  E    H                           .    R
1502.43    .                                      I       X  E    H                           .    R
1508.48    .                                      I       X  E    H                           .    R
1514.53    .                                      I       X   E   H                           .    R
1520.59    .                                       I       X  E    H                           .    JX
1526.64    .                                       I      C   WE   H                           .    R
1532.69    .                                                                                  .
1538.75    .                                        I      C  WE    H                          .    R
1544.80    .                                                                                  .
1550.85    .                                                                                  .
1556.91    .                                        I      C  WE    H                          .    R
1562.96    .                                                                                  .
1569.01    .                                                                                  .
1575.07    .                                         I      C WE     H                         .    R
1581.12    .                                                                                  .
1587.17    .                                                                                  .
1593.23    .                                         I       CW E     H                        .    R
1599.28    .                                                                                  .
1605.33    .                                                                                  .
1611.39    .                                          I      C WE     H                        .    R
1617.44    .                                                                                  .
1623.49    .                                                                                  .
1629.55    .                                           I      CW E     H                       .    R
1635.60    .                                                                                  .
1641.65    .                                                                                  .
1647.71    .                                                                                  .
1653.76    .                                           I      CW E     H                       .    JX
1659.81    .                                            I      C WE     H                      .    R
1665.87    .                                             I     C WE      H                     .    R
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1671.92    .                                   I     C WE      H                                  .    R
1677.97    .                                   I     C WE      H                                  .    R
1684.03    .                                   I      CWE      H                                  .    R
1690.08    .                                   I      X E      H                                  .    R
1696.13    .                                   I     WC E      H                                  .    R
1702.19    .                                                                                       .
1708.24    .                                                                                       .
1714.29    .                                                                                       .
1720.35    .                                                                                       .
1726.40    .                                                                                       .
1732.45    .                                       I     X  E      H                              .    R
1738.51    .                                       I     WC E       H                             .    R
1744.56    .                                                                                       .
1750.61    .                                                                                       .
1756.67    .                                                                                       .
1762.72    .                                                                                       .
1768.77    .                                         I     X  E      H                            .    R
1774.83    .                                         I      X E      H                            .    R
1780.88    .                                         I      X E      H                            .    JX
1786.93    .                                          I     C  X  H                                .    R
1792.99    .                                           I    C  WE  H                               .    R
1799.04    .                                           I     C WE  H                               .    R
1805.09    .                                           I     C WE  H                               .    R
1811.15    .                                           I     C WE  H                               .    R
1817.20    .                                            I    C WE   H                              .    R
1823.25    .                                            I     X E   H                              .    R
1829.31    .                                            I     X E   H                              .    R
1835.36    .                                            I     X E   H                              .    R
1841.41    .                                            I    WC E   H                              .    R
1847.47    .                                                                                       .
1853.52    .                                                                                       .
1859.57    .                                                                                       .
1865.63    .                                                                                       .
1871.68    .                                                                                       .
1877.73    .                                                                                       .
1883.79    .                                                                                       .
1889.84    .                                                                                       .
1895.89    .                                                                                       .
1901.95    .                                                                                       .
1908.00    .                                                                                       .
1914.05    .                                                                                       .
1920.11    .                                                                                       .
1926.16    .                                                                                       .
1932.21    .                                                                                       .
1938.27    .                                                                                       .
1944.32    .                                                                                       .
1950.37    .                                                                                       .
1956.43    .                                                                                       .
1962.48    .                                                                                       .
1968.53    .                                                                                       .
1974.59    .                                                                                       .
1980.64    .                                                                                       .
1986.69    .                                                                                       .
1992.75    .                                                                                       .
1998.80    .                                                                                       .
2004.85    .                                                                                       .
2010.91    .                                                                                       .
2016.96    .                                                                                       .
2023.01    .                                                                                       .
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2029.07    .                                                                                I    WC E   H                   .    R
2035.12    .                                                                                                                .
2041.17    .                                                                                                                .
2047.23    .                                                                                                                .
2053.28    .                                                                                  I    WC E   H                 .    R
2059.33    .                                                                                  I     X E   H                 .    R
2065.39    .                                                                                  I     X E   H                 .    JX
2071.44    .                                                                                   I   C   X   H                .    R
2077.49    .                                                                                    I   C  X    H               .    R
2083.55    .                                                                                    I   C  X    H               .    R
2089.60    .                                                                                    I   C  X    H               .    R
2095.65    .                                                                                    I   C  X    H               .    R
2101.71    .                                                                                     I   C X     H              .    R
2107.76    .                                                                                     I   C WE    H              .    R
2113.81    .                                                                                     I   C WE    H              .    R
2119.87    .                                                                                     I   C WE    H              .    R
2125.92    .                                                                                      I   CWE     H             .    R
2131.97    .                                                                                      I   CWE     H             .    R
2138.03    .                                                                                      I   CWE     H             .    R
2144.08    .                                                                                      I   CWE     H             .    R
2150.13    .                                                                                      I   CWE     H             .    R
2156.19    .                                                                                      I   CWE     H             .    R
2162.24    .                                                                                      I   CWE     H             .    R
2168.29    .                                                                                       I   XE      H            .    R
2174.35    .                                                                                       I  WCE      H            .    R
2180.40    .                                                                                                                .
2186.45    .                                                                                                                .
2192.51    .                                                                                                                .
2198.56    .                                                                                                                .
2204.61    .                                                                                                                .
2210.67    .                                                                                                                .
2216.72    .                                                                                                                .
2222.77    .                                                                                                                .
2228.83    .                                                                                            I   X E     H       .    R
2234.88    .                                                                                             I   XE      H      .    R
2240.93    .                                                                                             I   XE      H      .    JX
2246.99    .                                                                                              I  C X      H     .    R
2253.04    .                                                                                              I  C X      H     .    R
2259.09    .                                                                                              I  C X      H     .    R
2265.15    .                                                                                              I  C X      H     .    R
2271.20    .                                                                                              I   CX      H     .    R
2277.25    .                                                                                               I  CX       H    .    R
2283.31    .                                                                                               I  CX       H    .    R
2289.36    .                                                                                               I  CX       H    .    R
2295.41    .                                                                                               I  CWE      H    .    R
2301.47    .                                                                                               I  CWE      H    .    R
2307.52    .                                                                                               I   XE      H    .    R
2313.57    .                                                                                                I  XE       H   .    R
2319.63    .                                                                                                I  XE       H   .    R
2325.68    .                                                                                                I  XE       H   .    R
2331.73    .                                                                                                                .
2337.79    .                                                                                                                .
2343.84    .                                                                                                                .
2349.89    .                                                                                                                .
2355.95    .                                                                                                                .
2362.00    .                                                                                                  I   XE      H .    R
            .         .         .         .         .         .         .         .         .         .         .

          1197.02   1198.27   1199.52   1200.76   1202.01   1203.26   1204.51   1205.76   1207.00   1208.25   1209.50
```

N O T E S

1. GLOSSARY
   I = INVERT ELEVATION
   C = CRITICAL DEPTH
   W = WATER SURFACE ELEVATION
   H = HEIGHT OF CHANNEL
   E = ENERGY GRADE LINE
   X = CURVES CROSSING OVER
   B = BRIDGE ENTRANCE OR EXIT
   Y = WALL ENTRANCE OR EXIT
2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

DATE: 5/17/2012
TIME: 19:45

F0515P

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			2.50														
CD	2	4			2.00														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

UNIVERSITY CROSSINGS NODES 41 – 16 MIDLINE

HEADING LINE NO 2 IS -

HYDRAULIC STUDY 100 YEAR STORM

HEADING LINE NO 3 IS -

MARCH 2012

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                 1000.00 1201.98    1                                      1205.98

 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                 1087.00 1203.00    1             0.014                                 0.00   0.00    0.00     0

 ELEMENT NO   3 IS A JUNCTION          *         *     *     *                  *                   *               *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                 1091.00 1203.10    1     1     0  0.014      7.0      0.0  1203.20     0.00  90.00    0.00
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

 ELEMENT NO   4 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                 1268.00 1205.00    2             0.014                                 0.00   0.00    0.00     0

 ELEMENT NO   5 IS A JUNCTION          *         *     *     *                  *                   *               *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                 1272.00 1205.10    2     2     0  0.014      1.0      0.0  1205.20     0.00  90.00    0.00

 ELEMENT NO   6 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                 1339.00 1208.00    2             0.014                                 0.00   0.00    0.00     0

 ELEMENT NO   7 IS A JUNCTION          *         *     *     *                  *                   *               *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                 1343.00 1208.10    2     2     0  0.014      2.4      0.0  1208.20     0.00  90.00    0.00

 ELEMENT NO   8 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                 1469.00 1209.00    2             0.014                                 0.00   0.00    0.00     0

 ELEMENT NO   9 IS A SYSTEM HEADWORKS                  *                       *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                 1469.00 1209.00    2                                      1214.00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
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WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS MID-PROPERTY LINE
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1000.00	1201.98	4.000	1205.980	11.3	2.30	0.082	1206.062	0.00	1.126	2.50	0.00	0.00	0	0.00
87.00	0.01172					.000880	0.08		0.892			0.00		
1087.00	1203.00	3.057	1206.057	11.3	2.30	0.082	1206.139	0.00	1.126	2.50	0.00	0.00	0	0.00
JUNCT STR	0.02500					.000504	0.00					0.00		
1091.00	1203.10	3.099	1206.199	4.3	1.37	0.029	1206.228	0.00	0.728	2.00	0.00	0.00	0	0.00
106.58	0.01073					.000415	0.04		0.600			0.00		
1197.58	1204.24	2.000	1206.244	4.3	1.37	0.029	1206.273	0.00	0.728	2.00	0.00	0.00	0	0.00
17.59	0.01073					.000389	0.01		0.600			0.00		
1215.17	1204.43	1.814	1206.247	4.3	1.44	0.032	1206.279	0.00	0.728	2.00	0.00	0.00	0	0.00
10.12	0.01073					.000379	0.00		0.600			0.00		
1225.29	1204.54	1.706	1206.247	4.3	1.51	0.035	1206.282	0.00	0.728	2.00	0.00	0.00	0	0.00
8.18	0.01073					.000411	0.00		0.600			0.00		
1233.47	1204.63	1.618	1206.247	4.3	1.58	0.039	1206.286	0.00	0.728	2.00	0.00	0.00	0	0.00
7.21	0.01073					.000452	0.00		0.600			0.00		
1240.68	1204.71	1.540	1206.247	4.3	1.66	0.043	1206.290	0.00	0.728	2.00	0.00	0.00	0	0.00
6.43	0.01073					.000501	0.00		0.600			0.00		
1247.11	1204.78	1.470	1206.246	4.3	1.74	0.047	1206.293	0.00	0.728	2.00	0.00	0.00	0	0.00
5.83	0.01073					.000560	0.00		0.600			0.00		
1252.94	1204.84	1.406	1206.244	4.3	1.82	0.052	1206.296	0.00	0.728	2.00	0.00	0.00	0	0.00
5.42	0.01073					.000627	0.00		0.600			0.00		

1258.36	1204.90	1.346	1206.242	4.3	1.91	0.057	1206.299	0.00	0.728		2.00	0.00	0.00	0	0.00
4.92	0.01073					.000705	0.00			0.600			0.00		

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS MID-PROPERTY LINE
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
1263.28	1204.95	1.291	1206.240	4.3	2.00	0.062	1206.302	0.00	0.728	2.00	0.00	0.00	0	0.00
4.61	0.01073					.000793	0.00		0.600			0.00		
1267.89	1205.00	1.239	1206.238	4.3	2.10	0.069	1206.307	0.00	0.728	2.00	0.00	0.00	0	0.00
0.11	0.01073					.000843	0.00		0.600			0.00		
1268.00	1205.00	1.238	1206.238	4.3	2.11	0.069	1206.307	0.00	0.728	2.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.000700	0.00					0.00		
1272.00	1205.10	1.195	1206.295	3.3	1.69	0.044	1206.339	0.00	0.635	2.00	0.00	0.00	0	0.00
1.00	0.04328					.000590	0.00		0.370			0.00		
1273.00	1205.14	1.148	1206.291	3.3	1.77	0.049	1206.340	0.00	0.635	2.00	0.00	0.00	0	0.00
0.92	0.04328					.000667	0.00		0.370			0.00		
1273.92	1205.18	1.104	1206.287	3.3	1.85	0.053	1206.340	0.00	0.635	2.00	0.00	0.00	0	0.00
0.83	0.04328					.000755	0.00		0.370			0.00		
1274.75	1205.22	1.063	1206.282	3.3	1.94	0.059	1206.341	0.00	0.635	2.00	0.00	0.00	0	0.00
0.81	0.04328					.000857	0.00		0.370			0.00		
1275.56	1205.25	1.023	1206.277	3.3	2.04	0.065	1206.342	0.00	0.635	2.00	0.00	0.00	0	0.00
0.19	0.04328					.000973	0.00		0.370			0.00		
1275.75	1205.26	0.986	1206.248	3.3	2.14	0.071	1206.319	0.00	0.635	2.00	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
1275.75	1205.26	0.371	1205.633	3.3	8.21	1.046	1206.679	0.00	0.635	2.00	0.00	0.00	0	0.00
31.90	0.04328					.041235	1.32		0.370			0.00		

1307.65	1206.64	0.381	1207.024	3.3	7.88	0.963	1207.987	0.00	0.635		2.00	0.00	0.00	0	0.00
10.76	0.04328					.036335	0.39			0.370			0.00		

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS MID-PROPERTY LINE
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1318.41	1207.11	0.394	1207.503	3.3	7.52	0.877	1208.380	0.00	0.635	2.00	0.00	0.00	0	0.00
5.71	0.04328					.031769	0.18		0.370			0.00		
1324.12	1207.36	0.408	1207.764	3.3	7.17	0.799	1208.563	0.00	0.635	2.00	0.00	0.00	0	0.00
3.77	0.04328					.027781	0.10		0.370			0.00		
1327.89	1207.52	0.422	1207.941	3.3	6.83	0.725	1208.666	0.00	0.635	2.00	0.00	0.00	0	0.00
2.73	0.04328					.024276	0.07		0.370			0.00		
1330.62	1207.64	0.436	1208.073	3.3	6.52	0.660	1208.733	0.00	0.635	2.00	0.00	0.00	0	0.00
2.04	0.04328					.021215	0.04		0.370			0.00		
1332.66	1207.73	0.451	1208.177	3.3	6.21	0.600	1208.777	0.00	0.635	2.00	0.00	0.00	0	0.00
1.59	0.04328					.018542	0.03		0.370			0.00		
1334.25	1207.80	0.466	1208.261	3.3	5.92	0.545	1208.806	0.00	0.635	2.00	0.00	0.00	0	0.00
1.24	0.04328					.016206	0.02		0.370			0.00		
1335.49	1207.85	0.482	1208.330	3.3	5.65	0.496	1208.826	0.00	0.635	2.00	0.00	0.00	0	0.00
0.97	0.04328					.014177	0.01		0.370			0.00		
1336.46	1207.89	0.499	1208.389	3.3	5.38	0.450	1208.839	0.00	0.635	2.00	0.00	0.00	0	0.00
0.77	0.04328					.012401	0.01		0.370			0.00		
1337.23	1207.92	0.516	1208.439	3.3	5.13	0.409	1208.848	0.00	0.635	2.00	0.00	0.00	0	0.00
0.59	0.04328					.010847	0.01		0.370			0.00		
1337.82	1207.95	0.534	1208.483	3.3	4.90	0.372	1208.855	0.00	0.635	2.00	0.00	0.00	0	0.00

0.47	0.04328					.009489	0.00			0.370			0.00		
1338.29	1207.97	0.552	1208.521	3.3	4.67	0.338	1208.859	0.00	0.635		2.00	0.00	0.00	0	0.00
0.34	0.04328					.008299	0.00			0.370			0.00		

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS MID-PROPERTY LINE
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1338.63	1207.98	0.571	1208.555	3.3	4.45	0.307	1208.862	0.00	0.635	2.00	0.00	0.00	0	0.00
0.22	0.04328					.007262	0.00		0.370			0.00		
1338.85	1207.99	0.591	1208.584	3.3	4.24	0.279	1208.863	0.00	0.635	2.00	0.00	0.00	0	0.00
0.12	0.04328					.006359	0.00		0.370			0.00		
1338.97	1208.00	0.612	1208.611	3.3	4.04	0.254	1208.865	0.00	0.635	2.00	0.00	0.00	0	0.00
0.03	0.04328					.005555	0.00		0.370			0.00		
1339.00	1208.00	0.635	1208.635	3.3	3.85	0.230	1208.865	0.00	0.635	2.00	0.00	0.00	0	0.00
JUNCT STR	0.02500					.002642	0.01					0.00		
1343.00	1208.10	0.887	1208.987	0.9	0.67	0.007	1208.994	0.00	0.326	2.00	0.00	0.00	0	0.00
4.41	0.00714					.000119	0.00		0.300			0.00		
1347.41	1208.13	0.855	1208.987	0.9	0.70	0.008	1208.995	0.00	0.326	2.00	0.00	0.00	0	0.00
4.17	0.00714					.000136	0.00		0.300			0.00		
1351.58	1208.16	0.825	1208.986	0.9	0.74	0.008	1208.994	0.00	0.326	2.00	0.00	0.00	0	0.00
4.03	0.00714					.000155	0.00		0.300			0.00		
1355.61	1208.19	0.796	1208.986	0.9	0.77	0.009	1208.995	0.00	0.326	2.00	0.00	0.00	0	0.00
3.89	0.00714					.000177	0.00		0.300			0.00		
1359.50	1208.22	0.768	1208.986	0.9	0.81	0.010	1208.996	0.00	0.326	2.00	0.00	0.00	0	0.00
3.74	0.00714					.000201	0.00		0.300			0.00		
1363.24	1208.24	0.741	1208.986	0.9	0.85	0.011	1208.997	0.00	0.326	2.00	0.00	0.00	0	0.00
3.60	0.00714					.000229	0.00		0.300			0.00		

1366.84	1208.27	0.715	1208.985	0.9	0.89	0.012	1208.997	0.00	0.326		2.00	0.00	0.00	0	0.00
3.31	0.00714					.000261	0.00			0.300			0.00		

WATER SURFACE PROFILE LISTING

UNIVERSITY CROSSINGS MID-PROPERTY LINE
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1370.15	1208.29	0.691	1208.985	0.9	0.93	0.014	1208.999	0.00	0.326	2.00	0.00	0.00	0	0.00
3.31	0.00714					.000298	0.00		0.300			0.00		
1373.46	1208.32	0.667	1208.985	0.9	0.98	0.015	1209.000	0.00	0.326	2.00	0.00	0.00	0	0.00
3.16	0.00714					.000340	0.00		0.300			0.00		
1376.62	1208.34	0.644	1208.984	0.9	1.03	0.016	1209.000	0.00	0.326	2.00	0.00	0.00	0	0.00
3.01	0.00714					.000388	0.00		0.300			0.00		
1379.63	1208.36	0.622	1208.984	0.9	1.08	0.018	1209.002	0.00	0.326	2.00	0.00	0.00	0	0.00
2.87	0.00714					.000443	0.00		0.300			0.00		
1382.50	1208.38	0.601	1208.983	0.9	1.13	0.020	1209.003	0.00	0.326	2.00	0.00	0.00	0	0.00
2.71	0.00714					.000506	0.00		0.300			0.00		
1385.21	1208.40	0.581	1208.983	0.9	1.19	0.022	1209.005	0.00	0.326	2.00	0.00	0.00	0	0.00
2.56	0.00714					.000579	0.00		0.300			0.00		
1387.77	1208.42	0.562	1208.982	0.9	1.24	0.024	1209.006	0.00	0.326	2.00	0.00	0.00	0	0.00
2.57	0.00714					.000661	0.00		0.300			0.00		
1390.34	1208.44	0.543	1208.981	0.9	1.30	0.026	1209.007	0.00	0.326	2.00	0.00	0.00	0	0.00
2.40	0.00714					.000755	0.00		0.300			0.00		
1392.74	1208.45	0.525	1208.980	0.9	1.37	0.029	1209.009	0.00	0.326	2.00	0.00	0.00	0	0.00
2.40	0.00714					.000864	0.00		0.300			0.00		
1395.14	1208.47	0.507	1208.979	0.9	1.44	0.032	1209.011	0.00	0.326	2.00	0.00	0.00	0	0.00

2.25	0.00714					.000987	0.00			0.300			0.00		
1397.39	1208.49	0.490	1208.978	0.9	1.51	0.035	1209.013	0.00	0.326		2.00	0.00	0.00	0	0.00
2.07	0.00714					.001128	0.00			0.300			0.00		

WATER SURFACE PROFILE LISTING

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MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1399.46	1208.50	0.474	1208.977	0.9	1.58	0.039	1209.016	0.00	0.326		2.00	0.00	0.00	0	0.00
2.08	0.00714					.001290	0.00			0.300			0.00		
1401.54	1208.52	0.458	1208.976	0.9	1.65	0.043	1209.019	0.00	0.326		2.00	0.00	0.00	0	0.00
1.89	0.00714					.001476	0.00			0.300			0.00		
1403.43	1208.53	0.443	1208.975	0.9	1.73	0.047	1209.022	0.00	0.326		2.00	0.00	0.00	0	0.00
1.71	0.00714					.001690	0.00			0.300			0.00		
1405.14	1208.54	0.429	1208.973	0.9	1.82	0.052	1209.025	0.00	0.326		2.00	0.00	0.00	0	0.00
1.89	0.00714					.001932	0.00			0.300			0.00		
1407.03	1208.56	0.414	1208.971	0.9	1.91	0.057	1209.028	0.00	0.326		2.00	0.00	0.00	0	0.00
1.49	0.00714					.002211	0.00			0.300			0.00		
1408.52	1208.57	0.401	1208.969	0.9	2.00	0.062	1209.031	0.00	0.326		2.00	0.00	0.00	0	0.00
1.47	0.00714					.002531	0.00			0.300			0.00		
1409.99	1208.58	0.388	1208.966	0.9	2.10	0.068	1209.034	0.00	0.326		2.00	0.00	0.00	0	0.00
1.45	0.00714					.002896	0.00			0.300			0.00		
1411.44	1208.59	0.375	1208.964	0.9	2.20	0.075	1209.039	0.00	0.326		2.00	0.00	0.00	0	0.00
1.16	0.00714					.003315	0.00			0.300			0.00		
1412.60	1208.60	0.363	1208.960	0.9	2.31	0.083	1209.043	0.00	0.326		2.00	0.00	0.00	0	0.00
1.11	0.00714					.003808	0.00			0.300			0.00		
1413.71	1208.61	0.351	1208.956	0.9	2.43	0.091	1209.047	0.00	0.326		2.00	0.00	0.00	0	0.00
HYDRAULIC JUMP													0.00		

1413.71	1208.61	0.300	1208.905	0.9	3.05	0.145	1209.050	0.00	0.326		2.00	0.00	0.00	0	0.00
41.60	0.00714					.007769	0.32			0.300			0.00		

WATER SURFACE PROFILE LISTING

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MARCH 2012

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1455.31	1208.90	0.300	1209.202	0.9	3.05	0.145	1209.347	0.00	0.326	2.00	0.00	0.00	0	0.00
4.24	0.00714					.007546	0.03		0.300			0.00		
1459.55	1208.93	0.304	1209.236	0.9	2.98	0.138	1209.374	0.00	0.326	2.00	0.00	0.00	0	0.00
9.00	0.00714					.006857	0.06		0.300			0.00		
1468.55	1209.00	0.314	1209.311	0.9	2.85	0.126	1209.437	0.00	0.326	2.00	0.00	0.00	0	0.00
0.45	0.00714					.005954	0.00		0.300			0.00		
1469.00	1209.00	0.326	1209.326	0.9	2.70	0.113	1209.439	0.00	0.326	2.00	0.00	0.00	0	0.00

UNIVERSITY CROSSINGS MID-PROPERTY LINE
HYDRAULIC STUDY 100 YEAR STORM
MARCH 2012

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            .         .         .         .         .         .         .         .         .         .
1000.00    .I          C              H                WE                                                .    R
1003.37    .                                                                                           .
1006.75    .                                                                                           .
1010.12    .                                                                                           .
1013.50    .                                                                                           .
1016.87    .                                                                                           .
1020.24    .                                                                                           .
1023.62    .                                                                                           .
1026.99    .                                                                                           .
1030.37    .                                                                                           .
1033.74    .                                                                                           .
1037.12    .                                                                                           .
1040.49    .                                                                                           .
1043.86    .                                                                                           .
1047.24    .                                                                                           .
1050.61    .                                                                                           .
1053.99    .                                                                                           .
1057.36    .                                                                                           .
1060.73    .                                                                                           .
1064.11    .                                                                                           .
1067.48    .                                                                                           .
1070.86    .                                                                                           .
1074.23    .                                                                                           .
1077.60    .                                                                                           .
1080.98    .                                                                                           .
1084.35    .                                                                                           .
1087.73    .           I           C               H     WE                                            .    JX
1091.10    .            I       C             H           WE                                            .    R
1094.47    .                                                                                           .
1097.85    .                                                                                           .
1101.22    .                                                                                           .
1104.60    .                                                                                           .
1107.97    .                                                                                           .
1111.35    .                                                                                           .
1114.72    .                                                                                           .
1118.09    .                                                                                           .
1121.47    .                                                                                           .
1124.84    .                                                                                           .
1128.22    .                                                                                           .
1131.59    .                                                                                           .
1134.96    .                                                                                           .
1138.34    .                                                                                           .
1141.71    .                                                                                           .
1145.09    .                                                                                           .
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1148.46    .                                                                  .
1151.83    .                                                                  .
1155.21    .                                                                  .
1158.58    .                                                                  .
1161.96    .                                                                  .
1165.33    .                                                                  .
1168.71    .                                                                  .
1172.08    .                                                                  .
1175.45    .                                                                  .
1178.83    .                                                                  .
1182.20    .                                                                  .
1185.58    .                                                                  .
1188.95    .                                                                  .
1192.32    .                                                                  .
1195.70    .                                                                  .
1199.07    .                        I       C            X                    .    R
1202.45    .                                                                  .
1205.82    .                                                                  .
1209.19    .                                                                  .
1212.57    .                                                                  .
1215.94    .                          I       C          X H                  .    R
1219.32    .                                                                  .
1222.69    .                                                                  .
1226.06    .                           I       C         X  H                 .    R
1229.44    .                                                                  .
1232.81    .                                                                  .
1236.19    .                            I       C        X   H                .    R
1239.56    .                                                                  .
1242.94    .                             I       C       X    H               .    R
1246.31    .                                                                  .
1249.68    .                              I       C      X     H              .    R
1253.06    .                              I       C      X     H              .    R
1256.43    .                                                                  .
1259.81    .                               I       C     X      H             .    R
1263.18    .                                                                  .
1266.55    .                               I       C     X       H            .    R
1269.93    .                                I       C    X       H            .    R
1273.30    .                                I       C    X       H            .    JX
1276.68    .                                 I      C    WE       H           .    R
1280.05    .                                  I      C   WE        H          .    R
1283.42    .                                  I      C   WE        H          .    R
1286.80    .                                  I      C   WE         H         .    R
1290.17    .                                   I      C  WE         H         .    R
1293.55    .                                   I      C  WE         H         .    R
1296.92    .                                   I   W  C       E     H         .    R
1300.29    .                                                                  .
1303.67    .                                                                  .
1307.04    .                                                                  .
1310.42    .                                           I   W  C       E      H .    R
1313.79    .                                                                  .
1317.17    .                                                                  .
1320.54    .                                                I    W C      E        H .    R
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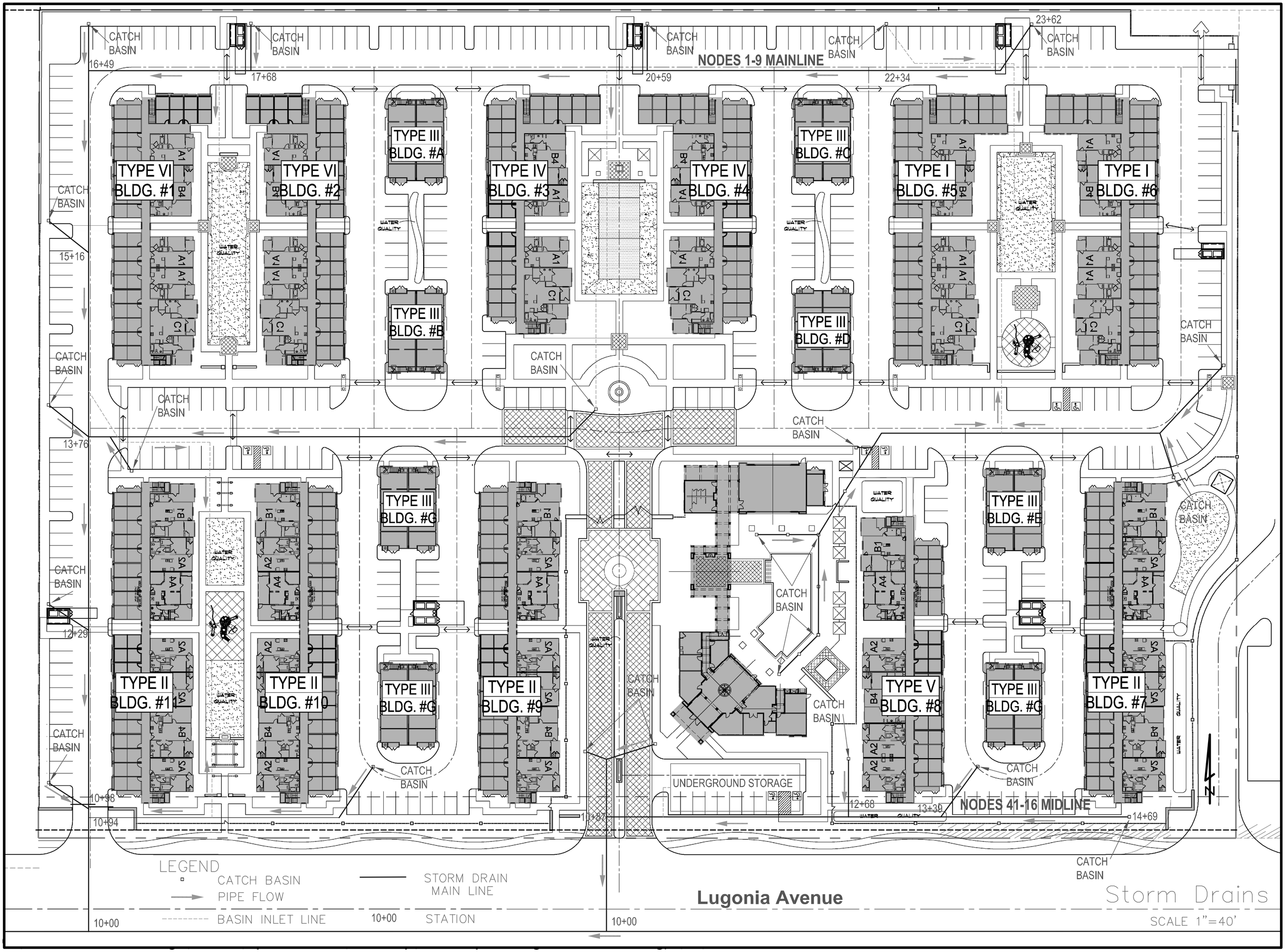
N O T E S

1. GLOSSARY

I = INVERT ELEVATION
C = CRITICAL DEPTH
W = WATER SURFACE ELEVATION
H = HEIGHT OF CHANNEL
E = ENERGY GRADE LINE
X = CURVES CROSSING OVER
B = BRIDGE ENTRANCE OR EXIT
Y = WALL ENTRANCE OR EXIT

2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY


NODES 1-9 MAINLINE
NODES 41-16 MIDLINE
TYPE VI BLDG. #1
TYPE VI BLDG. #2
TYPE III BLDG. #A
TYPE III BLDG. #B
TYPE IV BLDG. #3
TYPE IV BLDG. #4
TYPE III BLDG. #C
TYPE III BLDG. #D
TYPE I BLDG. #5
TYPE I BLDG. #6
TYPE II BLDG. #11
TYPE II BLDG. #10
TYPE III BLDG. #G
TYPE II BLDG. #9
TYPE III BLDG. #G
TYPE V BLDG. #8
TYPE III BLDG. #E
TYPE III BLDG. #G
TYPE II BLDG. #7
UNDERGROUND STORAGE
WATER QUALITY
CATCH BASIN
16+49
17+68
20+59
22+34
23+62
15+16
13+76
12+29
10+98
10+94
10+87
12+68
13+39
14+69
LEGEND
CATCH BASIN
PIPE FLOW
BASIN INLET LINE
STORM DRAIN MAIN LINE
STATION
Lugonia Avenue
Storm Drains
SCALE 1"=40'