Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

ENGINEER

RICK ENGINEERING COMPANY

McDowell Mountain Marketplace – Lot 2
SWC Bell Rd & Thompson Peak Pkwy
December 19, 2017

BASIS OF DESIGN REPORT FOR WATER

McDowell Mountain Marketplace – Lot 2

OWNER: MULLIN360BUILD
16679 North 90th Street, Suite 102
Scottsdale, Arizona 85260
John L. McCauley
Phone (602) 430-4603

CONTACT: RICK ENGINEERING COMPANY
6150 North 16th Street
Phoenix, Arizona 85016
Joseph M. Cirone, P.E.
Phone: (602) 957-3350

Registered Professional Engineer (Civil) CERTIFICATE NO. 40968 JOSEPH M. CIRONE 12.19.17 Date Signed ARIZONA, U.S.A.

Expires: 6-30-2019

Accepted For:
City of Scottsdale
Water Resources Department
9379 E. San Salvador
Scottsdale, Arizona
By: R. SACKS
Date: 12/28/17

PROJECT DESCRIPTION:

The proposed development is located at the southwest corner (SWC) of Bell Road and Thompson Peak Parkway within the McDowell Mountain Marketplace, City of Scottsdale, AZ. The development will consist of a gray shell, 5-tenant building, with appurtenant facilities. Pursuant to City of Scottsdale requirements, the building will be equipped with potable water in sufficient volume and pressure for domestic use and fire protection. The proposed water distribution network will include a 2-inch domestic service[8], a 3/4-inch landscape meter, and a 4-inch fire line.

The 2-inch domestic service will connect to an existing 8-inch DIP located within the adjacent drive aisle. The proposed 4-inch fire line will connect to an existing 4-inch DIP stub located near the northeast corner of the pad. The existing McDowell Mountain Marketplace water distribution system ties into existing facilities in 100th street to the west of the shopping center, 8-inch DIP, and in Thompson Peak Parkway to the east of the site, 16-inch pipe of unknown material.

The ensuing water demand and production criteria are indicative of tenant mixes for similar shell buildings within the McDowell Mountain Marketplace and are subject to change.

WATER DEMAND AND PRODUCTION CRITERIA	
Tenant 1:	Retail (1,580-gsf)
Tenant 2:	Retail (5,500-gsf)
Tenant 3:	Retail (3,000-gsf)
Tenant 4:	Retail (1,800-gsf)
Tenant 5:	Retail (2,400-gsf)
Property Area:	Lot 2 (65,296-sf) | Gray Shell (14,280-gsf)
Shell Building:	14,280-gsf
Average Day Demand:	0.8-gpd per sf Commercial/Retail[1]
Maximum Day Demand:	2 x Average Day Demand Commercial/Retail[2]
Normal Daily Operating Conditions Demand:	31.3 gallons/minute[3,4]
Minimum Maximum Day plus Fire Flow Demand:	1,500 - Commercial/Retail[5]
Fire Flow Demand:	3,250 gallons/minute[6,7]
Building Construction Type:	V-B

43-DR-2017
12/20/17

WATER DESIGN FLOWS

$$\textbf{Average Day Demand (Commercial/Retail)} = 0.8\ \frac{\text{gpd}}{\text{sf}}(14{,}280\text{sf}) = 11{,}424\ \text{gpd} = 7.9\ \text{gpm}$$

$$\textbf{Maximum Day Demand (Commercial/Retail)} = 2(11{,}424\ \text{gpd}) = 22{,}848\ \text{gpd} = 15.9\ \text{gpm}$$

$$\textbf{Normal Daily Operating Conditions Demand} = 39.1\ \text{gpm}$$

$$\textbf{Fire Flow} = (3{,}250\ \text{gpm})(1 - 0.75) = 812.5\ \text{gpm}$$

$$\textbf{Minimum Fire Flow} = 1{,}500\ \text{gpm}$$

$$\textbf{Maximum Day + FF Demand} = (15.9\ \text{gpm}) + (1{,}500\ \text{gpm}) = 1{,}515.9\ \text{gpm}$$

[1] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 6 - Water; Section 6-1, Figure 6.1-2.
[2] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 6 - Water; Section 6-1.404.
[2a] Source: California Department of Water Resources. Urban Water Management Plan. Chapter 5; Section 5.1.3.
[3] Water supply fixture calculations Attachment 2.
[4] Fixture calculations per IPC 2015, Appendix E.
[5] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 6 - Water; Section 6-1.501
[6] Source: International Fire Code 2015; Appendix B, Table B105.1 (Building Construction Type V-B).
[7] A reduction in required fire-flow of 75 percent, as approved, is allowed when the building is equipped with an approved automatic sprinkler systems.
[8] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 6 - Water; Section 6-1.416, Figure 6.1-4.

FIRE FLOW TEST

A fire flow test, dated 10/17/2017 was performed by AZ Flow Testing LLC on two existing hydrants located within the McDowell Mountain Marketplace Plaza. A 10% factor of safety was applied to the flow test data which includes a static pressure of 61.2-psi, a residual pressure of 55.2-psi and an available flow of 4.122-gpm at 20-psi. See Attachment 1 for fire hydrant flow test results.

SUMMARY

The water distribution system is designed to (1) maintain 50-120 pounds per square inch of pressure under normal daily operating conditions, (2) maintain a pressure greater than 30 pounds per square inch while supplying the maximum day plus fire flow condition, and (3) not exceed a maximum allowable pipe headloss of 10-ft/1000-ft for distribution lines. The Normal Daily Operating Conditions Demand of 39.1-gpm does not exceed the City of Scottsdale recommended maximum capacity of 80-gpm[8] for a 2-inch domestic service meter.

ATTACHMENTS

Attachment 1 – Fire Flow Test
Attachment 2 –IPC 2015 Appendix E, Table 103.3(3)
–Water Supply Fixture Calculations
Attachment 3 – Preliminary Grading and Drainage Plan (with water and sewer)

ATTACHMENT 1

Fire Flow Test

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	McDowell Mountain Marketplace, Lot 2
Project Address:	Bell Rd. & Thompson Peak Pkwy., (SWC), Scottsdale, Arizona 85255
Client Project No.:	4893-0
Arizona Flow Testing Project No.:	17224
Flow Test Permit No.:	C54037
Date and time flow test conducted:	October 17, 2017 at 8:30 AM
Data is current and reliable until:	April 17, 2018
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Witnessed by:	Larry Frandle –City of Scottsdale-Inspector (602-828-0847)

Raw Test Data

Static Pressure: **68.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **62.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **15.0 PSI**
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One (4 inch)
(Measured in inches)

Coefficient of Diffuser: .7875 Hose Monster

Flowing GPM: **1,456 GPM**
(Measured in gallons per minute)

GPM @ 20 PSI: **4,476 GPM**

Data with 10 % Safety Factor

Static Pressure: **61.2 PSI**
(Measured in pounds per square inch)

Residual Pressure: **55.2 PSI**
(Measured in pounds per square inch)

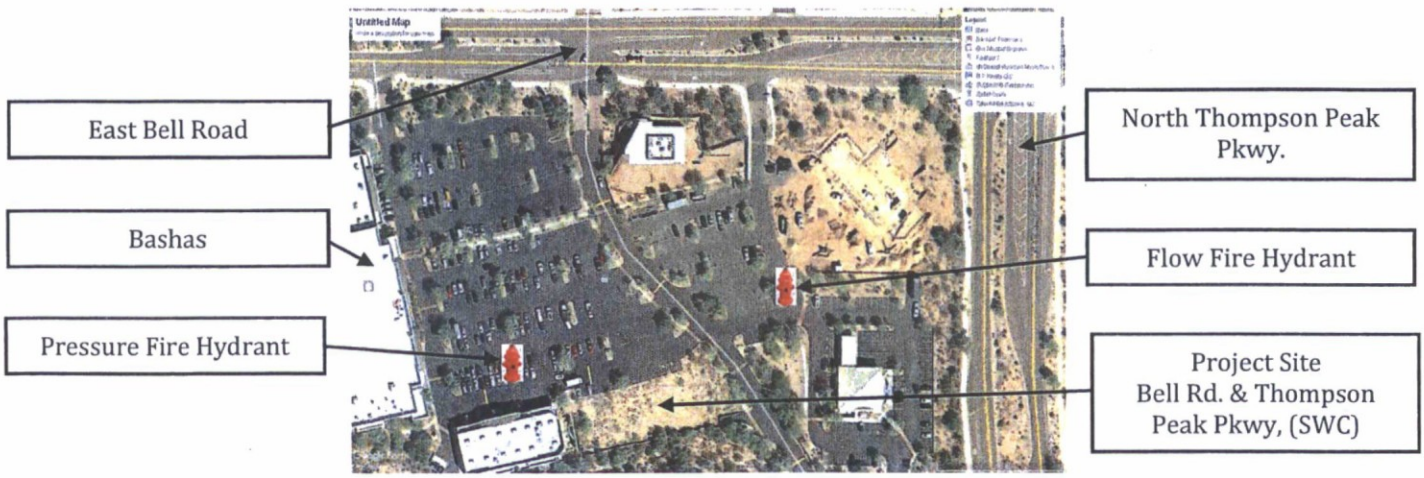
Distance between hydrants: Approx. 450 Feet

Main size: Not Provided

Flowing GPM: **1,456 GPM**

GPM @ 20 PSI: **4,122 GPM**

Flow Test Location North



ATTACHMENT 2

IPC 2015 Appendix E, Table 103.3(3)
Water Supply Fixtures Calculations

TABLE E103.3(3)
TABLE FOR ESTIMATING DEMAND

SUPPLY SYSTEMS PREDOMINANTLY FOR FLUSH TANKS			SUPPLY SYSTEMS PREDOMINANTLY FOR FLUSH VALVES		
Load	Demand		Load	Demand	
(Water supply fixture units)	(Gallons per minute)	(Cubic feet per minute)	(Water supply fixture units)	(Gallons per minute)	(Cubic feet per minute)
1	3.0	0.04104	—	—	—
2	5.0	0.0684	—	—	—
3	6.5	0.86892	—	—	—
4	8.0	1.06944	—	—	—
5	9.4	1.256592	5	15.0	2.0052
6	10.7	1.430376	6	17.4	2.326032
7	11.8	1.577424	7	19.8	2.646364
8	12.8	1.711104	8	22.2	2.967696
9	13.7	1.831416	9	24.6	3.288528
10	14.6	1.951728	10	27.0	3.60936
11	15.4	2.058672	11	27.8	3.716304
12	16.0	2.13888	12	28.6	3.823248
13	16.5	2.20572	13	29.4	3.930192
14	17.0	2.27256	14	30.2	4.037136
15	17.5	2.3394	15	31.0	4.14408
16	18.0	2.90624	16	31.8	4.241024
17	18.4	2.459712	17	32.6	4.357968
18	18.8	2.513184	18	33.4	4.464912
19	19.2	2.566656	19	34.2	4.571856
20	19.6	2.620128	20	35.0	4.6788
25	21.5	2.87412	25	38.0	5.07984
30	23.3	3.114744	30	42.0	5.61356
35	24.9	3.328632	35	44.0	5.88192
40	26.3	3.515784	40	46.0	6.14928
45	27.7	3.702936	45	48.0	6.41664
50	29.1	3.890088	50	50.0	6.684
60	32.0	4.27776	60	54.0	7.21872
70	35.0	4.6788	70	58.0	7.75344
80	38.0	5.07984	80	61.2	8.181216
90	41.0	5.48088	90	64.3	8.595624
100	43.5	5.81508	100	67.5	9.0234
120	48.0	6.41664	120	73.0	9.75864
140	52.5	7.0182	140	77.0	10.29336
160	57.0	7.61976	160	81.0	10.82808
180	61.0	8.15448	180	85.5	11.42964
200	65.0	8.6892	200	90.0	12.0312
225	70.0	9.3576	225	95.5	12.76644
250	75.0	10.026	250	101.0	13.50168

WSFU=47.5

(continued)

WATER SUPPLY FIXTURE UNITS TABULATION						
Tenant 1						
Water Closet	1	x	5.0	=	5.0	
Lavatory	1	x	2.0	=	2.0	
Sink	1	x	2.0	=	2.0	
Drinking Fountain	2	x	0.25	=	0.5	9.5
Tenant 2						
Water Closet	1	x	5.0	=	5.0	
Lavatory	1	x	2.0	=	2.0	
Sink	1	x	2.0	=	2.0	
Drinking Fountain	2	x	0.25	=	0.5	9.5
Tenant 3						
Water Closet	1	x	5.0	=	5.0	
Lavatory	1	x	2.0	=	2.0	
Sink	1	x	2.0	=	2.0	
Drinking Fountain	2	x	0.25	=	0.5	9.5
Tenant 4						
Water Closet	1	x	5.0	=	5.0	
Lavatory	1	x	2.0	=	2.0	
Sink	1	x	2.0	=	2.0	
Drinking Fountain	2	x	0.25	=	0.5	9.5
Tenant 5						
Water Closet	1	x	5.0	=	5.0	
Lavatory	1	x	2.0	=	2.0	
Sink	1	x	2.0	=	2.0	
Drinking Fountain	2	x	0.25	=	0.5	9.5
Water Supply Fixture Units (wsfu)						**47.5**
Water Supply Fixture Demand (gpm)						**29.1**
Additional GPM Demand						
Hose Bibb	2	x	5.0	=	10.0	10.0
Total Design Demand (gpm)						**39.1**

Note: This is a gray shell building; fixture counts as shown are estimates based upon proposed tenant uses. These calculations have been prepared in support of the Water Basis of Design (BOD) Memorandum.

ATTACHMENT 3

Preliminary Grading and Drainage Plan (with Water & Sewer)

ENGINEER

RICK ENGINEERING COMPANY

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SWC Bell Rd & Thompson Peak Pkwy
December 19, 2017

BASIS OF DESIGN REPORT FOR WATER

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OWNER: MULLIN360BUILD
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Registered Professional Engineer (Civil) CERTIFICATE NO. 40968 JOSEPH M. CIRONE 12.19.17 Date Signed ARIZONA, U.S.A.

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9379 E. San Salvador
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Maximum Day Demand:	2 x Average Day Demand Commercial/Retail[2]
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Building Construction Type:	V-B

43-DR-2017
12/20/17

WATER DESIGN FLOWS

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$$\textbf{Maximum Day + FF Demand} = (15.9\ \textbf{gpm}) + (1{,}500\ \textbf{gpm}) = 1{,}515.9\ \textbf{gpm}$$

[1] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 6 - Water; Section 6-1, Figure 6.1-2.
[2] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 6 - Water; Section 6-1.404.
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SUMMARY

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ATTACHMENTS

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Attachment 2 –IPC 2015 Appendix E, Table 103.3(3)
–Water Supply Fixture Calculations
Attachment 3 – Preliminary Grading and Drainage Plan (with water and sewer)

PRELIMINARY GRADING & DRAINAGE PLAN
FOR:
LOT 2; MCDOWELL MOUNTAIN MARKETPLACE

OF A PORTION OF THE NORTHEAST QUARTER OF SECTION 5, TOWNSHIP 3 NORTH, RANGE 5 EAST OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA.

LEGEND

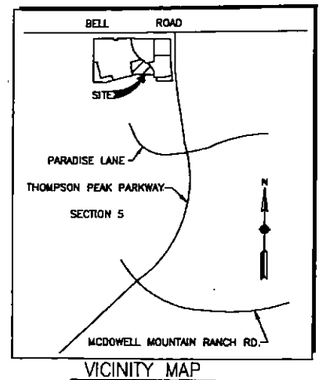
	EXISTING	PROPOSED
TRACT BOUNDARY		
PROPERTY LINE		
RIGHT-OF-WAY		
CENTERLINE		
CURB		
CURB & GUTTER		
FENCE-WOOD	-o-o-o-	-o-o-o-
EASEMENT		
WATER LINE	W	W
FIRE SERVICE	FS	FS
SANITARY SEWER LINE	S	S
GAS LINE	G	G
ELECTRIC LINE	E	E
FIBER OPTICS	FO	FO
TELEPHONE	T	T
FIRE HYDRANT	FH	
WATER VALVE		
FIRE DEPARTMENT CONNECTION		
BENCHMARK		
WATER METER	WM	WM
SEWER MANHOLE		S
YARD DRAIN		
PAVEMENT ELEVATION	*P:60.43	*P:60.43
NATURAL GROUND ELEVATION	*NG:60.43	*NG:60.43
CONCRETE ELEVATION	*C:60.43	*C:60.43
TOP OF CURB ELEVATION	*TC:60.50	*TC:60.50
GUTTER ELEVATION	*G:60.00	*G:60.00
FLOW ARROW		
STORM DRAIN		
CONTOUR LINE	20	20

FLOOD INSURANCE RATE MAP (FIRM) INFORMATION:

COMMUNITY NUMBER	PANEL - PANEL DATE	SUFFIX	DATE OF FIRM (INDEX DATE)	FIRM ZONE	BASE FLOOD ELEVATION (N AO ZONE, USE DEPTH)
045012	1340 10/16/13	L	10/16/13	X	AVERAGE DEPTH LESS THAN 1 FOOT

ENGINEER'S CERTIFICATION:

THE LOWEST FINISH FLOOR ELEVATION(S) AND/OR FLOOD PROOFING ELEVATION(S) ON THIS PLAN ARE SUFFICIENTLY HIGH TO PROVIDE PROTECTION FROM FLOODING CAUSED BY A 100-YEAR STORM, AND ARE IN ACCORDANCE WITH SCOTTSDALE REVISED CODE, CHAPTER 37 - FLOOD PLAIN AND STORMWATER REGULATION.



VICINITY MAP
N.T.S.

CLIENT:

MULLIN 360 BUILD
16879 N 90TH STREET, SUITE 102
SCOTTSDALE, ARIZONA 85260
CONTACT: JOHN L. McCAULEY
PHONE: (602) 430-4603
EMAIL: JMCCAULEY@MULLIN360.COM

ARCHITECT:

CIRCLE WEST ARCHITECTS
4148 N ARCADIA DR.
PHOENIX, ARIZONA 85018
CONTACT: NATHAN MOYERS
PHONE: (602) 889-2314
EMAIL: NATHAN@CIRCLEWEST.NET

ENGINEER:

RICK ENGINEERING COMPANY
6150 N 16TH STREET
PHOENIX, ARIZONA 85016
CONTACT: JOSEPH M. CIRONE, PE
PHONE: (602) 957-3350
EMAIL: JCIRONE@RICKENGINEERING.COM

ADDRESS:

16854 N. THOMPSON PEAK PARKWAY
SCOTTSDALE, ARIZONA, 85260

APN:

217-14-986

LEGAL DESCRIPTION:

PARCEL NO. 1:
LOT 2, OF MCDOWELL MOUNTAIN MARKETPLACE, ACCORDING TO BOOK 767 OF MAPS, PAGE 37, RECORDS OF MARICOPA COUNTY, ARIZONA.

BENCHMARK:

FOUND CITY OF SCOTTSDALE BRASS CAP FLUSH AT THE INTERSECTION OF BELL ROAD AND 104TH STREET.
ELEVATION: 1688.039 NAD83

PROJECT DATA:	
EXISTING ZONING	PCC (E.S.L.)
LOT AREA	PARCEL NO. 1:(LOT 2) 1.499± ACRES/65,296± SQ. FT.

KEY NOTES

1. SAWCUT, REMOVE & REPLACE EXISTING PAVEMENT
2. PROPOSED 2" DOMESTIC WATER METER
3. PROPOSED SIDEWALK RAMP
4. PROPOSED 4" FIRE LINE & RISER LOCATION
5. PROPOSED REMOTE FIRE DEPARTMENT CONNECTION
6. PROPOSED RETAINING WALL (HEIGHT VARIES 1' HIGH TO 6' HIGH)
7. PROPOSED AREA DRAIN
8. PROPOSED STAIRS (5 - 6" RISERS)
9. PROPOSED HANDICAP PARKING SIGNING & STRIPING PER COS STANDARD DETAIL
10. PROPOSED DRAINAGE OUTFALL/HEADWALL
11. PROPOSED CONCRETE SIDEWALK
12. EXISTING LANDSCAPE WATER METER VAULT
13. PROPOSED WALL OPENING
14. PROPOSED SIDEWALK SCUPPER
15. PROPOSED 2" REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER
16. REMOVE 4" SEWER SERVICE & REPLACE WITH 6" SEWER SERVICE
17. PROPOSED COS STORM WATER TREATMENT MANHOLE
18. PROPOSED 3/4" LANDSCAPE METER
19. PROPOSED BIKE RACK
20. PROPOSED 3/4" BACKFLOW PREVENTER

LOT 2; MCDOWELL MOUNTAIN MARKETPLACE
SCOTTSDALE, ARIZONA

PRELIMINARY GRADING AND DRAINAGE PLAN

RICK ENGINEERING COMPANY
6150 NORTH 16TH STREET
PHOENIX, AZ 85016
(602) 957-3350
FAX (602) 285-7896
Tucson - San Diego - Riverside - Orange Sacramento - San Luis Obispo - Denver
rickengineering.com

Expires: 6-30-2019

REV	DESCRIPTION	DATE

Contact Arizona 811 at least two full working days before you begin excavation.
Call 811 or click Arizona811.com

DATE: 12/14/2017
DRAWN: MSG
DESIGNED: MES
PROJ NO. 4893
SHT 1 OF 1

ENGINEER

RICK ENGINEERING COMPANY

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The ensuing wastewater demand and production criteria are indicative of tenant mixes for similar shell buildings within the McDowell Mountain Marketplace and are subject to change.

WASTEWATER DEMAND AND PRODUCTION CRITERIA	
Tenant 1:	Retail (1,580-gsf)
Tenant 2:	Retail (5,500-gsf)
Tenant 3:	Retail (3,000-gsf)
Tenant 4:	Retail (1,800-gsf)
Tenant 5:	Retail (2,400-gsf)
Property Area:	Lot 2 (65,296-sf) | Gray Shell (14,280-gsf)
Shell Building:	14,280-gsf
Average Daily Flow (ADF):	0.5-gpd per sf Commercial/Retail[1]
Peaking Factor (PF):	3 Commercial/Retail[1]
Peak Flow:	PF x ADF

[1] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 7-Wastewater; Section 7-1, Figure 7.1-2
[2] Source: City of Scottsdale Design Standards and Policies Manual. Chapter 7-Wastewater; Section 7-1.409

WATER DESIGN FLOWS

$$\text{ADF (Commercial/Retail)} = (14,280\ \text{sf})\left(0.5\ \frac{\text{gallons}}{\text{day}\cdot\text{sf}}\right) = 7,140\ \text{gpd} = 5.0\ \text{gpm}$$

$$\text{Peak Flow (Commercial/Retail)} = 3(7,140\ \text{gpd}) = 21,420\ \text{gpd} = 15.0\ \text{gpm}$$

ATTACHMENTS

Attachment 1 – Preliminary Grading and Drainage Plan (with Water & Sewer)

43-DR-2017
12/20/17

ATTACHMENT 1

Preliminary Grading and Drainage Plan (with Water & Sewer)

LEGEND

	EXISTING	PROPOSED
TRACT BOUNDARY		
PROPERTY LINE		
RIGHT-OF-WAY		
CENTERLINE		
CURB		
CURB & GUTTER		
FENCE-WOOD		
EASEMENT		
WATER LINE	W	W
FIRE SERVICE	FS	FS
SANITARY SEWER LINE	S	S
GAS LINE	G	G
ELECTRIC LINE	E	E
FIBER OPTICS	FO	FO
TELEPHONE	T	T
FIRE HYDRANT	FH	
WATER VALVE		
FIRE DEPARTMENT CONNECTION		
BENCHMARK		
WATER METER	WM	WM
SEWER MANHOLE		
YARD DRAIN		
PAVEMENT ELEVATION	·P:60.43	·P:60.43
NATURAL GROUND ELEVATION	·NG:60.43	·NG:60.43
CONCRETE ELEVATION	·C:60.43	·C:60.43
TOP OF CURB ELEVATION	·TC:60.50	·TC:60.50
GUTTER ELEVATION	·G:60.00	·G:60.00
FLOW ARROW		
STORM DRAIN		
CONTOUR LINE	20	20

PRELIMINARY GRADING & DRAINAGE PLAN FOR:

LOT 2; MCDOWELL MOUNTAIN MARKETPLACE

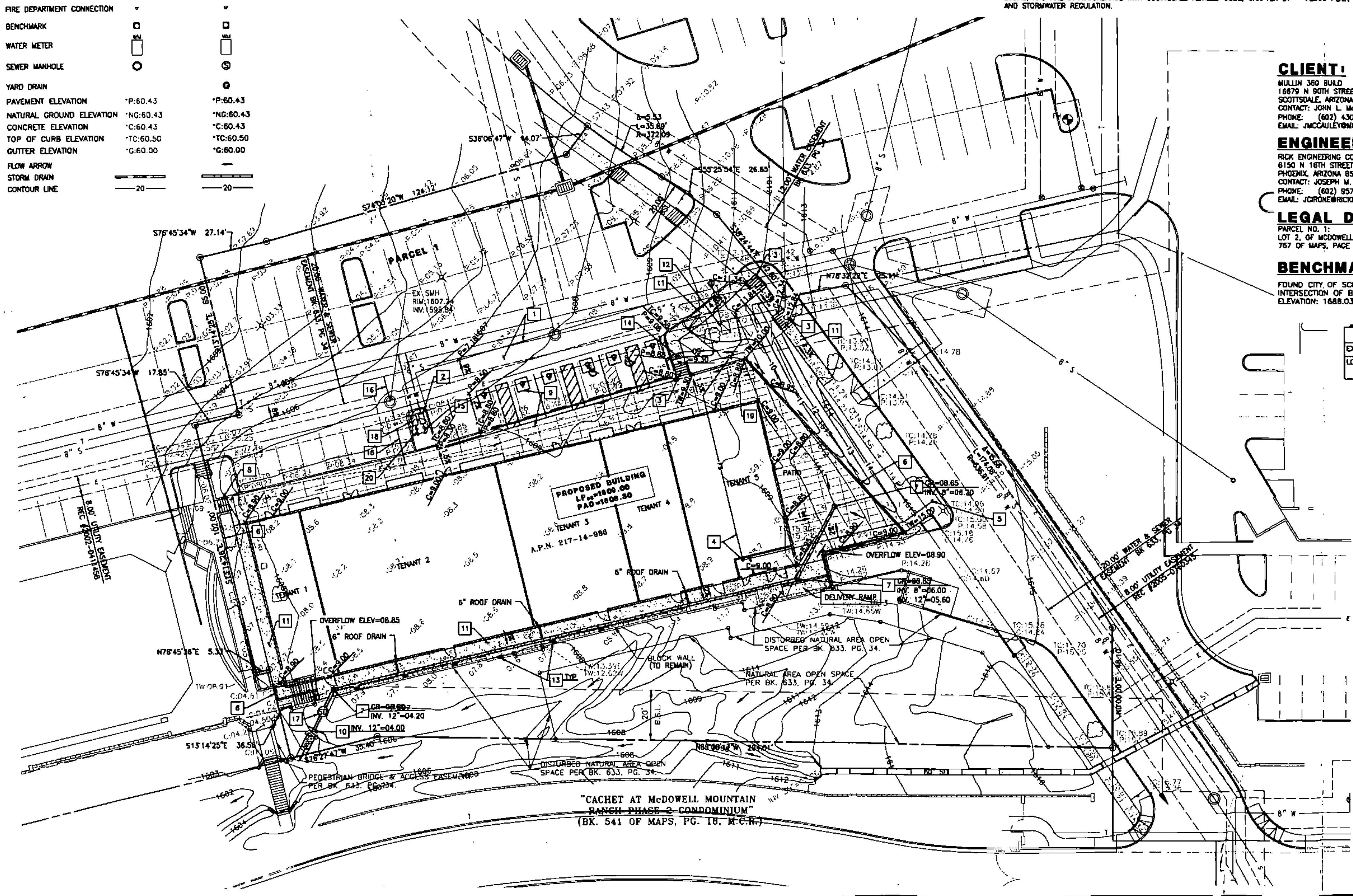
OF A PORTION OF THE NORTHEAST QUARTER OF SECTION 5, TOWNSHIP 3 NORTH, RANGE 5 EAST OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA.

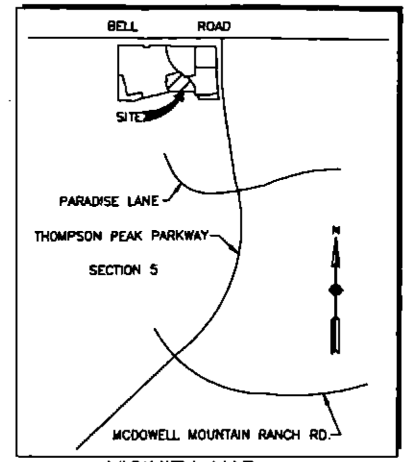
FLOOD INSURANCE RATE MAP (FIRM) INFORMATION:

COMMUNITY NUMBER	PANEL - PANEL DATE	SUFFIX	DATE OF FIRM (INDEX DATE)	FIRM ZONE	BASE FLOOD ELEVATION (IN AO ZONE, USE DEPTH)
045012	1340 10/16/13	L	10/16/13	X	AVERAGE DEPTH LESS THAN 1 FOOT

ENGINEER'S CERTIFICATION:

THE LOWEST FINISH FLOOR ELEVATION(S) AND/OR FLOOD PROOFING ELEVATION(S) ON THIS PLAN ARE SUFFICIENTLY HIGH TO PROVIDE PROTECTION FROM FLOODING CAUSED BY A 100-YEAR STORM, AND ARE IN ACCORDANCE WITH SCOTTSDALE REVISED CODE, CHAPTER 37 - FLOOD PLAIN AND STORMWATER REGULATION.





VICINITY MAP

N.T.S.

CLIENT:

MULLIN 360 BUILD
16679 N 90TH STREET, SUITE 102
SCOTTSDALE, ARIZONA 85260
CONTACT: JOHN L. McCAULEY
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EMAIL: JMCCAULEY@MULLIN360.COM

ARCHITECT:

CIRCLE WEST ARCHITECTS
4148 N ARCADIA DR,
PHOENIX, ARIZONA 85018
CONTACT: NATHAN MOYERS
PHONE: (602) 889-2314
EMAIL: NATHAN@CIRCLEWEST.NET

ENGINEER:

RICK ENGINEERING COMPANY
6150 N 16TH STREET
PHOENIX, ARIZONA 85016
CONTACT: JOSEPH M. CIRONE, PE
PHONE: (602) 957-3350
EMAIL: JCIRONE@RICKENGINEERING.COM

ADDRESS:

16854 N. THOMPSON PEAK PARKWAY
SCOTTSDALE, ARIZONA, 85260

APN:

217-14-986

LEGAL DESCRIPTION:

PARCEL NO. 1:
LOT 2, OF MCDOWELL MOUNTAIN MARKETPLACE, ACCORDING TO BOOK 767 OF MAPS, PAGE 37, RECORDS OF MARICOPA COUNTY, ARIZONA.

BENCHMARK:

FOUND CITY OF SCOTTSDALE BRASS CAP FLUSH AT THE INTERSECTION OF BELL ROAD AND 104TH STREET.
ELEVATION: 1688.039 NAD83

PROJECT DATA:	
EXISTING ZONING	PCC (E.S.L.)
LOT AREA	PARCEL NO. 1:(LOT 2) 1.499± ACRES/65,296± SQ. FT.

KEY NOTES

1. SAWCUT, REMOVE & REPLACE EXISTING PAVEMENT
2. PROPOSED 2" DOMESTIC WATER METER
3. PROPOSED SIDEWALK RAMP
4. PROPOSED 4" FIRE LINE & RISER LOCATION
5. PROPOSED REMOTE FIRE DEPARTMENT CONNECTION
6. PROPOSED RETAINING WALL (HEIGHT VARIES 1' HIGH TO 6' HIGH)
7. PROPOSED AREA DRAIN
8. PROPOSED STAIRS (5 - 6" RISERS)
9. PROPOSED HANDICAP PARKING SIGNING & STRIPING PER COS STANDARD DETAIL
10. PROPOSED DRAINAGE OUTFALL/HEADWALL
11. PROPOSED CONCRETE SIDEWALK
12. EXISTING LANDSCAPE WATER METER VAULT
13. PROPOSED WALL OPENING
14. PROPOSED SIDEWALK SCUPPER
15. PROPOSED 2" REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER
16. REMOVE 4" SEWER SERVICE & REPLACE WITH 6" SEWER SERVICE
17. PROPOSED CDS STORM WATER TREATMENT MANHOLE
18. PROPOSED 3/4" LANDSCAPE METER
19. PROPOSED BIKE RACK
20. PROPOSED 3/4" BACKFLOW PREVENTER

SCALE: 1"=20'

LOT 2; MCDOWELL MOUNTAIN MARKETPLACE

SCOTTSDALE, ARIZONA

PRELIMINARY GRADING AND DRAINAGE PLAN

RICK ENGINEERING COMPANY
6150 NORTH 16TH STREET
PHOENIX, AZ 85016

Expires: 6-30-2019

REV	DESCRIPTION	DATE

DATE: 12/14/2017
DRAWN: MSG
DESIGNED: MES
PROJ NO. 4893
SHT 1 OF 1

MCDOWELL MOUNTAIN MARKETPLACE-LOT 2

SWC Bell Rd & Thompson Peak Parkway
Scottsdale, AZ 85260

PRELIMINARY DRAINAGE REPORT

RICK ENGINEERING COMPANY JOB NO. 4893-0
DECEMBER 2017

COS PRE-APP #: 556-PA-2017

Plan # _____
Case # 43-DR-2017
Q-S # _____
☑ Accepted
☐ Corrections
N. Barones 1-5-18
Reviewed By Date

RICK ENGINEERING COMPANY

43-DR-2017
12/20/17

RICK ENGINEERING COMPANY
rickengineering.com

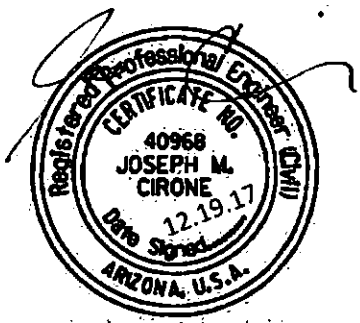
MCDOWELL MOUNTAIN MARKETPLACE-LOT 2

SWC Bell Rd & Thompson Peak Parkway
Scottsdale, AZ 85260

PRELIMINARY DRAINAGE REPORT

Prepared For:

MULLIN360BUILD
16679 North 90th Street, Suite 102
Scottsdale, Arizona 85260
Phone (602) 430-4603



Expires: 6-30-2019

Joseph M. Cirone, P.E.

December 2017

Prepared By:

RICK ENGINEERING COMPANY
6150 North 16th Street
Phoenix, Arizona 85016-1705
(602) 957-3350

JOB NUMBER 4893-0

1.0 TABLE OF CONTENTS

FIGURES & EXHIBITS

TABLES

1.0 INTRODUCTION

1.1 SITE LOCATION

The project site for McDowell Mountain Marketplace-Lot 2 is located within the northeast quarter of Section 5, Township 3 North, Range 5 East of the Gila and Salt River Meridian, Maricopa County, Arizona within the City of Scottsdale. More specifically, the project site is at the southwest corner of East Bell Road and North Thompson Peak Parkway. The site is bounded on the north by East Bell Road, on the east by North Thompson Peak Parkway, on the south by Cachet at McDowell Mountain Ranch Condominiums Phase 2, and to the west by North 100th Street. Refer to **Figure 1** – Vicinity Map, below, for the site location.

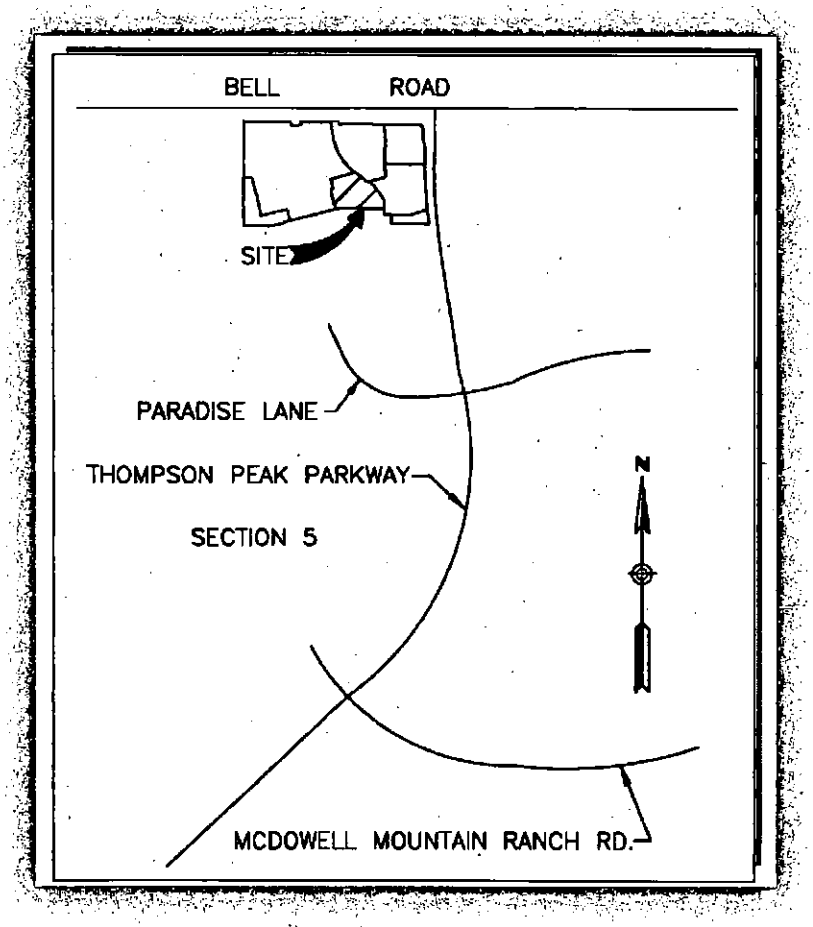


Figure 1: Vicinity Map

1.2 SITE DESCRIPTION

The project site has an area of approximately 1.499-acres and as depicted on the aerial photo (**Figure 2** within **Appendix A**), is developed with three access entrances along Bell Road to the north, one access entrance on Thompson Peak Parkway to the east, and two access entrances along 100th street to the west. The existing zoning is (PCC ESL) Planned Community Center-Environmentally Sensitive Land and no zoning change is proposed. The project scope includes the construction of a 5-tenant gray shell building for retail use.

1.3 PURPOSE AND OBJECTIVES

The purpose and objectives of this Preliminary Drainage Report are to:

1. Present the existing drainage conditions for the project site and proposed conceptual drainage plan for the project site.
2. Provide supporting information required for the proposed grading and drainage concept, in accordance with the City of Scottsdale drainage requirements.
3. Determine onsite peak discharges.
4. Determine the required onsite drainage improvements to convey runoff through the project site.

1.1. PREVIOUS STUDIES

A Master Drainage Report for McDowell Mountain Ranch Parcels "A"-"R" was prepared by Clouse Engineering in November 1993 [here forth referred to as "The Master Drainage Report"].

A Final Drainage Report for the McDowell Mountain Marketplace commercial development, prepared by David Evans & Associates was approved in February 2001 [here forth referred to as "The 2001 Master Drainage Report"]. Excerpts from this report are provided within **Appendix D**.

A Final Drainage Report for Cachet at McDowell Mountain Ranch, Phase 2 was prepared by Rick Engineering Company in March 2000 [here forth referred to as "The Cachet Drainage Report"].

A Basis of Design Report entitled *Bell Road Improvements-District Number 13704* was prepared by Hubert Engineering in December 1993 [here forth referred to as "Bell Road Improvements BODR"].

Drainage analyses and findings from all above documents are utilized in this study as a foundation for the proposed drainage concepts.

2.0 DESCRIPTION OF EXISTING DRAINAGE CONDITIONS

2.1. EXISTING ONSITE CONDITIONS

The project parcel is located within an existing shopping center, McDowell Mountain Marketplace, which includes a grocery store, retail businesses, restaurants, and associated parking lot and landscape improvements. The site is comprised of approximately 14% desert landscaping and 86% hardscape and pavement. Under existing conditions, the runoff generated by the entire center is captured onsite via a series of inlet structures and conveyed to an existing wash located west of 100th Street ("Wash G") via a combination of storm drain, gutter, and overland surface flow.

2.2. OFFSITE CONDITIONS

Natural topography in the vicinity of the site generally slopes from northeast to southwest. Runoff generated along Bell Road drains toward the west and Thompson Peak Parkway drains to toward the south away from the project site.

Pursuant to the Master Drainage Report, runoff from the offsite watersheds to the north and east of Thompson Peak Parkway (OS-1, OS-2, & OS-3) is either routed around the project site or routed through the project site via five existing 30-inch culverts under Bell Road. The Master Drainage Report quantifies said runoff (OS-3) to be approximately 121-cubic feet per second (cfs); it is collected onsite by the existing storm drain system and conveyed to Wash G. Pursuant to the Cachet Drainage Report, 14.6-cfs of runoff generated by the condominium development to the south (OS-4) is conveyed to Wash G via an existing wash corridor along the project's south property line. A portion of the development located directly east and southeast of the project site (OS-6) also contributes runoff to the existing wash corridor located south of the project (OS-5) via an existing 30-inch storm drain. The discharge associated with off-site areas OS-5 and OS-6 is 18.8-cfs and is conveyed within the existing wash corridor located immediately south and adjacent to the pad development. The discharge value of 18.8-cfs was utilized to determine the high water elevation within the existing wash corridor and establish the tailwater condition for the onsite storm drain piping.

Refer to **Figure 4** – Offsite Watershed Exhibit for a depiction of offsite watersheds and concentration points. A summary of offsite flows is provided in Table 1, below.

Table 1: Offsite Watershed Peak Flows

Watershed	100-Year Peak Discharge	Description	Source
CP	Q_{100}		
(ID)	*(cfs)*		
OS-1	24.5	Bell Road	Bell Road Improvements BDR, 1993
OS-2	109	Thompson Peak Parkway	Master Drainage Report, 1993
OS-3	121	Watershed north of Bell Road	Final Drainage Report, 2001
OS-4	14.6	Watershed south of Project Site	Cachet Drainage Report, 2000
OS-5	1.9	Existing Wash Corridor south of Project Site	Rational Method – DDMSW – conducted by RICK 12/12/2017
OS-6	16.9	Commercial Developments east and southeast of project site	Final Drainage Report, 2001

2.3. FEMA FLOOD HAZARD ZONE

The proposed site lies within Flood Hazard Zone "X" shaded as indicated on map number 04013C1340L, dated October 16, 2013, of the FEMA Flood Insurance Rate Map (Fig. 3, **Appendix A**).

Table 2: Flood Insurance Rate Map Information

COMMUNITY NUMBER	PANEL #	SUFFIX	DATE OF FIRM	FIRM ZONE	BASE FLOOD ELEVATION (IN AO ZONE USE DEPTH)
045012	1340	L	10/16/13	ZONE X (SHADED)	AVERAGE DEPTHS LESS THAN 1 FOOT

Zone "X" (shaded) areas are defined by Federal Emergency Management Agency (FEMA) as areas of 0.2% annual chance of flood; areas of 1% annual chance of flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

3.0 PROPOSED DRAINAGE PLAN

3.1. GENERAL DESCRIPTION

The project consists of the construction of a 5-tenant gray shell building for retail use with associated parking and landscape areas. The drainage design includes area drains to collect runoff from the landscape area and patio area located east of the proposed building and storm drain to ultimately convey said runoff to Wash G. The design also includes roof leader lines to collect runoff from the building rooftop; the rooftop and walkway stormwater at the rear of the building will drain to the existing drainage corridor located at the southern property line, ultimately discharging to Wash G. The frontage of the building is graded to drain towards the shopping center, consistent with the approved 2001 Master Drainage Report, and is to be collected by existing catch basin inlets and conveyed via the existing storm drain system to Wash G. Refer to **Appendix E** for the Preliminary Grading & Drainage Plan.

The majority of the shopping center and the adjacent roadways and parcels on all sides are fully developed. Development of Lot 2 was anticipated and incorporated in the overall drainage design for the shopping center per the 2001 Master Drainage Report, thus the existing drainage system has the capacity for the development of Lot 2.

3.2. STORMWATER STORAGE REQUIREMENTS

Pursuant to the 2001 Master Drainage Report, a retention waiver was approved for the McDowell Mountain Marketplace shopping center on the basis that post-development runoff rates from the site did not exceed pre-development runoff rates historically entering Wash G, located west of 100th Street. Pre-development and post-development 100-year peak discharges were quantified within the 2001 Master Drainage Report, provided as reference within **Appendix D**. In summary, the 2001 post-development improvements including parking lot catch basins and a storm drain system decreased the 100-year discharge to Wash G by approximately 19-cfs via routing 109-cfs of offsite flow to Thompson Peak Parkway and ultimately south away from the project site.

3.3. PRE- AND POST-DEVELOPMENT RUNOFF CHARACTERISTICS

In the pre-development condition, all flows generated by the property were conveyed to existing onsite catch basins located north of the site via surface sheet flow over the parking lot.

In the post-development condition, the parking area at the frontage and northeast of the proposed building will continue to drain north to existing onsite catch basins and ultimately conveyed to Wash G via an the existing storm drain network. Runoff generated from the building rooftop, the walkway at the rear of the building, and the patio to the east of the building will be conveyed via storm drain and roof leader lines to the existing wash corridor located south of the project site.

Onsite peak discharges are calculated to support the preliminary design of proposed onsite drainage structures. Refer to **Appendix B** for hydrologic analysis for the peak discharges. The following table summarizes the proposed design flows used for the preliminary design of onsite drainage structures.

Table 4: Inlet Sizing

CONCENTRATION POINT	INLET TYPE	PEAK DISCHARGE (Q_{100})	FLOW DEPTH (d)	FLOW TYPE
(CP)		(cfs)	(ft)	
AD-1	Nyloplast 12" Standard Grate Inlet	0.3	0.16	WEIR
AD-2	Nyloplast 12" Standard Grate Inlet	0.9	0.33	WEIR
AD-3	Nyloplast 12" Standard Grate Inlet	0.3	0.16	WEIR

The calculated ponding depth does not exceed the maximum 1-ft established by City of Scottsdale DPSM, 2010.

3.4.2. STORM DRAIN

The installation of 8-inch storm drain and 12-inch storm drain is proposed to convey the 100-year storm event from the proposed building rooftop, rear walkway area, and patio area to the existing wash corridor located south of the project site. The tailwater elevation input in the model was 1604.51-ft, as calculated by an open channel analysis of the existing wash corridor (**Appendix C**). This analysis accounts for the peak discharges contributed by the development to the east and southeast of the project. Figure 5 depicts the locations of all storm drain.

Table 5: Storm Drain Summary

PIPE	DIAMETER	SLOPE	100-YEAR FLOW	FLOW CAPACITY	UPSTREAM RIM/GROUND ELEVATION	HYDRAULIC GRADE LINE	RIM_{ELEV}- HGL_{ELEV}
(ID)	(D)	(S)	(Q_{100})	(Q_{cap})	(RIM_{ELEV})	(HGL)	ΔELEV
	(in)	(ft/ft)	(cfs)	(cfs)	(ft)	(ft)	(ft)
CO-1	8.0	0.006	0.30	1.02	8.65	7.44	1.21
CO-2	12.0	0.007	1.20	3.33	8.80	7.40	1.40
CO-3	12.0	0.007	2.00	3.30	8.60	7.35	1.25
CO-4	12.0	0.007	2.60	3.31	8.30	7.18	1.12
CO-5	12.0	0.007	3.80	3.31	8.40	6.89	1.51
CO-6	12.0	0.011	4.10	4.04	8.80	6.27	2.53
CO-7	12.0	0.010	4.10	3.89	6.97	4.97	2.00

The hydraulic grade line (HGL) falls, at minimum, 1-ft below all catch basins and manholes.

3.4.3. STORMWATER TREATMENT

One (1) CDS unit is proposed at the outfall of the proposed storm drain for the treatment of stormwater before it is discharged to the existing wash corridor south of the site. The design assumes 80% removal efficiency down to a 125 micron particle size and 100% trash and debris capture for particle sizes greater than 2,400 microns. The CDS unit design has utilized Maricopa County's requirement of the 0.5-inch first flush depth with a minimum time of concentration of 15-minutes to calculate the treatment flow for sizing CDS-1. The 100-year flow will be bypassed internally in the system as well.

Hydraulic design calculations for the unit (CDS-1) were conducted by Rick Engineering Company (**Appendix C**). Refer to Figure 5 within **Appendix A** for the Drainage Exhibit which shows the CDS unit location and the contributing treatment areas (1P-1 through 1P-6). Table 6 provides a summary of the stormwater treatment hydraulic design.

Table 6: CDS Unit Design Summary

TREATMENT AREA ID	BMP TYPE	TREATMENT AREA	TREATMENT FLOW	100-YR PEAK FLOW
DA		A_T	Q_T	Q_{100}
		(sf)	(cfs)	(cfs)
1P-1	CDS-1 (CDS2020)	23,182	1.1	4.1
1P-2				
1P-3				
1P-4				
1P-5				
1P-6				

3.5. PROJECT PHASING

The project is proposed to be constructed as one phase. All proposed drainage infrastructure will be constructed as one phase.

4.0 SPECIAL CONDITIONS

There are no special conditions anticipated for this project.

5.0 DATA ANALYSIS METHODS

5.1. HYDROLOGIC PROCEDURES

The drainage scheme for this project was determined in accordance with the existing topographic and drainage features. The hydrologic analyses were done using the following methodologies and procedures:

1. Proposed drainage improvements were designed consistent with *The City of Scottsdale Design Standards and Policies Manual* (January 2010) and the *Drainage Design Manual for Maricopa County*, Volumes I and II (DDM Vol. I and Vol. II).

2. Offsite and onsite 100-year peak discharges were adopted from the 2001 Master Drainage Report. (Appendix F) or determined using the Rational Method through the Drainage Design Management System (DDMSW) software, version 5.3.0, available from the Flood Control District of Maricopa County. In accordance with *The City of Scottsdale Design Standards and Policies Manual* (COS DSPM, January 2010) the Rational Method was utilized because all watersheds are less than 160 acres. Default runoff coefficients from the COS DSPM were utilized based on land use and cover type.

Appendix A: Figures & Exhibits

1) *FIGURE 2 - Aerial Exhibit*
2) *FIGURE 3 - FEMA Firmette*
3) *FIGURE 4 - Offsite Watershed Map*
4) *FIGURE 5 - Drainage Exhibit*

WINDGATE RANCH
PHASE 1 PARCEL C

VILLAS ALTOZANO
CONDOMINIUMS

LEGEND:

PROJECT BOUNDARY

BELL RD

AQUILA
MCDOWELL
MOUNTAIN
CONDOMINIUMS

MCDOWELL
MOUNTAIN
MARKETPLACE

PROJECT
SITE

LOT 2

THOMPSON PEAK PKWY

MCDOWELL
MOUNTAIN RANCH
PARCEL P

TRAILS
NORTH AT
HORSEMAN'S
PARK

CACHET AT MCDOWELL
MOUNTAIN RANCH, PHASE 2
CONDOMINIUMS

SCALE: 1"= 120'

FIGURE NO. 2: Aerial Exhibit
MCDOWELL MOUNTAIN MARKETPLACE-LOT 2
SWC Bell Rd & Thompson Peak Pkwy

RICK ENGINEERING COMPANY
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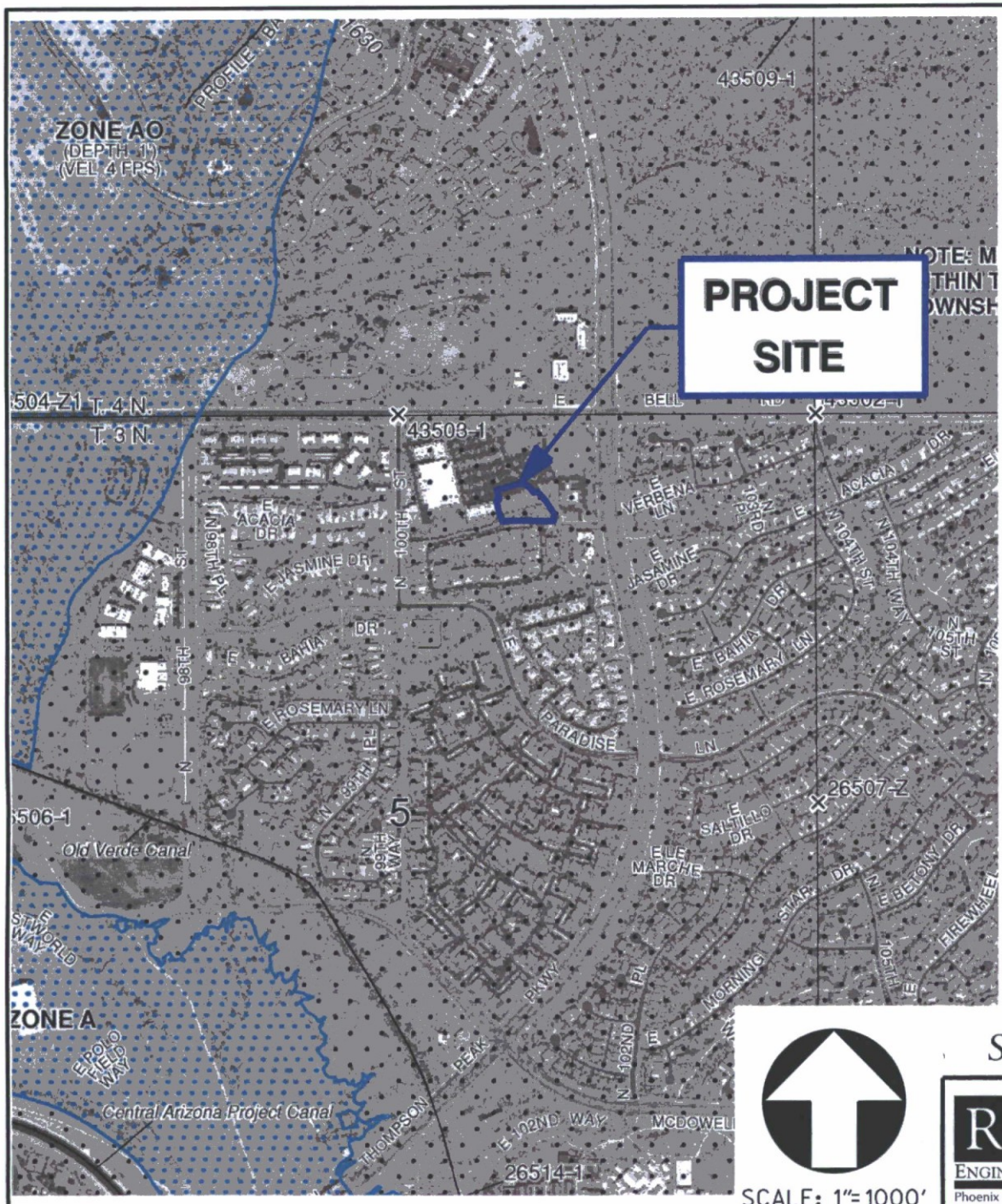
(FAX) 602-285-2396
rickengineering.com
San Diego - Riverside - Orange - Sacramento - San Luis Obispo - Tucson - Denver

J-4893

JOB NUMBER	PREPARED BY:	DATE PREPARED:
4893	HTF	17-OCT-2017

P:\4893_McDowell_Mtn_Lot_2\Drainage\4893exb_FIG02_aerialdgn (Model: Default)
17-OCT-2017



SCALE: 1"=1000'

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1340L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1340 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE, CITY OF	045012	1340	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1340L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

FIGURE NO. 3: FEMA Firmette
MCDOWELL MOUNTAIN MARKETPLACE-LOT 2
SWC Bell Rd & Thompson Peak Pkwy

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J-4893

P:\4893_McDowellMtn_Lot_2\Drainage\4893exb_FIG03_fema.dgn (Model: Default)
17-OCT-2017

JOB NUMBER	PREPARED BY:	DATE PREPARED:
4893	HTF	17-OCT-2017

Appendix B: Hydrologic Calculation

1) *Rational Method Calculations using DDMSW Software, 12/13/2017*

Project

Reference	4893
Title	McDowell Mountain Marketplace-Lot 2
Location	City of Scottsdale, AZ
Agency	Flood Control District of Maricopa County

Project Defaults

Model	Rational
Land Use Agency	FCDMC
Rainfall	NOAA14
Roads Agency	MCDOT
Inlets Agency	MCDOT

Comments

Flood Control District of Maricopa County
Drainage Design Management System
RAINFALL DATA
Project Reference: 4893

12/11/2017

ID	Method	Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DEFAULT	NOAA14	5 MIN	0.268	0.362	0.433	0.528	0.600	0.674
	NOAA14	10 MIN	0.408	0.551	0.659	0.803	0.914	1.027
	NOAA14	15 MIN	0.506	0.683	0.817	0.996	1.133	1.273
	NOAA14	30 MIN	0.681	0.920	1.100	1.341	1.526	1.714
	NOAA14	1 HOUR	0.843	1.138	1.362	1.660	1.888	2.121
	NOAA14	2 HOUR	0.977	1.297	1.542	1.876	2.126	2.386
	NOAA14	3 HOUR	1.056	1.378	1.633	1.990	2.273	2.565
	NOAA14	6 HOUR	1.249	1.592	1.865	2.238	2.528	2.829
	NOAA14	12 HOUR	1.435	1.811	2.106	2.504	2.810	3.126
	NOAA14	24 HOUR	1.711	2.217	2.621	3.185	3.634	4.105

MAP INDEX NO: 64
CELL NO: 863-854

Flood Control District of Maricopa County
Drainage Design Management System
LAND USE
Project Reference: 4893

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	Runoff Coefficient C						Description
					2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	
Major Basin ID: 01											
1P-1	200	0.04	100.0	0.049	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	
		0.040	**100.0**								
1P-2	200	0.12	100.0	0.046	0.72*	0.72*	0.72*	0.79*	0.87*	0.90*	
		0.120	**100.0**								
1P-3	200	0.10	100.0	0.046	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	
		0.100	**100.0**								
1P-4	200	0.07	100.0	0.047	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	
		0.070	**100.0**								
1P-5	200	0.16	100.0	0.045	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	
		0.160	**100.0**								
1P-6	200	0.04	100.0	0.049	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	
		0.040	**100.0**								
OS-5	730	0.45	100.0	0.042	0.40*	0.40*	0.40*	0.44*	0.48*	0.50*	
		0.450	**100.0**								

* Non default value

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: 4893

ID	Sub Basin Data							Sub Basin Hydrology Summary					
	Area (acres)	Length (ft)	USGE	DSGE	Slope (ft/mi)	Kb		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Major Basin ID: 01													
1P-1	-	54	9.00	8.70	29.3	0.049	Q (cfs)	0.1	0.1	0.2	0.2	0.3	0.3
							C	0.76	0.76	0.76	0.84	0.91	0.95
							CA (ac)	0.03	0.03	0.03	0.03	0.04	0.04
							Volume (ac-ft)	0.0009	0.0009	0.0018	0.0018	0.0028	0.0028
							Tc (min)	5	5	5	5	5	5
							i (in/hr)	3.22	4.34	5.20	6.34	7.20	8.09
1P-2	0.1	174	15.70	8.90	206.3	0.046	Q (cfs)	0.3	0.4	0.5	0.6	0.7	0.9
							C	0.72	0.72	0.72	0.79	0.87	0.90
							CA (ac)	0.09	0.09	0.09	0.09	0.10	0.11
							Volume (ac-ft)	0.0028	0.0037	0.0046	0.0055	0.0064	0.0083
							Tc (min)	5	5	5	5	5	5
							i (in/hr)	3.22	4.34	5.20	6.34	7.20	8.09
1P-3	0.1	67	21.90	21.00	70.9	0.046	Q (cfs)	0.3	0.3	0.4	0.5	0.6	0.8
							C	0.76	0.76	0.76	0.84	0.91	0.95
							CA (ac)	0.08	0.08	0.08	0.08	0.09	0.10
							Volume (ac-ft)	0.0028	0.0028	0.0037	0.0046	0.0055	0.0074
							Tc (min)	5	5	5	5	5	5
							i (in/hr)	3.22	4.34	5.20	6.34	7.20	8.09
1P-4	0.1	67	21.90	21.00	70.9	0.047	Q (cfs)	0.2	0.2	0.3	0.4	0.4	0.6
							C	0.76	0.76	0.76	0.84	0.91	0.95
							CA (ac)	0.05	0.05	0.05	0.06	0.06	0.07
							Volume (ac-ft)	0.0018	0.0018	0.0028	0.0037	0.0037	0.0055
							Tc (min)	5	5	5	5	5	5
							i (in/hr)	3.22	4.34	5.20	6.34	7.20	8.09
1P-5	0.2	67	21.90	21.00	70.9	0.045	Q (cfs)	0.4	0.5	0.6	0.8	1.1	1.2
							C	0.76	0.76	0.76	0.84	0.91	0.95

* Non default value

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: 4893

ID	Sub Basin Data							Sub Basin Hydrology Summary					
	Area (acres)	Length (ft)	USGE	DSGE	Slope (ft/mi)	Kb		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Major Basin ID: 01													
							CA (ac)	0.12	0.12	0.12	0.13	0.15	0.15
							Volume (ac-ft)	0.0037	0.0046	0.0055	0.0074	0.0101	0.0110
							Tc (min)	5	5	5	5	5	5
							i (in/hr)	3.22	4.34	5.20	6.34	7.20	8.09
1P-6	-	99	9.00	8.90	5.3	0.049	Q (cfs)	0.1	0.1	0.1	0.2	0.3	0.3
							C	0.76	0.76	0.76	0.84	0.91	0.95
							CA (ac)	0.03	0.03	0.03	0.03	0.04	0.04
							Volume (ac-ft)	0.0014	0.0013	0.0012	0.0021	0.0030	0.0029
							Tc (min)	8	7	6	6	5	5
							i (in/hr)	2.76	3.94	4.84	6.10	7.04	8.00
OS-5	0.5	307	16.20	3.50	218.4	0.042	Q (cfs)	0.6	0.8	0.9	1.3	1.6	1.9
							C	0.40	0.40	0.40	0.44	0.48	0.50
							CA (ac)	0.18	0.18	0.18	0.20	0.22	0.23
							Volume (ac-ft)	0.0055	0.0074	0.0083	0.0120	0.0147	0.0175
							Tc (min)	5	5	5	5	5	5
							i (in/hr)	3.22	4.34	5.20	6.34	7.20	8.09

* Non default value

Appendix C: Hydraulic Calculation

1) *FlowMaster Open Channel Cross Section Calculations, 12/13/2017*
2) *Grate Inlet Calculations, 12/13/2017*
3) *StormCAD Pipe Calculations, 12/13/2017*
4) *Contech CDS Unit Brochure*
5) *CDS Unit Hydraulic Design Calculations, 12/13/2017*

Worksheet for Cross Section A-Existing Wash

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	18.80	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1607.50
0+07	1607.00
0+12	1606.00
0+15	1605.00
0+18	1604.00
0+22	1603.50
0+27	1604.00
0+31	1605.00
0+49	1605.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1607.50)	(0+49, 1605.50)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.69	ft
Elevation Range	1603.50 to 1607.50 ft	
Flow Area	4.12	ft²
Wetted Perimeter	10.48	ft

Worksheet for Cross Section A-Existing Wash

Results

Hydraulic Radius		0.39	ft
Top Width		10.37	ft
Normal Depth		0.69	ft
Critical Depth		0.77	ft
Critical Slope		0.02363	ft/ft
Velocity		4.56	ft/s
Velocity Head		0.32	ft
Specific Energy		1.01	ft
Froude Number		1.27	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.69	ft
Critical Depth	0.77	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.02363	ft/ft

Cross Section for Cross Section A

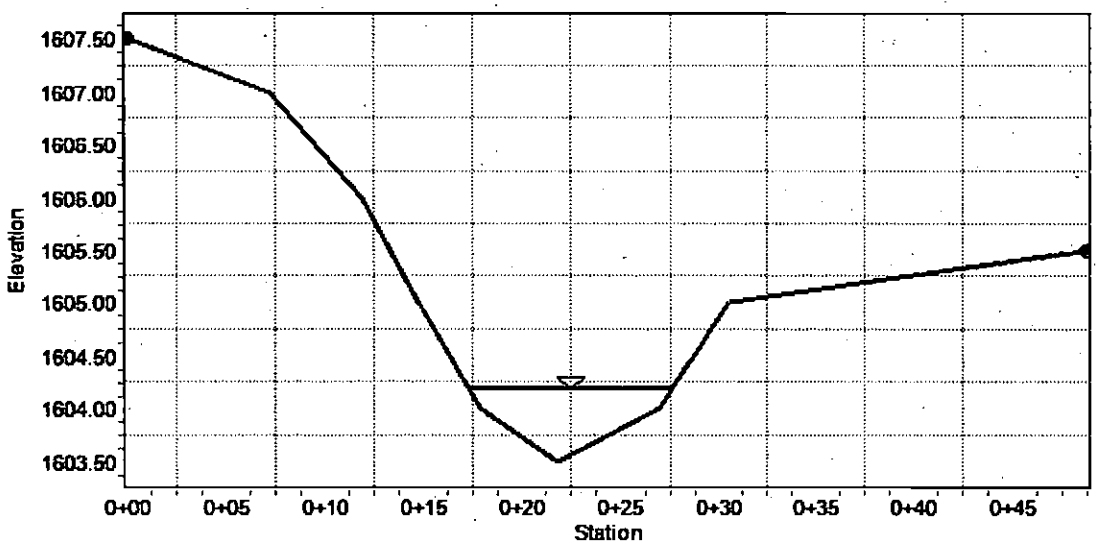
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Normal Depth	0.69	ft
Discharge	18.80	ft³/s

Cross Section Image



Worksheet for Cross Section B-Existing Wash

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	18.80	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	10.50
0+04	10.00
0+07	9.00
0+09	8.00
0+10	7.00
0+12	6.80
0+13	7.00
0+18	8.00
0+22	9.00
0+27	9.30

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 10.50)	(0+27, 9.30)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.86	ft
Elevation Range	6.80 to 10.50 ft	
Flow Area	3.59	ft²

Worksheet for Cross Section B-Existing Wash

Results

Wetted Perimeter		7.42	ft
Hydraulic Radius		0.48	ft
Top Width		7.07	ft
Normal Depth		0.86	ft
Critical Depth		0.97	ft
Critical Slope		0.02309	ft/ft
Velocity		5.23	ft/s
Velocity Head		0.43	ft
Specific Energy		1.28	ft
Froude Number		1.29	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.86	ft
Critical Depth	0.97	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.02309	ft/ft

Cross Section for Cross Section B

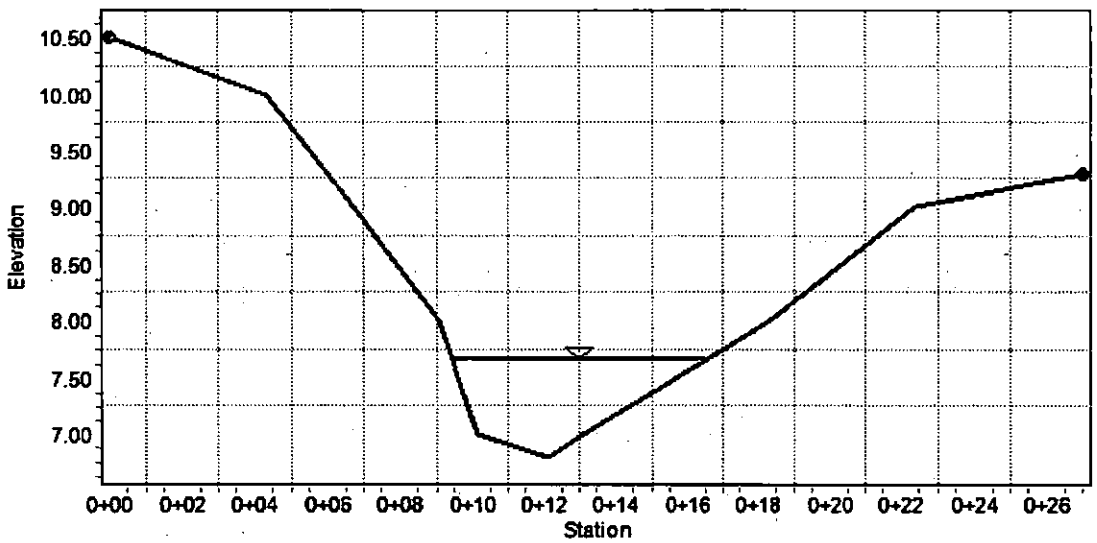
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Normal Depth	0.86	ft
Discharge	18.80	ft^3/s

Cross Section Image



Worksheet for Cross Section C-Existing Wash

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	16.90	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	12.50
0+04	12.00
0+06	11.00
0+07	10.00
0+09	9.00
0+09	8.90
0+10	9.00
0+11	10.00
0+14	11.00
0+16	12.00
0+24	12.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 12.50)	(0+24, 12.50)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.17	ft
Elevation Range	8.90 to 12.50 ft	

Worksheet for Cross Section C-Existing Wash

Results

Flow Area		2.87	ft²
Wetted Perimeter		4.97	ft
Hydraulic Radius		0.58	ft
Top Width		4.31	ft
Normal Depth		1.17	ft
Critical Depth		1.31	ft
Critical Slope		0.02397	ft/ft
Velocity		5.89	ft/s
Velocity Head		0.54	ft
Specific Energy		1.71	ft
Froude Number		1.27	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.17	ft
Critical Depth	1.31	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.02397	ft/ft

Cross Section for Cross Section C

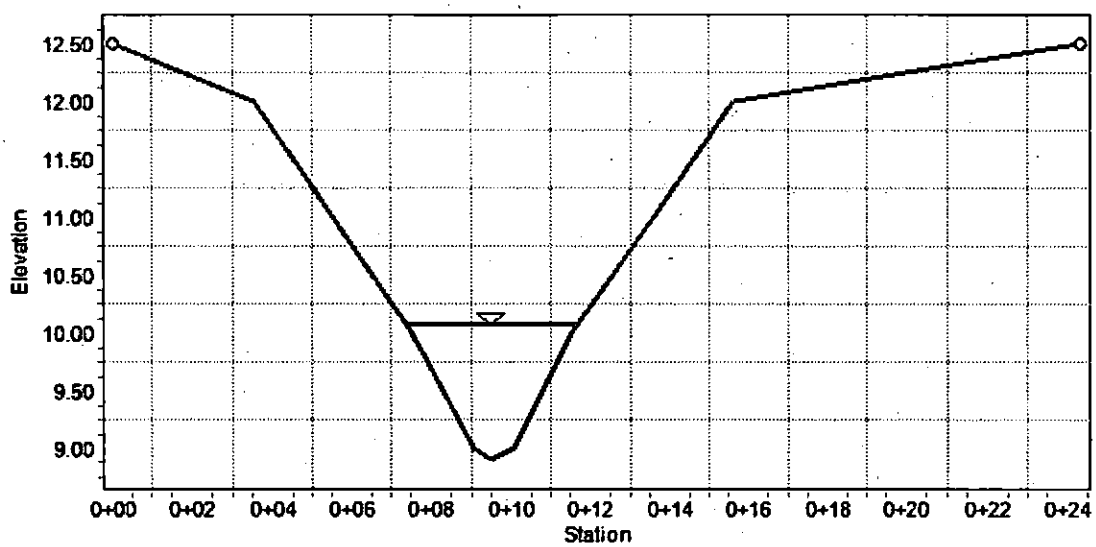
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Normal Depth	1.17	ft
Discharge	16.90	ft³/s

Cross Section Image



Worksheet for Cross Section A_Prop_No Project_TW Condition

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	18.80	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	7.50
0+07	7.00
0+11	6.00
0+14	5.00
0+18	4.00
0+20	3.90
0+22	4.00
0+25	5.00
0+30	5.70
0+34	5.00
0+36	4.00
0+39	4.00
0+43	5.00
0+54	5.30

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 7.50)	(0+54, 5.30)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Cross Section A_Prop_No Project_TW Condition

Results

Normal Depth		0.51	ft
Elevation Range	3.90 to 7.50 ft		
Flow Area		4.53	ft²
Wetted Perimeter		13.22	ft
Hydraulic Radius		0.34	ft
Top Width		12.94	ft
Normal Depth		0.51	ft
Critical Depth		0.57	ft
Critical Slope		0.02521	ft/ft
Velocity		4.15	ft/s
Velocity Head		0.27	ft
Specific Energy		0.78	ft
Froude Number		1.24	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.51	ft
Critical Depth	0.57	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.02521	ft/ft

Cross Section for XS A_Prop_No Project_TW Condition

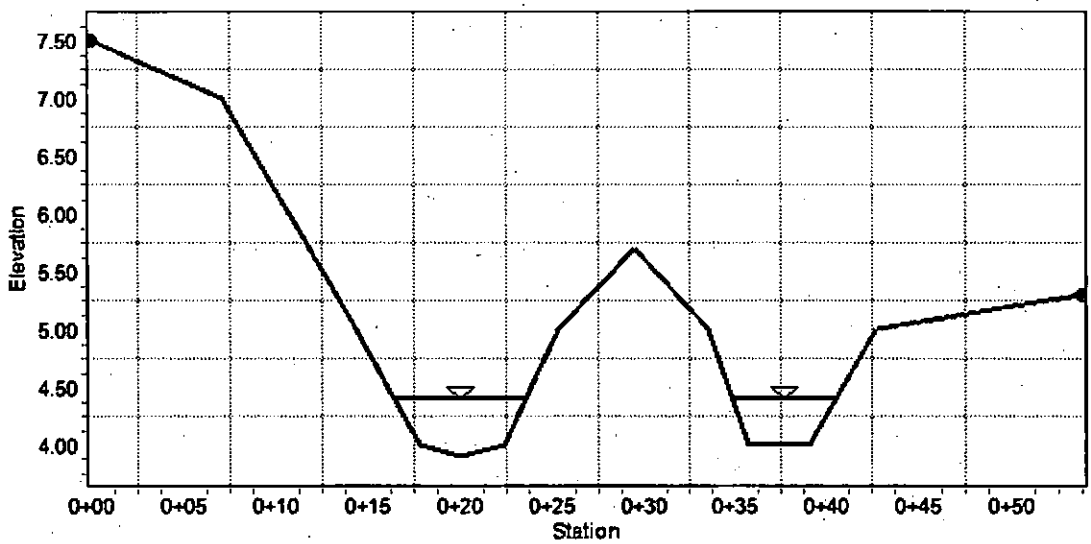
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Normal Depth	0.51	ft
Discharge	18.80	ft³/s

Cross Section Image



Worksheet for Cross Section A_Prop_With Project

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	22.90	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	7.50
0+07	7.00
0+11	6.00
0+14	5.00
0+18	4.00
0+20	3.90
0+22	4.00
0+25	5.00
0+30	5.70
0+34	5.00
0+36	4.00
0+39	4.00
0+43	5.00
0+54	5.30

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 7.50)	(0+54, 5.30)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Cross Section A_Prop_With Project

Results

Normal Depth		0.56	ft
Elevation Range	3.90 to 7.50 ft		
Flow Area		5.19	ft²
Wetted Perimeter		13.87	ft
Hydraulic Radius		0.37	ft
Top Width		13.56	ft
Normal Depth		0.56	ft
Critical Depth		0.63	ft
Critical Slope		0.02446	ft/ft
Velocity		4.41	ft/s
Velocity Head		0.30	ft
Specific Energy		0.86	ft
Froude Number		1.26	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.56	ft
Critical Depth	0.63	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.02446	ft/ft

Cross Section for Cross Section A_Prop_With Project

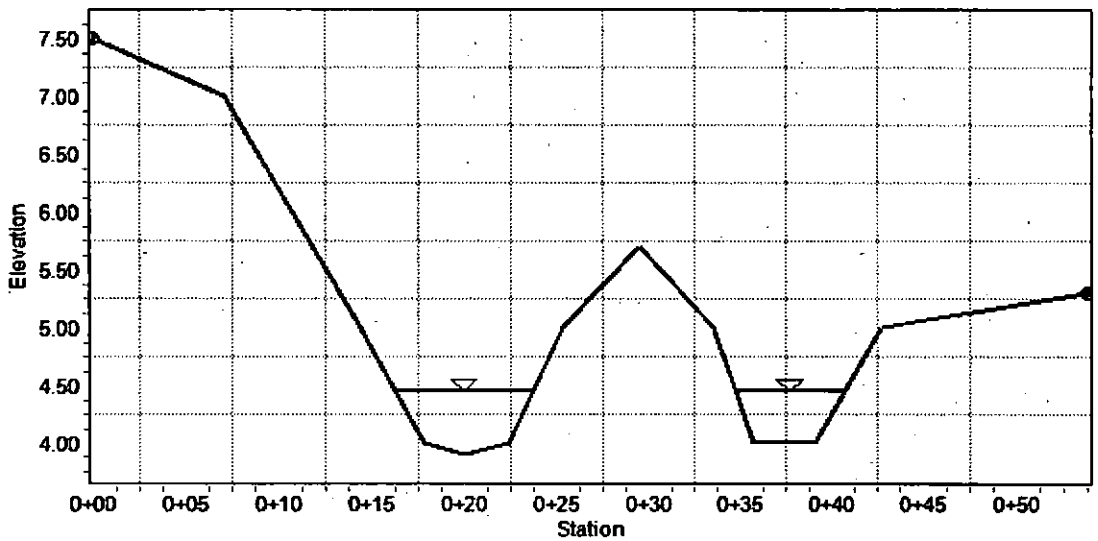
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Normal Depth	0.56	ft
Discharge	22.90	ft³/s

Cross Section Image



GRATE INLET SIZING CALCULATIONS

City of Scottsdale, Drainage Policies and Standards Manual, 2010. "The maximum depth of ponded water within any parking lot location shall be 1 foot." Section 6.10.7, Page 6-44. All calculations assume weir flow.

Inlet operating as weir:

$$Q_i = C_W \left(\frac{P}{2}\right) d^{1.5}$$

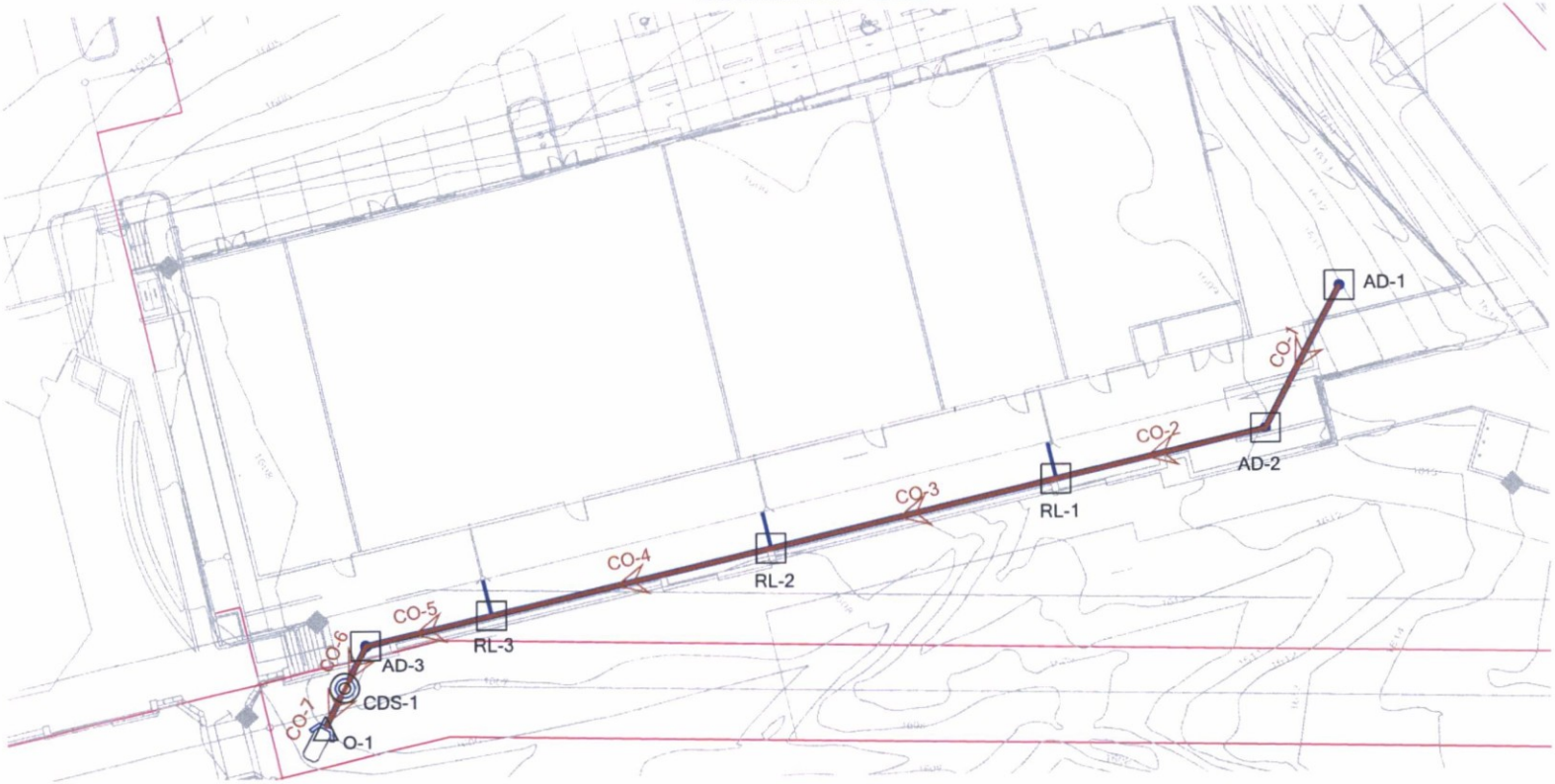
Where:

Q_i = Flow capacity of the inlet (cfs)
C_W = Weir Coefficient (3.0)
P = Perimeter of the grate disregarding side against
d = Depth of water of grate (ft)
C_f = Clogging Factor (2)

Inlet ID	Description	Proposed Inlet	Design Discharge	Clogging Factor	Weir Coefficient	Perimeter of Proposed Inlet	Depth
			Q_i	C_f	C_w	P	d
(ID)		(Type)	(cfs)			(ft)	(ft)
AD-1	1P-1 Area Drain	Nyloplast 12" Standard Grate Inlet	0.3	2	3.0	3.14	0.16
AD-2	1P-2 Area Drain	Nyloplast 12" Standard Grate Inlet	0.9	2	3.0	3.14	0.33
AD-3	1P-6 Area Drain	Nyloplast 12" Standard Grate Inlet	0.3	2	3.0	3.14	0.16

None of the calculated ponding depths exceed the maximum 1-ft established by City of Scottsdale *DPSM, 2010.*

Scenario: Base



FlexTable: Catch Basin Table

Label	Elevation (Ground) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation (Invert) (ft)	Inlet Type	Capture Efficiency (Calculated) (%)	Inlet Location	Headloss Method	HEC-22 Benching Method	Flow (Local In) (cfs)	Flow (Total Out) (cfs)
AD-1	8.65	7.44	7.44	6.20	Full Capture	100.0	In Sag	HEC-22 Energy (Second Edition)	Depressed	0.30	0.30
AD-2	8.80	7.43	7.40	5.60	Full Capture	100.0	In Sag	HEC-22 Energy (Second Edition)	Depressed	0.90	1.20
RL-1	8.60	7.35	7.35	5.27	Full Capture	100.0	In Sag	HEC-22 Energy (Second Edition)	Depressed	0.80	2.00
RL-2	8.30	7.19	7.18	4.83	Full Capture	100.0	In Sag	HEC-22 Energy (Second Edition)	Depressed	0.60	2.60
RL-3	8.40	6.91	6.89	4.40	Full Capture	100.0	In Sag	HEC-22 Energy (Second Edition)	Depressed	1.20	3.80
AD-3	8.80	6.64	6.27	4.20	Full Capture	100.0	In Sag	HEC-22 Energy (Second Edition)	Depressed	0.30	4.10

FlexTable: Manhole Table

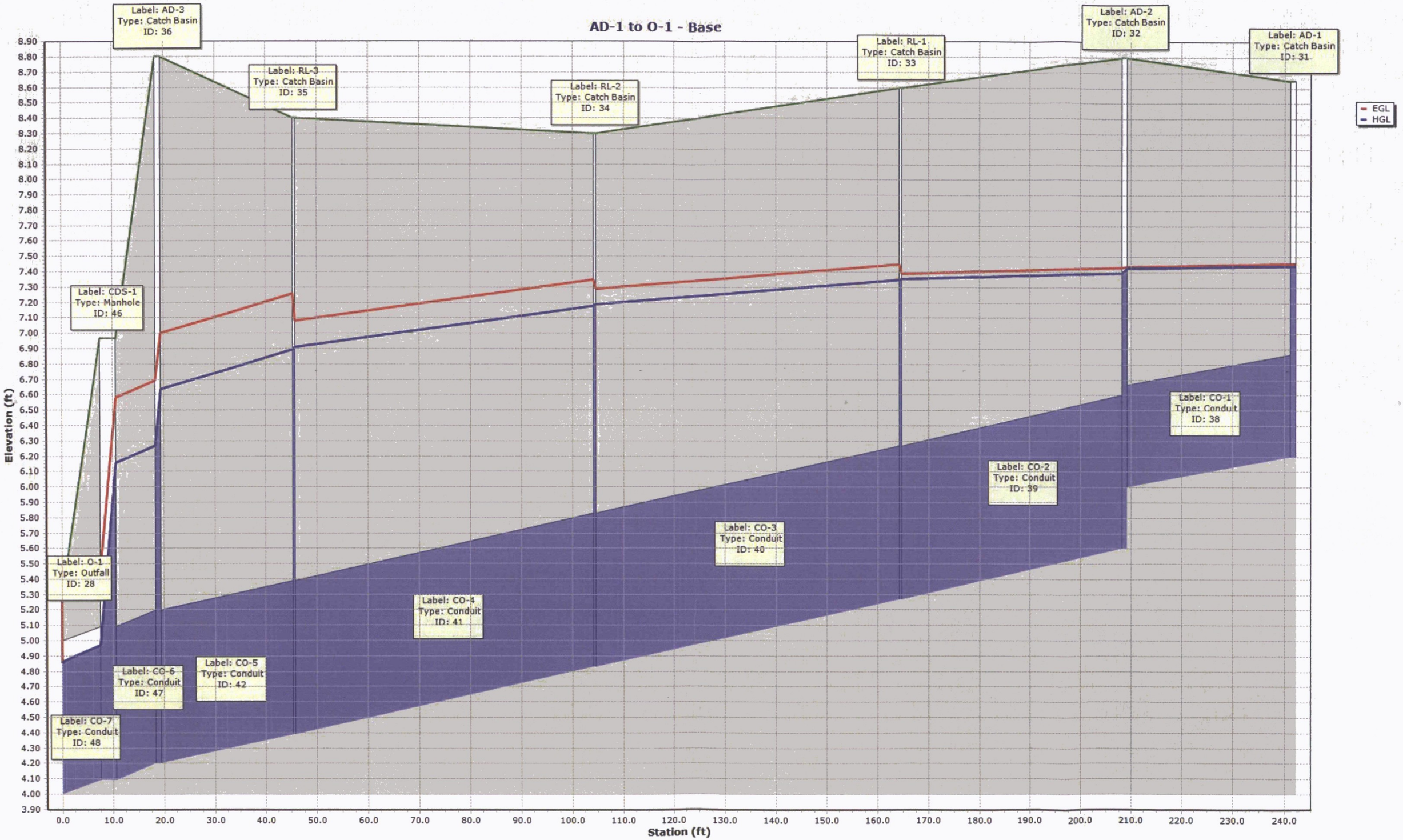
ID	Label	Elevation (Rim) (ft)	Elevation (Invert In 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Headloss Method	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
46	CDS-1	6.97	4.09	4.10	0.88	Absolute	1.19	6.16	4.97

FlexTable: Conduit Table

Label	Start Node	Stop Node	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Cover (Start) (ft)	Cover (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Slope (Calculated) (ft/ft)	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Manning's n	Length (Scaled) (ft)	Velocity (ft/s)	Flow Depth (Out) (ft)	Depth (Critical) (ft)	Area (Flow) (ft²)
CO-1	AD-1	AD-2	8.65	8.80	6.20	6.00	1.78	2.13	7.44	7.43	0.006	0.30	1.02	8.0	0.012	33.0	0.86	1.43	0.25	0.12
CO-2	AD-2	RL-1	8.80	8.60	5.60	5.27	2.20	2.33	7.40	7.35	0.007	1.20	3.33	12.0	0.012	44.2	1.53	2.08	0.46	0.31
CO-3	RL-1	RL-2	8.60	8.30	5.27	4.83	2.33	2.47	7.35	7.19	0.007	2.00	3.30	12.0	0.012	60.1	2.55	2.36	0.60	0.45
CO-4	RL-2	RL-3	8.30	8.40	4.83	4.40	2.47	3.01	7.18	6.91	0.007	2.60	3.31	12.0	0.012	59.0	3.31	2.52	0.69	0.56
CO-5	RL-3	AD-3	8.40	8.80	4.40	4.20	3.01	3.60	6.89	6.64	0.007	3.80	3.31	12.0	0.012	26.5	4.84	2.44	0.83	0.79
CO-6	AD-3	CDS-1	8.80	6.97	4.20	4.09	3.60	1.87	6.27	6.16	0.011	4.10	4.04	12.0	0.012	9.8	5.22	2.07	0.86	0.70
CO-7	CDS-1	O-1	6.97	5.30	4.09	4.00	1.87	0.30	4.97	4.86	0.010	4.10	3.89	12.0	0.012	9.1	5.60	0.86	0.86	0.73

FlexTable: Outfall Table

ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
28	O-1	5.30	True	4.00	User Defined Tailwater	4.51	4.86	4.10


AD-1 to O-1 - Base
Label: AD-3
Type: Catch Basin
ID: 36
Label: RL-3
Type: Catch Basin
ID: 35
Label: RL-2
Type: Catch Basin
ID: 34
Label: RL-1
Type: Catch Basin
ID: 33
Label: AD-2
Type: Catch Basin
ID: 32
Label: AD-1
Type: Catch Basin
ID: 31
EGL
HGL
Label: CDS-1
Type: Manhole
ID: 46
Label: CO-1
Type: Conduit
ID: 38
Label: CO-2
Type: Conduit
ID: 39
Label: CO-3
Type: Conduit
ID: 40
Label: O-1
Type: Outfall
ID: 28
Label: CO-4
Type: Conduit
ID: 41
Label: CO-5
Type: Conduit
ID: 42
Label: CO-6
Type: Conduit
ID: 47
Label: CO-7
Type: Conduit
ID: 48
Elevation (ft)
8.90
8.80
8.70
8.60
8.50
8.40
8.30
8.20
8.10
8.00
7.90
7.80
7.70
7.60
7.50
7.40
7.30
7.20
7.10
7.00
6.90
6.80
6.70
6.60
6.50
6.40
6.30
6.20
6.10
6.00
5.90
5.80
5.70
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5.50
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5.20
5.10
5.00
4.90
4.80
4.70
4.60
4.50
4.40
4.30
4.20
4.10
4.00
3.90
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
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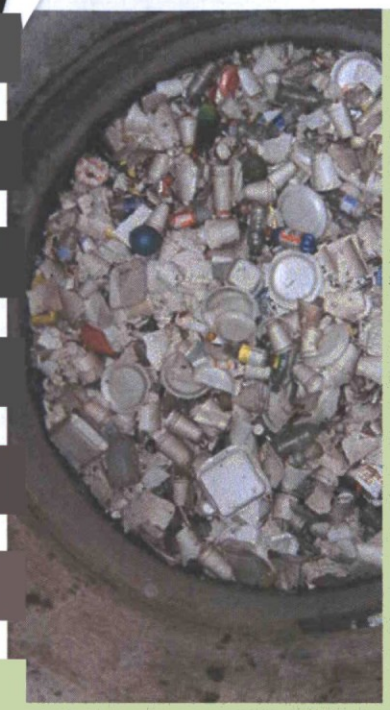
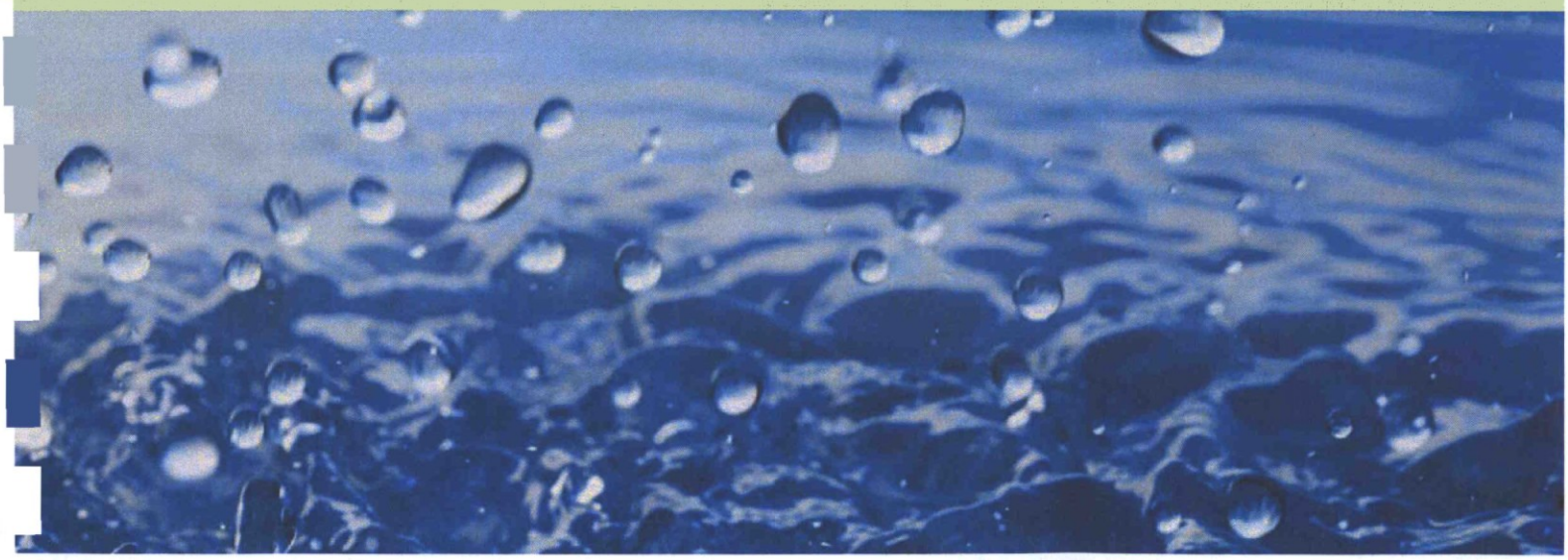
220.0
230.0
240.0
Station (ft)



CONTECH®
ENGINEERED SOLUTIONS

CDS®

Solutions Guide

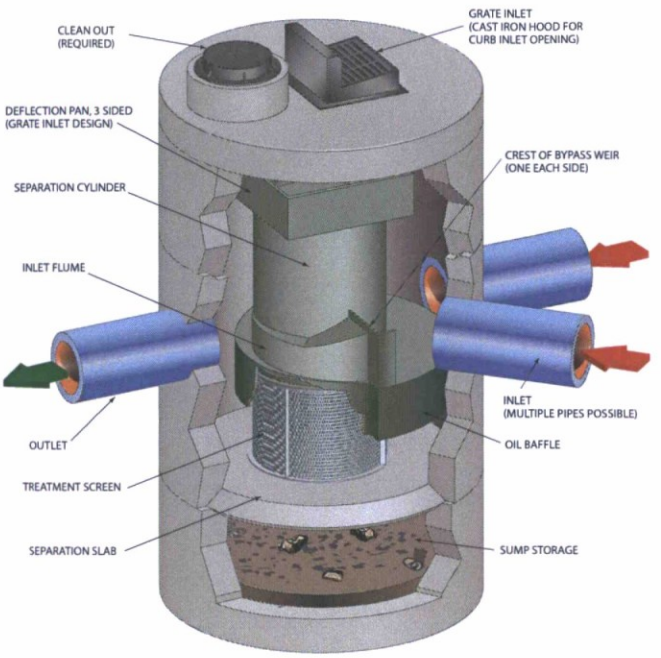


Continuous Deflective Separation - CDS®

Superior Stormwater Trash and Sediment Removal

The CDS is a swirl concentrator hybrid technology that uses continuous deflective separation – a combination of swirl concentration and indirect screening to screen, separate and trap debris, sediment, and hydrocarbons from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material debris 2.4 mm or larger, without binding. CDS retains all captured pollutants, even at high flow rates, and provides easy access for maintenance.

CDS is used to meet trash Total Maximum Daily Load (TMDL) requirements, for stormwater quality control, inlet and outlet pollution control, and as pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and a variety of green infrastructure practices.



Learn more about the CDS system at www.ContechES.com/CDS

CDS® Approvals

CDS has been verified by some of the most stringent stormwater technology evaluation organizations in North America, including:

- Washington State Department of Ecology
- New Jersey Department of Environmental Protection
- Canadian Environmental Technology Verification (ETV)
- California Statewide Trash Amendments Full Capture System Certified*

Performance Claim Verified by the Canadian ETV Program

** The CDS System has been certified by the California State Water Resources Control Board as a Full Capture System provided that it is sized to treat the peak flow rate from the region specific 1-year, 1-hour design storm, or the peak flow capacity of the corresponding storm drain, whichever is less.*

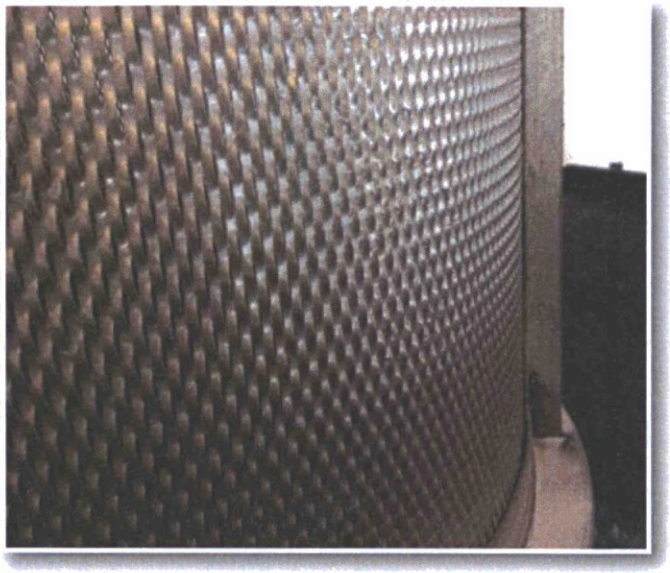
CDS® Features & Benefits

Feature	Benefit
1. Captures and retains 100% of floatables and neutrally buoyant debris 2.4 mm or larger	1. Superior pollutant removal
2. Self-cleaning screen	2. Ease of maintenance
3. Isolated storage sump eliminates scour potential	3. Excellent pollutant retention
4. Internal bypass	4. Eliminates the need for additional structures
5. Multiple pipe inlets and 90-180° angles	5. Design flexibility
6. Numerous regulatory approvals	6. Proven performance

The CDS® Screen

Traditional approaches to trash control typically involve "direct screening" that can easily become clogged, as trash is pinned to the screen as water passes through. Clogged screens can lead to flooding as water backs up.

The design of the CDS screen is fundamentally different. Flow is introduced to the screen face which is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder.

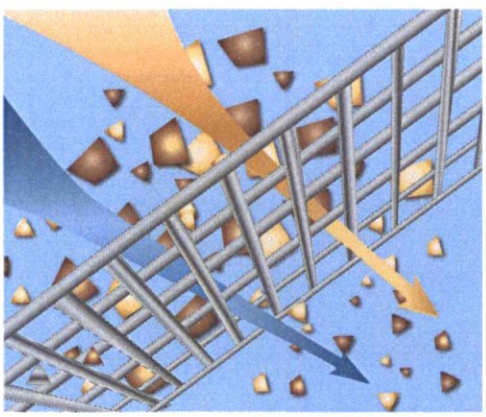


Key Features:

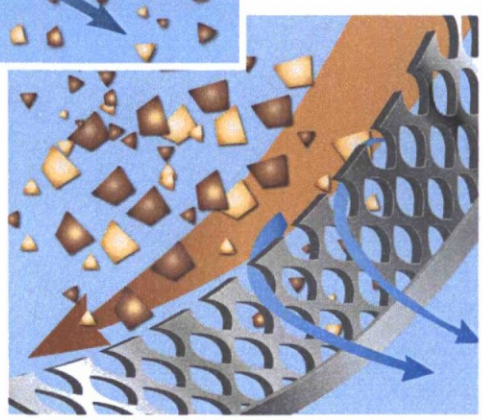
Self-Cleaning Screening Technology

- CDS Screen captures neutrally buoyant materials missed by other separator systems.
- Screen is hydraulically designed to be self-cleaning.
- Runoff entering the separation cylinder must pass through the screen prior to discharge, eliminating potential for scouring previously captured trash at high flow rates.

The CDS Screen – Self-Cleaning Screening Technology ❖ ❖ ❖



Direct Screening – particles that are larger than the aperture size of the screen can cause clogging, resulting in flooding if not maintained frequently.



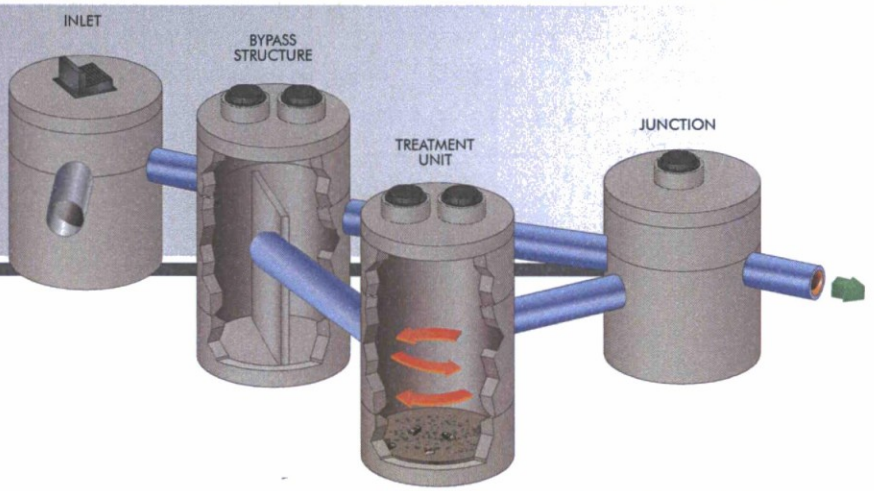
Continuous Deflective Separation Indirect Screening – water velocities within the swirl chamber continually shear debris off the screen to keep it clean.

CDS® Configuration - One System that Can Do It All!

The CDS effectively treats stormwater runoff while reducing the number of structures on your site.

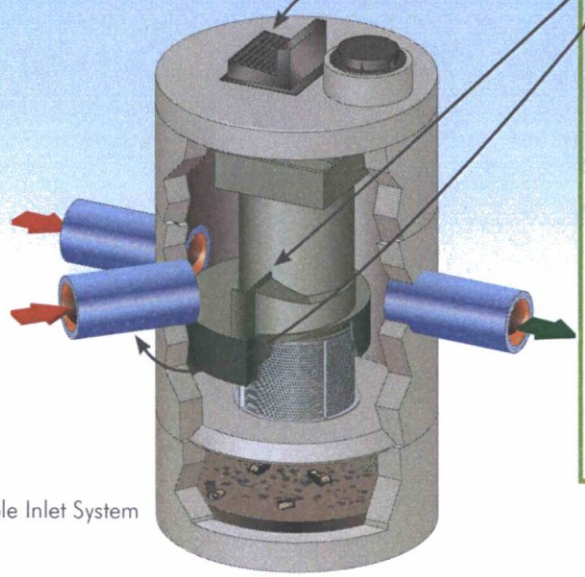
WHY GO THROUGH ALL THIS?

TRADITIONAL STORMWATER TREATMENT SITE DESIGN



ONE SYSTEM CAN DO IT ALL!

- Inline, offline, grate inlet, and drop inlet configurations available
- Internal and external peak bypass options available



CDS® Multiple Inlet System

Save Time, Space, and Money with CDS®

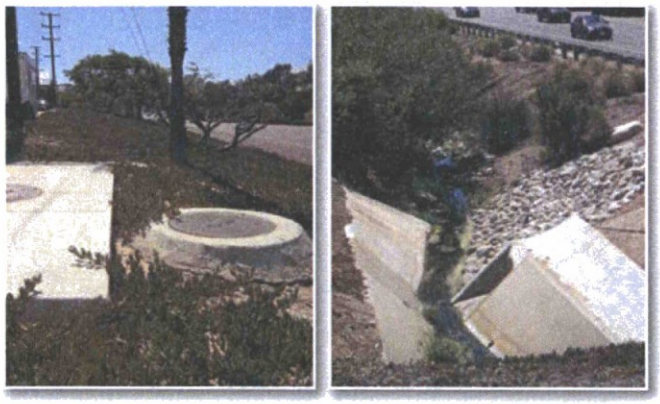
- Grate inlet option available
- Internal bypass weir
- Accepts multiple inlets at a variety of angles
- Advanced hydrodynamic separator
- Captures and retains 100% of floatables and neutrally buoyant debris 2.4 mm or larger
- Indirect screening capability keeps screen from clogging
- Retention of all captured pollutants, even at high flows
- Performance verified by NJCAT, WA Ecology, and ETV Canada

CDS® Applications

CDS is commonly used in the following stormwater applications:

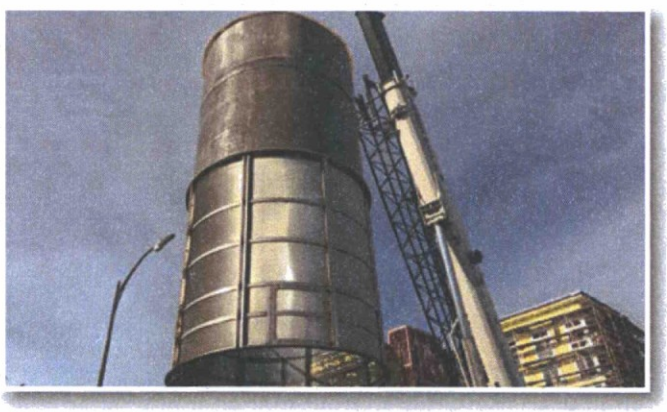
- Stormwater quality control – trash, debris, sediment, and hydrocarbon removal
- Urban retrofit and redevelopment
- Inlet and outlet protection
- Pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and Low Impact Development designs.

CDS provides trash control.



CDS pretreats a bioswale.

CDS pretreats a rainwater harvesting cistern.



CDS standalone system removes trash and sediment.

CDS® Models and Capacities

	CDS MODEL	Treatment Flow Rates[1]			Estimated Maximum Peak Conveyance Flow[3] (cfs)/(L/s)	Minimum Sump Storage Capacity[4] (yd^3)/(m^3)	Minimum Oil Storage Capacity[4] (gal)/(L)
		75 microns (cfs)/(L/s)	125 microns[2] (cfs)/(L/s)	Trash & Debris (cfs)/(L/s)			
PRECAST	CDS2015-4	0.5 (14.2)	0.7 (19.8)	1.0 (28.3)	10 (283)	0.9 (0.7)	61 (232)
	CDS2015-5	0.5 (14.2)	0.7(19.8)	1.0 (28.3)	10 (283)	1.5 (1.1)	83 (313)
	CDS2020-5	0.7 (19.8)	1.1 (31.2)	1.5 (42.5)	14 (396)	1.5 (1.1)	99 (376)
	CDS2025-5	1.1 (31.2)	1.6 (45.3)	2.2 (62.3)	14 (396)	1.5 (1.1)	116 (439)
	CDS3020-6	1.4 (39.6)	2.0 (56.6)	2.8 (79.3)	20 (566)	2.1 (1.6)	184 (696)
	CDS3025-6	1.7 (48.1)	2.5 (70.8)	3.5 (99.2)	20 (566)	2.1 (1.6)	210 (795)
	CDS3030-6	2.0 (56.6)	3.0 (85.0)	4.2 (118.9)	20 (566)	2.1 (1.6)	236 (895)
	CDS3035-6	2.6 (73.6)	3.8 (106.2)	5.3 (150.0)	20 (566)	2.1 (1.6)	263 (994)
	CDS4030-8	3.1 (87.7)	4.5 (127.4)	6.3 (178.3)	30 (850)	5.6 (4.3)	426 (1612)
	CDS4040-8	4.1 (116.1)	6.0 (169.9)	8.4 (237.8)	30 (850)	5.6 (4.3)	520 (1970)
	CDS4045-8	5.1 (144.4)	7.5 (212.4)	10.5 (297.2)	30 (850)	5.6 (4.3)	568 (2149)
	CDS5640-10	6.1 (172.7)	9.0 (254.9)	12.6 (356.7)	50 (1416)	8.7 (6.7)	758 (2869)
	CDS5653-10	9.5 (268.9)	14.0 (396.5)	19.6 (554.8)	50 (1416)	8.7 (6.7)	965 (3652)
	CDS5668-10	12.9 (365.1)	19.0 (538.1)	26.6 (752.9)	50 (1416)	8.7 (6.7)	1172 (4435)
	CDS5678-10	17.0 (481.2)	25.0 (708.0)	35.0 (990.7)	50 (1416)	8.7 (6.7)	1309 (4956)
	CDS9280-12	27.2 (770.2)	40.0 (1132.7)	56.0 (1585.7)	Offline	16.8 (12.8)	N/A
	CDS9290-12	35.4 (1002.4)	52.0 (1472.5)	72 (2038.8)		16.8 (12.8)	
	CDS92100-12	42.8 (1212.0)	63.0 (1783.9)	88 (2491.9)		16.8 (12.8)	
CAST-IN-PLACE	CDS150134-22	100.7 (2851.5)	148.0 (4190.9)	270 (7645.6)		56.3 (43.0)	
	CDS200164-26	183.6 (5199.0)	270.0 (7645.6)	378.0 (10703.8)		78.7 (60.2)	
	CDS240160-32	204 (5776.6)	300.0 (8495.1)	420.0 (8495.1)		119.1 (91.1)	
	Additional Cast-in-Place models available upon request.						

1. Alternative PSD/D_{50} sizing is available upon request.
2. 125 micron flows are based on the CDS Washington State Department of Ecology approval for 80% removal of a particle size distribution (PSD) having a mean particle size (D_{50}) of 125 microns.
3. Estimated maximum peak conveyance flow is calculated using conservative values and may be exceeded on sites with lower inflow velocities and sufficient head over the weir.
4. Sump and oil capacities can be customized to meet site needs

CDS® Maintenance

Systems vary in their maintenance needs, and the selection of a cost-effective and easy-to-access treatment system can mean a huge difference in maintenance expenses for years to come.

A CDS unit is designed to minimize maintenance and make it as easy and inexpensive as possible to keep our systems working properly.

Most CDS units can easily be cleaned in 30 minutes.

Inspection

Inspection is the key to effective maintenance. Pollutant deposition and transport may vary from year to year and site to site. Semi-annual inspections will help ensure that the system is cleaned out at the appropriate time. Inspections should be performed more frequently where site conditions may cause rapid accumulation of pollutants.

Recommendations for CDS Maintenance

The recommended cleanout of solids within the CDS unit's sump should occur at 75% of the sump capacity. Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection and cleanout of the separation chamber and sump, and another allows inspection and cleanout of sediment captured and retained behind the screen. A vacuum truck is recommended for cleanout of the CDS unit and can be easily accomplished in less than 30 minutes for most installations.

DYOHDS™ Tool

Design Your Own Hydrodynamic Separator

Features

- Choose from three HDS technologies - CDS®, Vortechs® and VortSentry® HS
- Site specific questions ensure the selected unit will comply with site constraints
- Unit size based on selected mean particle size and targeted removal percentage
- Localized rainfall data allows for region specific designs
- PDF report includes detailed performance calculations, specification and standard drawing for the unit that was sized

DYO Project design made easy.

Design Your Own (DYO) Hydrodynamic Separator online at www.ContechES.com/dyohds

Next Steps

Learn more

See our CDS systems in action at **www.ContechES.com/videos**

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FSC

HYDRAULIC DESIGN SUMMARY FOR INLINE MODEL CDS2020

The following hydraulic summary supports the design of the CDS model proposed on the McDowell Mountain Marketpalce-Lot 2 project located in Scottsdale, AZ . The attached hydraulic calculations supporting the proposed CDS structure's design serve two purposes.

1. To ensure the proposed CDS model will achieve the design treatment capacity under the site-specific hydraulic conditions.

The proposed CDS model CDS2020 unit is designed to process a treatment flow of 1.1-cfs. Under the site-specific conditions, the proposed diversion weir will generate the operational energy necessary to achieve the 1.1-cfs design treatment flow rate.

$$Q_{FF} = C\frac{P_{FF}}{T_C}A$$ FCDMC Std. 6.4.1

where:
- Q_{FF}= minimum First Flush discharge (cfs)
- C= runoff coefficient (set=1)
- P_{FF}= first 0.5-in of direct runoff (in)
- I_C= Time of Conc. of the upstream watershed (hr)
- A= area of project site (ac)

$$Q_{FF} = (1)\frac{(0.5)}{(0.25)}(0.53) = \underline{\quad 1.1 \quad} \text{ cfs}$$

2. To quantify the hydraulic losses introduced to the conveyance system under peak design conditions.

A flow of 4.1-cfs represents the peak discharge generated by the contributing drainage area for a design storm having a 100 year return interval. Under these peak design conditions, all of the 4.1-cfs flow is assumed to be conveyed over the diversion weir. This conservative assumption predicts the worst-case resulting hydraulic condition and preserves the integrity of this calculation even if the structure is not properly maintained.

Based on the information provided, the proposed CDS model CDS2020 is predicted to increase the upstream Hydraulic Gradeline (ΔHGL) by 0.X ft for the above cited peak design flow.

$$\Delta HGL = H_{CDS} = \underline{\quad 1.19 \quad} \text{ ft}$$

The effective headloss coefficient across the proposed CDS model CDS2020 for the 100-year storm event may be estimated as a function of the velocity in the downstream pipe.

where, $K_{CDS} = CDS\ Headloss\ Coefficient$:

$$K_{CDS} = \frac{H_{CDS}}{\left[V_{d/s}{}^2/2g\right]} = \underline{\quad 2.44 \quad}$$

If a software program is being used to develop the Hydraulic Gradeline (HGL) for the upstream conveyance system, the values listed above for HCDS and/or KCDS can be used as either a headloss factor to be multipled by the downstream velocity head, or input the headloss amount for the proposed CDS model at the corresponding node.

INLINE HYDRUALIC CALCULATIONS

DESIGN PARAMETERS:

CDS Model No.=	CDS2020	
Design Treatment Flow (Q)=	1.1	cfs
Peak Design Flow=	4.1	cfs
Peak Design Return Interval=	100	year
Rim Elevation @ US Structure=	1608.80	ft

PIPE CHARACTERISTICS:

Pipe Diameter=	12	in
Pipe Slope=	0.010	ft/ft
Manning's N=	0.012	

FLOW CHARACTERISTICS:

Depth of Flow (D_F)=	0.86	ft
Area of Flow (A_F)=	0.73	sf
Wetted Perimeter (P_W)=	2.4	ft
Hydraulic Radius (R)=	0.3	ft

DETAILED CALCULATIONS (TREATMENT FLOW)

Tailwater Condition at Outfall: EL_0= 1604.51 ft

Exit Loss from DownStream Pipe, h_1:

$$h_1 = k\left[\frac{V^2}{2g}\right], \quad V = \frac{Q}{A_F}$$

k= 1.00
V= 1.51 fps
g= 32.2 ft/sec^2

$$EGL_1 = EL_0 + h_1$$

h_1= 0.04 ft

EGL_1= 1604.55 ft

Head Loss Through DS Pipe, h2:

$$h_2 = S_{EGL}L, \quad S_{EGL} = \left(\frac{Qn}{1.49A_F R^{2/3}}\right)^2$$

L= 7 ft
S_{EGL}= 0.16 ft/ft

$$EGL_2 = EGL_1 + h_2$$

h_2= 1.15 ft

EGL_2= 1605.69 ft

Check Entrance Condition for Critical Depth Control:

$EL_{CDSInv.}$= 1604.10 ft
d_c= 0.86 ft

$$EGL_C = EL_{CDSInv.} + d_c + \frac{V_{dc}^2}{2g}$$

Controlling EGL:

EGL_C= 1605.49 ft

Re-entry Loss into DS Pipe, h_3=

$$h_3 = k\left[\frac{V^2}{2g}\right] \quad , \quad V = \frac{Q}{A} \quad \text{(area based on entry depth)}$$

k= 0.20
A_{Fdc}= 0.77 sf
V= 1.43 fps

$$EGL_3 = EGL_2 + h_3$$

h_3= 0.01 ft	
EGL_3= 1605.50 ft	

Oil Baffle Loss, h_4=

$$h_4 = k\left[\frac{V^2}{2g}\right] \quad , \quad V = \frac{Q}{A_{Baffle}}$$

k= 1.00
A_{Baffle}= 4.51 sf
V= 0.24 fps

$$EGL_4 = EGL_3 + h_4$$

h_4= 0.0009 ft	
EGL_4= 1605.50 ft	

Appendix D: Reference Material

6) Master Drainage Report prepared by David Evans & Associates (2001)
7) Master Drainage Report (2001)-Drainage Exhibit
8) Master Drainage Report (2001)-Conceptual Grading & Drainage Plan

MASTER

~~PRELIMINARY~~

DRAINAGE REPORT

McDOWELL MOUNTAIN VILLAGE CENTER SWC BELL ROAD AND THOMPSON PEAK PARKWAY

FILE COPY

APPROVED IN CONCEPT
FOR CASE # 69-DR-00
SUBMIT A FINAL DRAINAGE
REPORT WITH FINAL PLANS
REVIEWED BY _____ DATE 8/7/00

69-DR-00

JUNE 2000
DEA PROJECT NO. CNTR0001

DAVID EVANS AND ASSOCIATES, INC.

PRELIMINARY DRAINAGE REPORT
FOR

McDOWELL MOUNTAIN VILLAGE CENTER SWC BELL ROAD AND THOMPSON PEAK PARKWAY

PREPARED FOR

CENTREFUND
7702 E. DOUBLETREE RANCH ROAD
SUITE 300
SCOTTSDALE, ARIZONA 85258

PREPARED BY

Jeff M. Hunter P.E.
DAVID EVANS AND ASSOCIATES, INC.
7878 N. 16TH STREET
PHOENIX, AZ 85020
(602) 678-5151

JUNE 2000
DEA PROJECT NO. CNTR0001

TABLE OF CONTENTS

1.0 INTRODUCTION

This Preliminary Drainage Report has been prepared under a contract from Centrefund, Owner/Developer of the proposed commercial project at the southwest corner of Bell Road and Thompson Peak Parkway. This site will be part of the McDowell Mountain Ranch Master Community. The purpose of this report is to provide the hydrologic and hydraulic analyses, required by the City of Scottsdale, to support the commercial lot development. Preparation of this report has been done in accordance with the procedures detailed in the City of Scottsdale's *Design Standards and Policies Manual, Chapter 2* (Reference 1).

The project site is located in the City of Scottsdale, in the northern portion of Section 5, Township 3 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. More specifically, the site is located in Parcel R of the McDowell Mountain Ranch Master Community and is bounded by Thompson Peak Parkway on the east, Bell Road on the north and a proposed commercial development on the south. With the development of this project and the commercial site on the south, 100th Street will be built along the western project boundary. Access to the site will be provided by 100th Street, Thompson Peak Parkway and Bell Road. Figure 1, located in Appendix A, illustrates the location of the project site in relation to the City of Scottsdale's street system.

N½

2.0 EXISTING DRAINAGE CONDITIONS

The proposed project site is a 17 acre undeveloped parcel, with significant native vegetation. The site has a general slope to the southwest of about 4.0 percent. As part of the McDowell Mountain Ranch Master Community, storm water drainage is addressed in the Master Drainage Report (Reference 2). In its undeveloped condition, runoff generated upstream of the project site, west of Thompson Creek Parkway, is conveyed through the project site by the historic drainage corridors.

NOT ACCORDING TO YOUR DRAINAGE EXHIBIT SEE NEXT PAGE - SECTION 3.1

The flood hazard zones determined in the area were derived from the *Scottsdale Area Drainage Master Study* prepared by Boyle Engineering Corp. (Reference 3). The study determines the ponding elevations caused by the canals and other obstructions in the area. The current published FEMA Flood Insurance Rate Map (FIRM) for this area, map number 04013C1265 E (Effective date December 3, 1993), shows the project site is entirely within flood hazard Zone X. Zone X is defined as "Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood". A copy of the FIRM is located in Appendix B.

3.0 PROPOSED DRAINAGE CONCEPT

The proposed drainage concept is presented in three parts: off-site drainage conveyance, on-site drainage conveyance, and on-site storm water retention. See Exhibit A, located in the back pocket, for graphical illustration of the proposed drainage concept.

3.1 Off-site Drainage Conveyance

Runoff from Thompson Peak Boulevard is intercepted by an existing storm drain inlet approximately 750ft south of the Thompson Peak and Bell Road intersection and outfalls into an existing wash, south of the proposed development. Bell Road runoff is intercepted by an existing storm drain inlet located approximately 950ft west of the intersection. This drain connects to the storm drain crossing under Bell Road, which outfalls into wash "G" (See exhibit B). 100th Street drains to the southwest and is conveyed overland to the existing wash "G".

Runoff, approximately 123 cfs for the 100-year storm, currently flows from under Bell Road, southwest through wash "G" and continues to a regional B.O.R. detention facility south of the development. Additionally, 109 cfs for the 100-year storm historically entered the site from the northwest and combined with Wash "G". When Thompson Peak Parkway was developed, the historic 109 cfs was re-directed south along the west side of Thompson Peak to the B.O.R. regional detention facility.

3.2 On-site Drainage Conveyance

The on-site drainage is divided into several sub-areas. Runoff from these areas will enter a piped conveyance system via catch basins or manholes. This conveyance system will combine the onsite and offsite flows in a series of pipes, direct the flows to the southwest corner of the site, and outfall directly into the Wash "G.

3.3 On-site Storm Water Retention

PAGE 5 of MDR

According to Sandra Lie, City of Scottsdale, the development within Parcel "R" (see exhibit B) drains to the B.O.R. detention area. Ms. Lie stated that if the developed site runoff does not exceed the pre-developed historical runoff rate, no on-site retention will be required. A preliminary analysis determined that the pre-developed 100-year storm discharge from our site to Wash "G" is 281.3 cfs. The developed 100-year discharge will be 226.2 cfs, therefore, this development will not significantly impact the existing downstream conditions. The developed peak flow at the outlet will not exceed pre-developed because 109cfs has been rerouted around the site via Thompson Peak Boulevard. The difference between the on-site pre-developed and post developed flow is approximately 70 cfs wich is less than the amount diverted by Thompson Peak Boulevard.

why because upstream waters have been cut off. BJ 2.

4.0 CONCLUSIONS

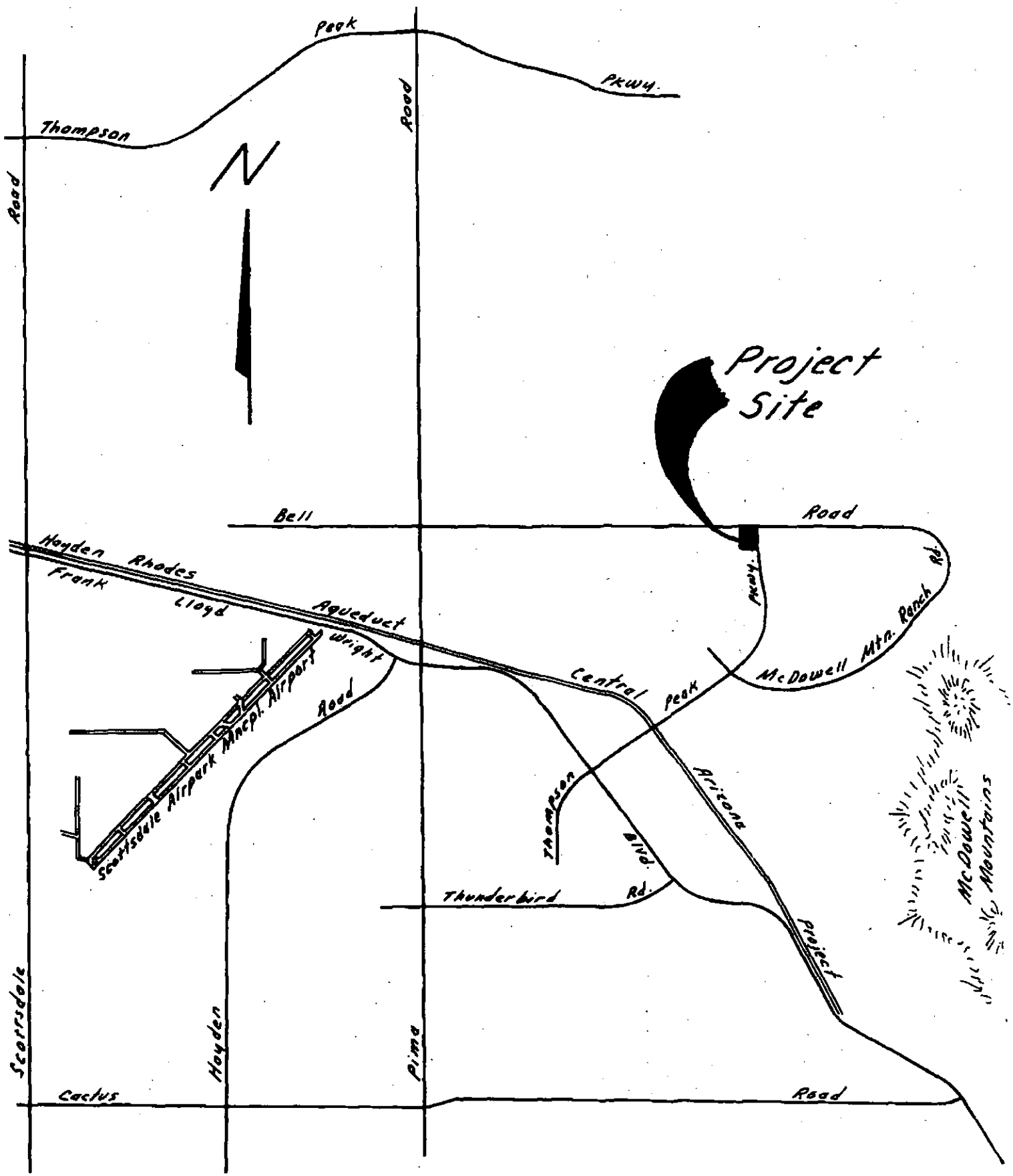
Based on the results of this study, it can be concluded that:

- The site is developed according to City of Scottsdale's *Design Standards and Policies Manual, Chapter 2.*
- Retention is not required.
- There will be no downstream flooding.
- The finish floor elevations are set a minimum 12 inches above the 100-year water surface elevation.

5.0 REFERENCES

1) City of Scottsdale's *Design Standards and Policies Manual, Chapter 2*, dated July, 1996
2) *Scottsdale Area Drainage Master Study* prepared by Boyle Engineering Corp., December, 1986
3) Master Drainage Report for McDowell Mountain Ranch Parcels "A"–"R" Prepared by Clouse Engineering, Inc. November 18, 1993
4) *Cathet at McDowell Mountain Ranch Phase II Prepared by Rick Engineering Co. March 27,2000*

APPENDIX A
(Figures)

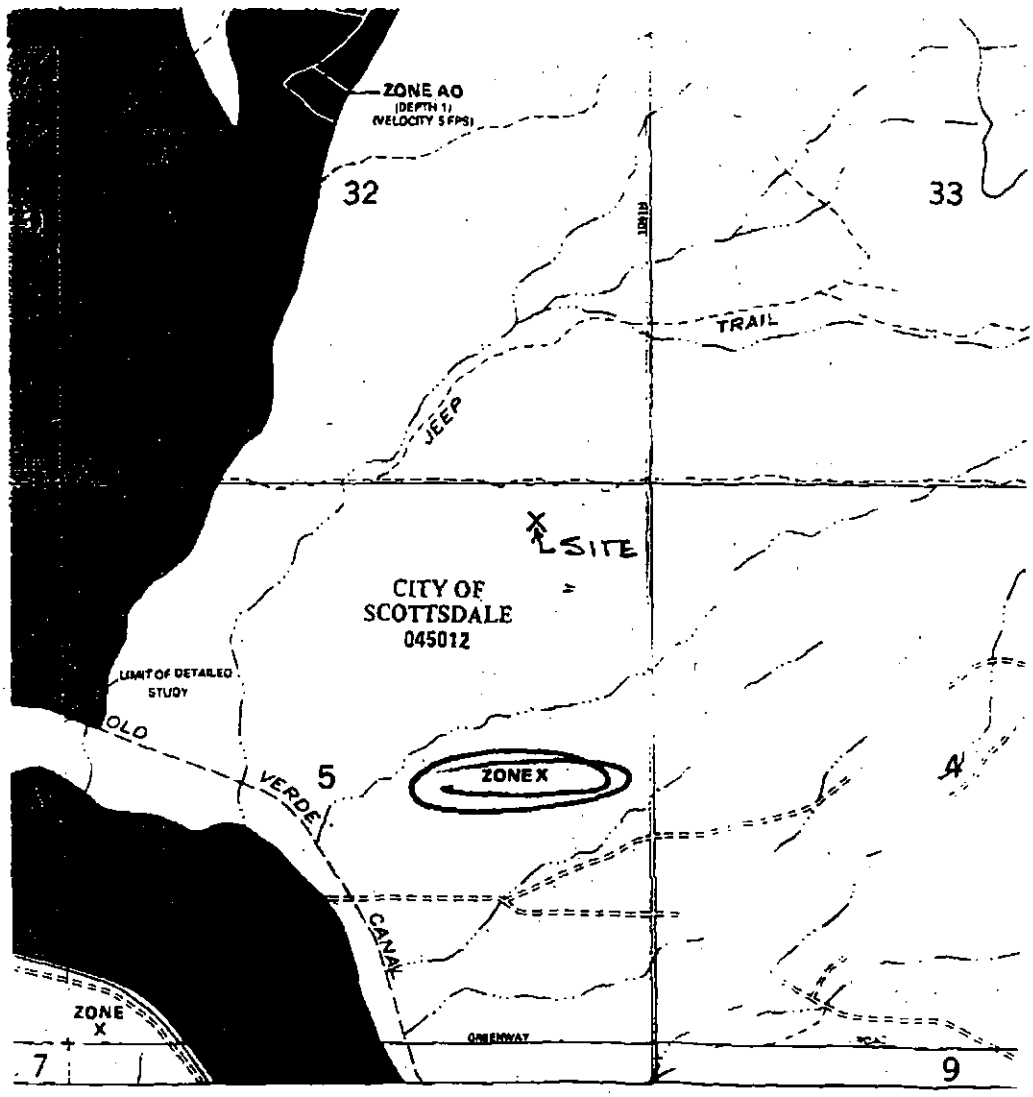


VICINITY MAP

N.T.S.

Figure 1

APPENDIX B
(FEMA Flood Insurance Rate Map)



PORTION OF PANEL SHOWING SITE

XXXX-0000 PH03810/28/97 08:10:58 drbo S:\CAD\FEMA\FEMABDR

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

$RM7_X$ — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

MAP LEGEND

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1265 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE CITY OF	045012	1265	E

MAP NUMBER
04013C1265 E

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency

FIRM PANEL

APPENDIX C
(Hydrologic Calculation and Data Sheets)

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Village Center Concentration Point: CP-1

Location: AREAS 1,3,4,5,6,7

Project No.: CNTR0001 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						13.38	Acres
	A2							Acres
	A3							Acres
	Total (A)						13.38	Acres
Drainage Length:							1300	Feet
Elevation								
Top of Drainage Area							1631.6	Feet
At Structure							1584.8	Feet
Drainage Area Slope							3.60	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):		2.4		3.9		5	5.8	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1						0.90	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)		29		47		72	87.3	cfs

Computed By: Jeff Hunter Date: 6/27/00

Checked By: Date:

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Village Center Concentration Point: CP-2

Location: AREA 8

Project No.: CNTR0001 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.54	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.54	Acres
Drainage Length:							250	Feet
Elevation								
Top of Drainage Area							1628.0	Feet
At Structure							1613.0	Feet
Drainage Area Slope							4.69	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):		2.4		3.9		5	5.8	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1						0.90	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)		3		5		8	10.0	cfs

Computed By: Jeff Hunter Date: 6/27/00

Checked By: Date:

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Village Center Concentration Point: CP-3

Location: AREA 2

Project No.: CNTR0001 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						2.44	Acres
	A2							Acres
	A3							Acres
	Total (A)						2.44	Acres
Drainage Length:							250	Feet
Elevation								
Top of Drainage Area							1601.5	Feet
At Structure							1584.5	Feet
Drainage Area Slope							4.47	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):		2.4		3.9		5	5.8	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1						0.90	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)		5		9		13	15.9	cfs

Computed By: Jeff Hunter Date: 6/27/00

Checked By: Date:

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Village Center Concentration Point: CP-3

Existing pre-developed conditions

Project No.: CNTR0001 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						17	Acres
	A2							Acres
	A3							Acres
	Total (A)						17	Acres
Drainage Length:							1300	Feet
Elevation								
Top of Drainage Area							1631.6	Feet
At Structure							1584.8	Feet
Drainage Area Slope							3.60	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):		2.4		3.9		5	5.8	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1						0.40	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)		16		27		41	49.3	cfs

Computed By: Jeff Hunter Date: 6/27/00

Checked By: Date:

FINAL DRAINAGE REPORT
FOR

McDOWELL MOUNTAIN MARKETPLACE

PREPARED FOR

McDOWELL MOUNTAIN MARKETPLACE, LLLP
6900 EAST 2ND STREET
SCOTTSDALE, ARIZONA 85251

PREPARED BY

GEOFFREY S. BROWNELL, E.I.T.
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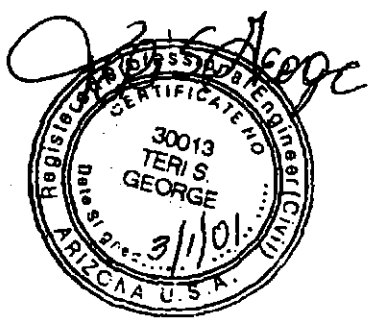
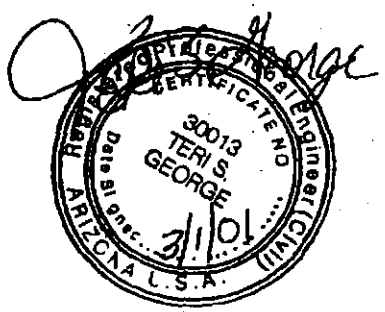
7878 N. 16TH STREET
PHOENIX, AZ 85020
(602) 678-5151



FEBRUARY 2001
DEA PROJECT NO. CNTR0002

TABLE OF CONTENTS



1.0 INTRODUCTION

This Final Drainage Report has been prepared under a contract from McDowell Mountain Marketplace, LLLP, Owner/Developer of the proposed commercial project at the southwest corner of Bell Road and Thompson Peak Parkway. This site will be part of the McDowell Mountain Ranch Master Planned Community. The purpose of this report is to provide the hydrologic and hydraulic analyses, required by the City of Scottsdale, to support the commercial lot development. Preparation of this report has been done in accordance with the procedures detailed in the City of Scottsdale's *Design Standards and Policies Manual, Chapter 2* (Reference 1).

The project site is located in the City of Scottsdale, in the northern portion of Section 5, Township 3 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. More specifically, the site is located in Parcel R of the McDowell Mountain Ranch Master Planned Community and is bounded by Thompson Peak Parkway on the east, Bell Road on the north and a residential development on the south. With the development of this project and the site on the south, 100th Street will be built along the western project boundary. Access to the site will be provided along 100th Street, Thompson Peak Parkway and Bell Road. Figure 1, located in Appendix A, illustrates the location of the project site in relation to the City of Scottsdale's street system.

2.0 EXISTING DRAINAGE CONDITIONS

The proposed project site is a 17 acre undeveloped parcel, currently vacant, with significant native vegetation. The site has a general slope to the southwest of about 4.0 percent. Several natural drainage corridors transport offsite runoff through the project site.

As part of the McDowell Mountain Ranch Master Planned Community, storm water drainage is addressed in the *Master Drainage Report for McDowell Mountain Ranch Parcels "A" – "R"* prepared by Clouse Engineering (Reference 2). In its undeveloped condition, runoff generated upstream of the project site is conveyed through the project site by the historic drainage corridors. This runoff is conveyed onto the project site via five 30" concrete pipes under Bell Road.

The flood hazard zones determined in the area were derived from the *Scottsdale Area Drainage Master Study* prepared by Boyle Engineering Corp. (Reference 3). The study determines the ponding elevations caused by the canals and other obstructions in the area. The current published FEMA Flood Insurance Rate Map (FIRM) for this area, map number 04013C1265 E (Effective date December 3, 1993), shows the project site is entirely within flood hazard Zone X. Zone X is defined as "Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood". A copy of the FIRM is located in Appendix B.

3.0 PROPOSED DRAINAGE CONCEPT

The proposed drainage concept is presented in three parts: on-site drainage conveyance, off-site drainage conveyance, and on-site storm water retention. The hydrologic analysis is summarized in section 4.0 and the hydraulic analysis is summarized in section 5.0. See Exhibit A, located in the back pocket, for graphical illustration of the proposed drainage concept.

3.1 On-site Drainage Conveyance

The on-site drainage area is divided into 16 sub-basins. Runoff from these areas will enter the historic drainage corridors downstream via catch basins and storm drain. Curb openings will also be utilized to route flow from paved parking areas to the historic drainage corridors. Roof drains will be utilized to route flow to the paved parking areas and into the storm drain system.

3.2 Off-site Drainage Conveyance

Off-site drainage conveyance is addressed in the McDowell Mountain Ranch Master Drainage Report. Runoff from the off-site watershed to the north and east is routed through and around the project site via culvert crossings under Bell Road. Runoff crossing Bell Road east of Thompson Peak Parkway is diverted south along the east side of Thompson Peak Parkway. Runoff crossing Bell Road along the project's northern boundary is routed on-site via five 30" concrete pipes under Bell Road. This runoff, approximately 121 cfs, will be routed through the site by the storm drain system, and returned to its historic drainage corridor, Wash "G".

Runoff generated along Thompson Peak Parkway flows to the south away from the project site. Runoff generated along Bell Road flows west and is intercepted by catch basins approximately 950 feet west of Thompson Peak. These catch basins are on-grade, and therefore only intercept approximately 6.6 cfs of the total 24.5 cfs at that point according to *Basis of Design Report for Bell Road Improvement District #13704* prepared by Kaminski-Hubbard Engineering (Reference 4). The intercepted flow will be routed through the project site via storm drain system to Wash "G". Flowby continues west down Bell Road away from the project site. Runoff generated along the 100th Street half street adjacent to the project will be routed to Wash "G" by catch basin. The condominium project directly south of McDowell Mountain Marketplace is routing approximately 14.6 cfs to Wash "G" by way of an existing wash corridor along the southern property line. This flow is addressed in the *Cachet at McDowell Mountain Ranch, Phase II* report by Rick Engineering (Reference 5).

3.3 On-site Storm Water Retention

The City of Scottsdale has waived retention requirements if the post-developed runoff from the site does not exceed the pre-developed historic runoff rate entering Wash "G", and runoff has been included in a storage facility downstream. According to the McDowell Mountain Ranch Master Drainage Report, the pre-development 100-year runoff entering Wash "G" immediately downstream of the project site totals 282 cfs. This includes 230 cfs from the off-site watershed and 52 cfs generated within the project boundaries. In post-development condition, 109 cfs from off-site is diverted down Thompson Peak Parkway with 121 cfs routed through the project site. Post-development on-site runoff is approximately 142 cfs. This includes 14.6 cfs from the development directly south of McDowell Mountain Marketplace. Thus, runoff entering Wash "G" has been decreased by approximately 19 cfs. Furthermore, historic runoff from Wash "G" has been included in the Bureau of Reclamation retention area behind the Central Arizona Project dike downstream.

4.0 HYDROLOGIC ANALYSIS

The hydrologic analysis for this study has been prepared in accordance with the City of Scottsdale's *Design Standards and Policies Manual, Chapter 2*. Peak flows for the site were computed using the Rational Method. Time of concentration was calculated using the velocities from Figure 2.2-14. The intensities were then determined from the I-D-F curves, included in Appendix C. The following establishes the Rational Method equation and the basic input data required:

$$Tc = (L/V)/60$$
$$Q = C_{wt}IA$$

Where:

Q = Peak Flow (cfs)
C_{wt} = weighted runoff coefficient relating runoff to rainfall
I = average rainfall intensity in inches/hour, lasting for T_c
A = the contributing drainage area in acres (from Exhibit A)
T_c = time of concentration (min.)
L = drainage length (ft.)
V = minimum velocity of stormwater in street flowing at curb height (fps)

A weighted C coefficient was used for each sub-basin. The weighted C value was determined by using a 100-year C coefficient of 0.95 for paved areas and 0.31 for NAOS areas.

A summary of peak flows for the 10-year (Q_{10}), 50-year (Q_{50}), and 100-year storm (Q_{100}) events is shown below in Table 4.1. Appendix C contains the detailed calculation sheets that establish the input data and estimated peak flow values for drainage areas.

SUMMARY OF PEAK FLOWS
Table 4.1

Sub-basin Designation	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Sub-basin Designation	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
1	3.3	5.2	6.2	9	0.4	0.6	0.7
2	2.7	4.3	5.1	10	9.6	15.3	18.1
3	3.7	5.9	7.0	11	0.5	0.7	0.9
4	6.1	9.7	11.4	12	6.1	9.7	11.5
5	8.6	13.7	16.2	13	6.0	9.6	11.3
6	5.1	8.2	9.7	14	2.0	3.2	3.8
7	7.6	12.2	14.4	15	1.9	3.1	3.7
8	4.8	7.6	9.0	16	1.0	1.6	1.8

5.0 HYDRAULIC ANALYSIS

The hydraulic analyses of the proposed storm water management facilities have been completed according to the City of Scottsdale's *Design Standards and Policies Manual, Chapter 2* and the *Drainage Design Manual for Maricopa County, Arizona, Volume II* (Reference 6).

Haestad Method's FlowMaster computer program (Reference 7) was used to analyze the flow depth for runoff generated along 100th Street. FlowMaster uses Manning's equation to establish flow depths for a user defined channel section. Flow depth along 100th Street was determined to be approximately 0.28 feet for the 100-year storm event. Detailed calculation and data sheets are included in Appendix D.

The on-site catch basins were sized using the weir and orifice equations with a 50% clogging factor. Flow depth at the grate inlets was analyzed using both equations. The analysis resulting in the greater flow depth was used for the water surface elevation determination. Detailed calculation and data sheets are included in Appendix D.

The HEC-12 computer software program by SMF Engineering (Reference 8) was utilized to size the off-site catch basin on 100th Street. The opening was sized to intercept the 100-year peak discharge. The water depths calculated by the HEC-12 program include the 2 inch gutter depression for the sump condition. Table 5.1 summarizes inlet type and size along with water surface elevations at each inlet. Detailed calculation and data sheets are located in Appendix D.

Summary of Inlet Type & Size
Table 5.1

Concentration Point*	Catch Basin Type/Length	Gutter/Rim Elev. (ft)	10-yr Depth (ft)	100-yr Depth (ft)	10-yr WS Elev. (ft)	100-yr WS Elev. (ft)
1	COP 1569-1/3' Wing	1587.73	0.27	0.41	1587.83	1587.97
2	MAG 535-'F'	1600.00	0.33	0.51	1600.33	1600.51
3	MAG 535-'F'	1596.85	0.41	0.63	1597.26	1597.48
5	MAG 535-'F'	1598.90	0.72	1.24	1599.62	1600.14
6	MAG 535-'F'	1599.87	0.51	0.78	1600.38	1600.65
7	MAG 535-'F'	1599.05	0.67	1.02	1599.72	1600.07
10	MAG 535-'F'	1605.20	0.78	1.54	1605.98	1606.74
15	MAG 535-'F'	1588.50	0.26	0.41	1588.76	1588.91
16	MAG 535-'F'	1596.75	0.17	0.25	1596.92	1597.00

* All catch basins are in sump condition.

The storm drain system was sized using Haestad Method's StormCad computer program (Reference 9). The storm drain system was sized to convey the 10-year flow with the hydraulic grade line at least 0.5 feet below any rim or gutter elevation. The 100-year flow was also analyzed to ensure the hydraulic grade line remains below the ponding elevation at the inlets. The storm drain system conveying the off-site flow from north of Bell Road through the site was sized for the 100-year storm event. The condominium site to the south of McDowell Mountain Marketplace provided a stub to an existing storm drain system to drain the southeast corner of the

project site. This system was also analyzed to ensure adequate capacity. Detailed calculation and data sheets are included in Appendix D.

FlowMaster was used to establish the minimum criteria for the small channel connecting the culvert outlet under Bell Road and the culvert entrance for the storm drain that will convey this flow through the project site. It was determined that the channel must be at least 4.5 feet in depth with 3:1 side slopes. Furthermore, the channel must be approximately 25 feet wide with at least a 2% longitudinal slope. These parameters were established based on a natural channel.

Flow depth at the culvert entrance downstream of the channel was established by analyzing the weir depth into the drop structure. Haestad Method's CulvertMaster computer program (Reference 10) was used to perform this analysis. This program uses the broad crested weir equation to establish weir depths. The flow depth at the culvert entrance was found to be 3.61 feet above the weir into the drop structure for the 100-year storm event. The weir depth was used to establish minimum channel depth allowing at least 0.5 feet of freeboard for the 100-year storm event. Using StormCad, the water surface elevation at the culvert entrance within the drop structure was determined to be 1597.93 for the 100-year storm event. Detailed calcualtion and data sheets are included in Appendix D.

CulvertMaster was also used to analyze the culvert at the southwest corner of the project site. The existing CMP culverts will be extended with the 100th Street improvements. CulvertMaster was used to establish the head water depth at the inlet, and to ensure sufficient capacity to convey the required flow. Headloss at the bend/manhole was also taken into consideration while establishing the headwater depth. The head water depth was determined to be 1587.70. This head water depth was then used as the downstream condition for the analyses to determine if the upstream wash can convey the required flow. The Army Corps of Engineer's HEC-RAS (Reference 11) computer program was used for these analyses. Flow entering the channel includes 14.6 cfs from the condominium site to the south, and 16.6 cfs (Sub-basins 8, 9, 11 and 13) from McDowell Mountain Marketplace for the 100-year storm event. Pre-development flow entering this wash from the project site totaled approximately 11.3 cfs for the 100-year storm event. Detailed calculation and data sheets are included in Appendix D and E. HEC-RAS cross section locations are shown on Exhibit A, located in the back pocket.

6.0 CONCLUSIONS

Based on the results of this study, it can be concluded that:

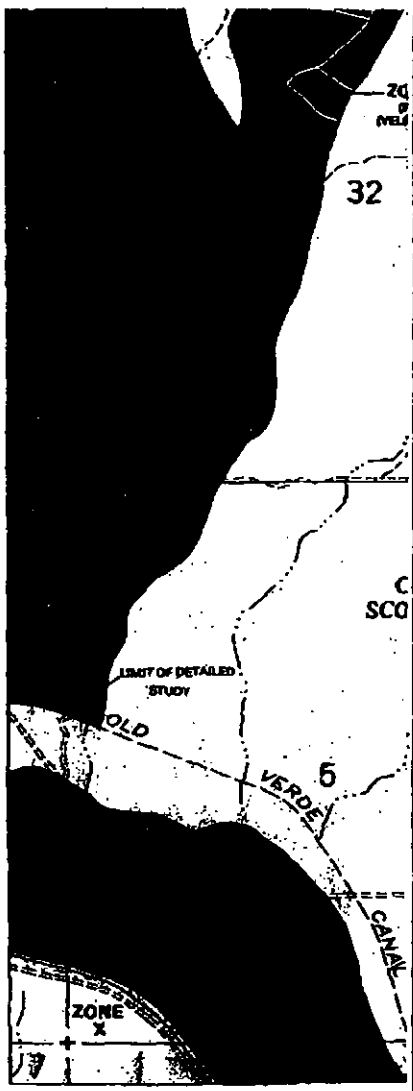
- The site can be developed in accordance with City of Scottsdale's *Design Standards and Policies Manual, Chapter 2.*
- The site can be developed such that the prerequisites for waived retention can be met.
- The finish floor elevations are set a minimum 12 inches above the 100-year water surface elevation.

7.0 REFERENCES

1) City of Scottsdale's *Design Standards and Policies Manual, Chapter* 2, July, 1996
2) *Master Drainage Report for McDowell Mountain Ranch Parcels "A" – "R"*, Clouse Engineering, November 1993.
3) *Scottsdale Area Drainage Master Study* prepared by Boyle Engineering Corp., December, 1986
4) *Basis of Design Report for Bell Road Improvement District #I3704*, Kaminski-Hubbard Engineering, December 1993.
5) *Cachet at McDowell Mountain Ranch, Phase 2*, Rick Engineering, March 2000.
6) *Drainage Design Manual for Maricopa County, Arizona, Volume II*, January 1996.
7) Haestad Methods FlowMaster PE, Version 6.0
8) SMF (Scott, Meyer, Ferguson) Pavement Drainage Program, HEC-12, Version 2.11
9) Haestad Method's StormCad, Version 4.1.1
10) Haestad Methods CulvertMaster version 1.0
11) U.S. Army Corps of Engineer's HEC-RAS, Version 2.2

APPENDIX A
(Figures)

APPENDIX B
(FEMA Flood Insurance Rate Map)



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1265 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE, CITY OF	045012	1265	E

MAP NUMBER
04013C1265 E

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency

PORTION OF FIRM PANEL

APPENDIX C
(Hydrologic Calculation and Data Sheets)

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 1

Location: CP1

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.96	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.96	Acres
Drainage Length:							580	Feet
Elevation								
Top of Drainage Area							102.1	Feet
At Structure							87.6	Feet
Drainage Area Slope							2.51	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.56	0.56	0.56	0.62	0.70	0.70	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				3.3		5.2	6.2	cfs

Computed By: GSB Date: 2/19/01

Checked By: [signature] Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

s:\dm\library\sprdshts\sct-qsht.xls

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 2

Location: CP2

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.85	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.85	Acres
Drainage Length:							270	Feet
Elevation								
Top of Drainage Area							106.0	Feet
At Structure							100.0	Feet
Drainage Area Slope							2.22	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1	0.52	0.52	0.52	0.57	0.65	0.65	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				2.7		4.3	5.1	cfs

Computed By: GSB Date: 2/19/01

Checked By: TSG Date: 2/28/01

FIGURE 2.2-18

Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 3
Location: Scottsdale
Project No.: CNTR0002 Station:
Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.8	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.8	Acres
Drainage Length:							330	Feet
Elevation								
Top of Drainage Area							104.00	Feet
At Structure							96.85	Feet
Drainage Area Slope							2.17	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				3.7		5.9	7.0	cfs

Computed By: GSB Date: 2/26/01
Checked By: [signature] Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 4

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.31	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.31	Acres
Drainage Length:							240	Feet
Elevation								
Top of Drainage Area							100.00	Feet
At Structure							95.20	Feet
Drainage Area Slope							2.00	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr
								(Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				6.1		9.7	11.4	cfs

Computed By: GSB Date: 2/26/01

Checked By: [signature] Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 5
Location: Scottsdale
Project No.: CNTR0002 Station:
Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.96	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.96	Acres
Drainage Length:							260	Feet
Elevation								
Top of Drainage Area							106.00	Feet
At Structure							98.90	Feet
Drainage Area Slope							2.73	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.72	0.72	0.72	0.79	0.90	0.90	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				8.6		13.7	16.2	cfs

Computed By: GSB Date: 2/19/01
Checked By: 956 Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 6

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.11	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.11	Acres
Drainage Length:							196	Feet
Elevation								
Top of Drainage Area							104.00	Feet
At Structure							99.75	Feet
Drainage Area Slope							2.17	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				5.1		8.2	9.7	cfs

Computed By: GSB Date: 2/19/01

Checked By: RSB Date: 2/28/01

FIGURE 2.2-18

Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 7

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100 Years
Drainage Area	A1						1.65 Acres
	A2						Acres
	A3						Acres
	Total (A)						1.65 Acres
Drainage Length:							325 Feet
Elevation							
Top of Drainage Area							106.00 Feet
At Structure							99.50 Feet
Drainage Area Slope							2.00 Percent
Hydrologic Soil Group:							B

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25
Time of Concentration:							5 Minutes
Rainfall Intensity (I):				6.1		8.1	9.2 Inches/Hr
							(Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95
	C2						
	C3						
Weighted. Runoff Coefficient (Cw):							
Peak Discharge Qp = CwIA(F)				7.6		12.2	14.4 cfs

Computed By: GSB Date: 2/19/01

Checked By: 956 Date: 2/28/01

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FIGURE 2.2-18
Hydrologic Design Data Record

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 8

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.95	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.95	Acres
Drainage Length:							330	Feet
Elevation								
Top of Drainage Area							113.50	Feet
At Structure							100.00	Feet
Drainage Area Slope							4.09	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.40	0.40	0.40	0.44	0.50	0.50	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				4.8		7.6	9.0	cfs

Computed By: GSB Date: 2/19/01

Checked By: [signature] Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 9
Location: Scottsdale
Project No.: CNTR0002 Station:
Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.08	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.08	Acres
Drainage Length:							48	Feet
Elevation								
Top of Drainage Area							101.00	Feet
At Structure							100.00	Feet
Drainage Area Slope							2.08	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				0.4		0.6	0.7	cfs

Computed By: GSB Date: 2/19/01
Checked By: TSB Date: 2/28/01

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FIGURE 2.2-18
Hydrologic Design Data Record

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 10

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						2.32	Acres
	A2							Acres
	A3							Acres
	Total (A)						2.32	Acres
Drainage Length:							370	Feet
Elevation								
Top of Drainage Area							25.00	Feet
At Structure							5.50	Feet
Drainage Area Slope							5.27	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.68	0.68	0.68	0.75	0.85	0.85	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				9.6		15.3	18.1	cfs

Computed By: GSB Date: 2/19/01

Checked By: [signature] Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 11

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.1	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.1	Acres
Drainage Length:							120	Feet
Elevation								
Top of Drainage Area							8.00	Feet
At Structure							5.50	Feet
Drainage Area Slope							2.08	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				0.5		0.7	0.9	cfs

Computed By: GSB Date: 2/19/01

Checked By: 956 Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 12

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.79	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.79	Acres
Drainage Length:							355	Feet
Elevation								
Top of Drainage Area							100.00	Feet
At Structure							92.90	Feet
Drainage Area Slope							2.00	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.56	0.56	0.56	0.62	0.70	0.70	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				6.1		9.7	11.5	cfs

Computed By: GSB Date: 2/22/01

Checked By: GSB Date: 2/28/01

FIGURE 2.2-18

Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 13

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						1.45	Acres
	A2							Acres
	A3							Acres
	Total (A)						1.45	Acres
Drainage Length:							323	Feet
Elevation								
Top of Drainage Area							100.00	Feet
At Structure							95.20	Feet
Drainage Area Slope							1.49	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.68	0.68	0.68	0.75	0.85	0.85	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				6.0		9.6	11.3	cfs

Computed By: GSB Date: 2/19/01

Checked By: [signature] Date: 2/26/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 14
Location: Scottsdale
Project No.: CNTR0002 Station:
Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.5	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.5	Acres
Drainage Length:							155	Feet
Elevation								
Top of Drainage Area							100.00	Feet
At Structure							95.00	Feet
Drainage Area Slope							3.23	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.66	0.66	0.66	0.72	0.82	0.82	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				2.0		3.2	3.8	cfs

Computed By: GSB Date: 2/22/01
Checked By: 956 Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 15

Location: Scottsdale

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.42	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.42	Acres
Drainage Length:							200	Feet
Elevation								
Top of Drainage Area							97.00	Feet
At Structure							88.50	Feet
Drainage Area Slope							4.25	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				1.9		3.1	3.7	cfs

Computed By: GSB Date: 2/26/01

Checked By: 956 Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: 16
Location: Scottsdale
Project No.: CNTR0002 Station:
Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						0.21	Acres
	A2							Acres
	A3							Acres
	Total (A)						0.21	Acres
Drainage Length:							160	Feet
Elevation								
Top of Drainage Area							98.05	Feet
At Structure							96.75	Feet
Drainage Area Slope							0.81	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							5	Minutes
Rainfall Intensity (I):				6.1		8.1	9.2	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.76	0.76	0.76	0.84	0.95	0.95	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				1.0		1.6	1.8	cfs

Computed By: GSB Date: 2/27/01
Checked By: [signature] Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: N/A
Location: pre-developed
Project No.: CNTR0002 Station: Site Outfall @ SWC
Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						17.12	Acres
	A2							Acres
	A3							Acres
	Total (A)						17.12	Acres
Drainage Length:							1540	Feet
Elevation								
Top of Drainage Area							1635.0	Feet
At Structure							1582.0	Feet
Drainage Area Slope							3.44	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							8	Minutes
Rainfall Intensity (I):		3.2	4.1	5.1	5.8	6.7	7.8	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.31	0.31	0.31	0.34	0.39	0.39	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)		17	22	27	34	43	52	cfs

Computed By: GSB Date: 1/29/01
Checked By: [illegible] Date: 2/28/01

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FIGURE 2.2-18
Hydrologic Design Data Record

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: Site Outfall @ SWC

Location: Post Development

Project No.: CNTR0002 Station:

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						17.46	Acres
	A2							Acres
	A3							Acres
	Total (A)						17.46	Acres
Drainage Length:							1575	Feet
Elevation								
Top of Drainage Area							1621.00	Feet
At Structure							1582.00	Feet
Drainage Area Slope							2.48	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							6	Minutes
Rainfall Intensity (I):				5.8		7.6	9	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.65	0.65	0.65	0.72	0.81	0.81	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				65.8		103.5	127.7	cfs

Computed By: GSB Date: 2/19/01

Checked By: 956 Date: 2/28/01

FIGURE 2.2-18

Hydrologic Design Data Record

s:\dm\library\sprdshts\sct-qshtxls

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: N/A

Location: pre-developed

Project No.: CNTR0002 Station: South Boundary Wash

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						5.27	Acres
	A2							Acres
	A3							Acres
	Total (A)						5.27	Acres
Drainage Length:							1415	Feet
Elevation								
Top of Drainage Area							1633.0	Feet
At Structure							1584.1	Feet
Drainage Area Slope							3.46	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							12	Minutes
Rainfall Intensity (I):				4.5		5.9	6.9	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.25	0.25	0.25	0.27	0.31	0.31	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				5.9		9.3	11.3	cfs

Computed By: GSB Date: 2/20/01

Checked By: GSB Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

s:\dm\library\sprdshts\sct-qsht.xls

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD
RATIONAL METHOD

LOCATION DATA

Project: McDowell Mountain Marketplace Concentration Point: N/A

Location: post-developed

Project No.: CNTR0002 Station: South Boundary Wash

Name of Stream/Watershed:

DESIGN DATA

Design Frequency:		2	5	10	25	50	100	Years
Drainage Area	A1						3.58	Acres
	A2							Acres
	A3							Acres
	Total (A)						3.58	Acres
Drainage Length:							1320	Feet
Elevation								
Top of Drainage Area							1595.2	Feet
At Structure							1582.0	Feet
Drainage Area Slope							1.00	Percent
Hydrologic Soil Group:							B	

DESIGN COMPUTATIONS

Frequency Factor (F):		1.00	1.00	1.00	1.10	1.20	1.25	
Time of Concentration:							11	Minutes
Rainfall Intensity (I):				4.6		6.0	7.0	Inches/Hr (Figure 2.2-13)
Runoff Coefficient (C):	C1	0.53	0.53	0.53	0.58	0.66	0.66	
	C2							
	C3							
Weighted. Runoff Coefficient (Cw):								
Peak Discharge Qp = CwIA(F)				8.7		13.7	16.6	cfs

Computed By: GSB Date: 2/20/01

Checked By: GSB Date: 2/28/01

FIGURE 2.2-18
Hydrologic Design Data Record

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APPENDIX D
(Hydraulic Calculation and Data Sheets)

100th Street CP1-4" Roll Curb
Worksheet for Irregular Channel

Project Description	
Worksheet	100th Street CP1-4" Roll Curb
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.019200	ft/ft
Discharge	6.20	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.28	ft
Elevation Range	0.00 to 0.59	
Flow Area	1.7	ft²
Wetted Perimeter	13.76	ft
Top Width	13.73	ft
Actual Depth	0.28	ft
Critical Elevation	0.35	ft
Critical Slope	0.005584	ft/ft
Velocity	3.58	ft/s
Velocity Head	0.20	ft
Specific Energy	0.48	ft
Froude Number	1.78	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+14	0.015
0+14	0+21	0.013
0+21	0+30	0.035

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.32
0+14	0.04
0+14	0.00
0+16	0.33
0+21	0.41
0+30	0.59

100th Street CP1-4" Roll Curb
Rating Table for Irregular Channel

Project Description	
Worksheet	100th Street CP1-4" Roll Curb
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.019200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

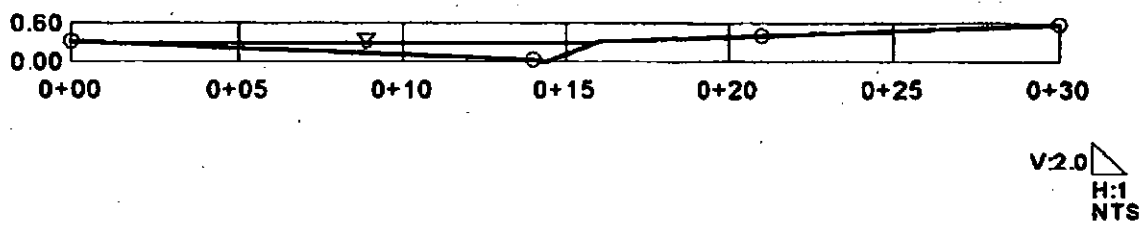
Attribute	Minimum	Maximum	Increment
Discharge (cfs)	1.00	7.00	0.50

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	
1.00	0.15	2.35	0.4	6.77	6.75	
1.50	0.18	2.57	0.6	7.95	7.93	
2.00	0.19	2.75	0.7	8.90	8.87	
2.50	0.21	2.89	0.9	9.70	9.68	
3.00	0.22	3.02	1.0	10.41	10.39	
3.50	0.23	3.13	1.1	11.05	11.02	← Q_{10}: 3.3 cfs, d_{10}: 0.23'
4.00	0.24	3.23	1.2	11.63	11.60	
4.50	0.25	3.32	1.4	12.17	12.14	
5.00	0.26	3.40	1.5	12.67	12.64	
5.50	0.27	3.48	1.6	13.15	13.11	
6.00	0.28	3.55	1.7	13.59	13.56	← Q_{100}: 6.2 cfs, d_{100}: 0.28'
6.50	0.29	3.62	1.8	14.01	13.98	
7.00	0.29	3.69	1.9	14.42	14.38	

100th Street CP1-4" Roll Curb
Cross Section for Irregular Channel

Project Description	
Worksheet	100th Street CP1-4" Roll Curb
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.014	
Slope	0.019200	ft/ft
Water Surface Elevation	0.28	ft
Elevation Range	0.00 to 0.59	
Discharge	6.20	cfs



Grate Inlet Calculations

Inlet at Concentration Point 2, Rim Elevation 1600.00

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	2.7	cfs	Q_{100} =	5.1	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.33	ft	d =	0.51	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	2.7	cfs	Q_{100} =	5.1	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.03	ft	d =	0.12	ft

Inlet at Concentration Point 3, Rim Elevation 1596.85

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	3.7	cfs	Q_{100} =	7.0	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.41	ft	d =	0.63	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	3.7	cfs	Q_{100} =	7.0	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.06	ft	d =	0.23	ft

Inlet at Concentration Point 5, Rim Elevation 1598.9

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	8.6	cfs	Q_{100} =	16.2	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.72	ft	d =	1.10	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	8.6	cfs	Q_{100} =	16.2	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.35	ft	d =	1.24	ft

Inlet at Concentration Point 6, Rim Elevation 1599.87

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	5.1	cfs	Q_{100} =	9.7	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.51	ft	d =	0.78	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	5.1	cfs	Q_{100} =	9.7	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.12	ft	d =	0.44	ft

Inlet at Concentration Point 7, Rim Elevation 1599.55

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	7.6	cfs	Q_{100} =	14.4	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.67	ft	d =	1.02	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	7.6	cfs	Q_{100} =	14.4	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.27	ft	d =	0.98	ft

Inlet at Concentration Point 10, Rim Elevation 1605.20

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	9.6	cfs	Q_{100} =	18.1	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.78	ft	d =	1.19	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	9.6	cfs	Q_{100} =	18.1	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.43	ft	d =	1.54	ft

Inlet at Concentration Point 15, Rim Elevation 1588.50

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	1.9	cfs	Q_{100} =	3.7	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.26	ft	d =	0.41	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	1.0	cfs	Q_{100} =	1.8	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.00	ft	d =	0.02	ft

Inlet at Concentration Point 16, Rim Elevation 1596.75

Grate inlet operating as weir:
Q = Cw x P x d^1.5 MAG Detail 535 'F'

Q_{10} =	1.0	cfs	Q_{100} =	1.8	cfs
C_w =	3.00		C_w =	3.00	
P =	9.33	ft	P =	9.33	ft
d =	0.17	ft	d =	0.25	ft

Grate inlet operating as an orifice:
Q = Co x A x (2gd)^0.5 MAG Detail 535 'F'

Q_{10} =	1.9	cfs	Q_{100} =	3.7	cfs
Co =	0.67		Co =	0.67	
A =	5.42	sf	A =	5.42	sf
g =	32.2	ft/s^2	g =	32.2	ft/s^2
d =	0.02	ft	d =	0.06	ft

Actual perimeter and area of grate used in calculations considers 50% clog factor
Calculations based on the *Drainage Design Manual for Maricopa County, Volume II*

PAVEMENT DRAINAGE PROGRAM - HEC-12 Page 1
Licensed to: David Evans & Associates, Phoenix, AZ 85016
Project : CNTR0002 10-yr File: cp1-10

Sta INPUT
Intens.= 0.00 C1=0.00 A1= 0.00 Qadd = 3.3 Slope1= 6.0000 Gutter= 1.50 Area = 0.00
CB ID = CP1 C2=0.00 A2= 0.00 Qrunoff= 3.3 Slope2= 0.0590 a = 2.00 Perim = 0.00
Curb Opening C3=0.00 A3= 0.00 Grade = 0.0000 Slope3= 0.0200 W = 1.50 Length=10.00

OUTPUT
Flowby= 0.0 Qtotal= 3.3 Qint= 3.3 Flowby dn= 0.0 Depth=0.27 Spread= 2.30 Veloc= 0.00

CRITERIA
Runoff computed by Rational Method Manning's n Gutter=0.013 Manning's n Pavement=0.015
Clogging Factors in Sag Location:
----- Curb Opening= 1.25 Grate= 2.00 Slotted Drain= 1.25 Comb-Curb= 1.25 Comb-Grate= 2.00
Clogging Factors on Continuous Grade:
----- Curb Opening= 1.25 Grate= 2.00 Slotted Drain= 1.25 Comb-Curb= 1.25 Comb-Grate= 2.00

Prepared by: Date:02/28/10 Time:18:37:45 Checked by: Date:

PAVEMENT DRAINAGE PROGRAM - HEC-12 Page 1

Licensed to: David Evans & Associates, Phoenix, AZ 85016

Project : CNTR0002 100-YR, File: CP1-100

Sta

INPUT

Intens.= 0.00 C1=0.00 A1= 0.00 Qadd = 6.2 Slope1= 6.0000 Gutter= 1.50 Area = 0.00

CB ID = CP1 C2=0.00 A2= 0.00 Qrunoff= 6.2 Slope2= 0.0590 a = 2.00 Perim = 0.00

Curb Opening C3=0.00 A3= 0.00 Grade = 0.0000 Slope3= 0.0200 W = 1.50 Length=10.00

OUTPUT

Flowby= 0.0 Qtotal= 6.2 Qint= 6.2 Flowby dn= 0.0 Depth=0.41 Spread= 9.39 Veloc= 0.00

CRITERIA

Runoff computed by Rational Method Manning's n Gutter=0.013 Manning's n Pavement=0.015

Clogging Factors in Sag Location:

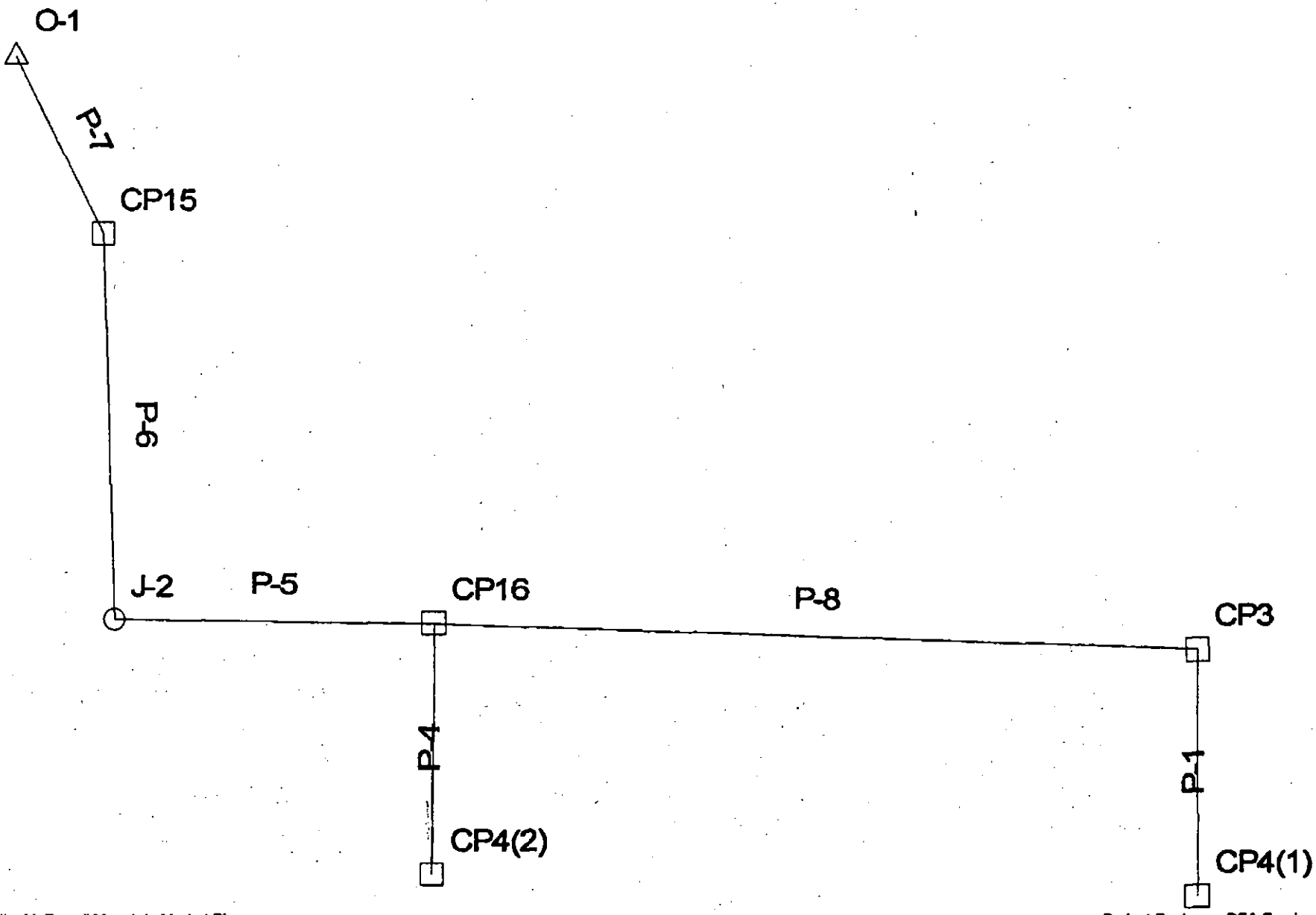
----- Curb Opening= 1.25 Grate= 2.00 Slotted Drain= 1.25 Comb-Curb= 1.25 Comb-Grate= 2.00

Clogging Factors on Continuous Grade:

----- Curb Opening= 1.25 Grate= 2.00 Slotted Drain= 1.25 Comb-Curb= 1.25 Comb-Grate= 2.00

Prepared by: Date:02/28/10 Time:18:37:29 Checked by: Date:

Scenario: 10-YR

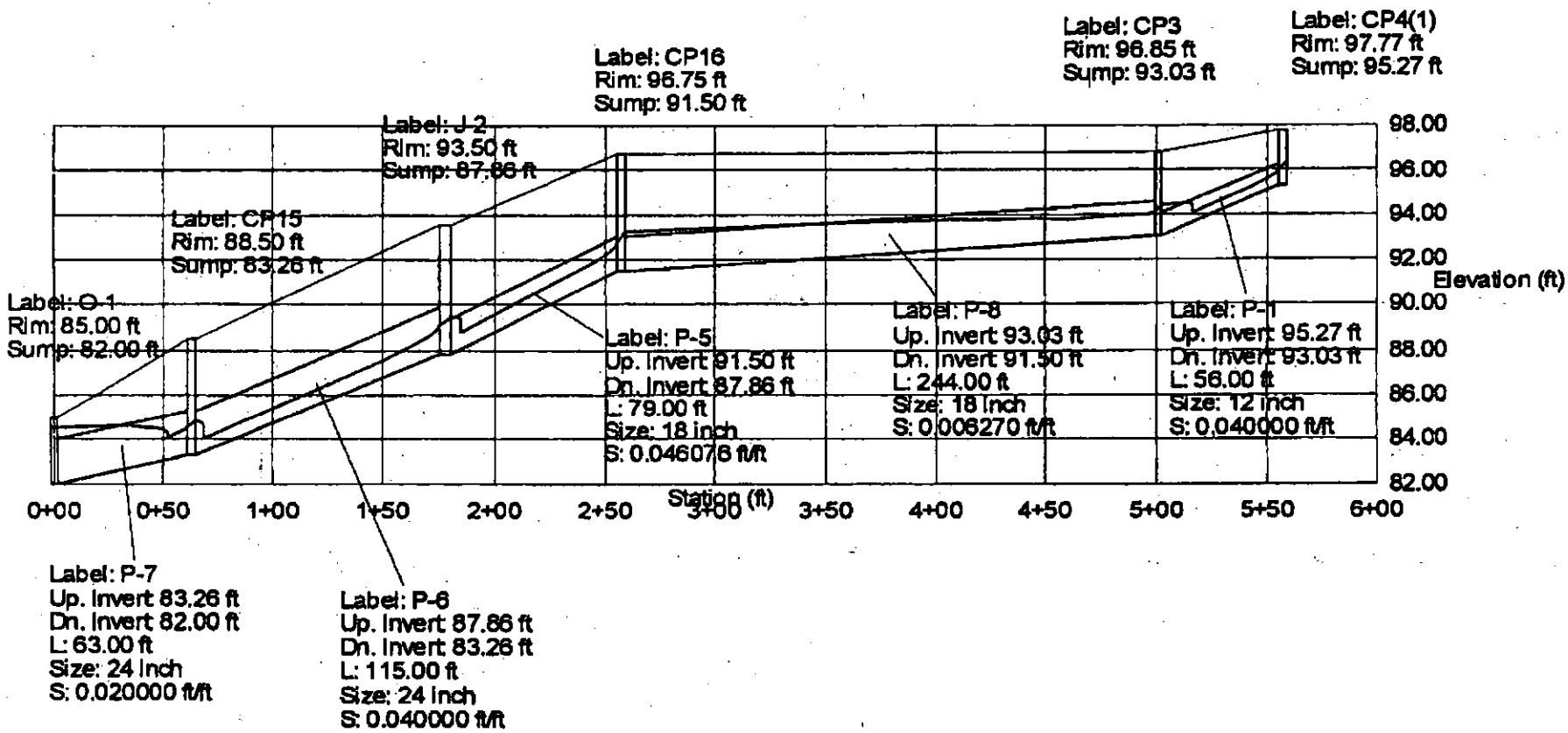


Scenario: 10-YR

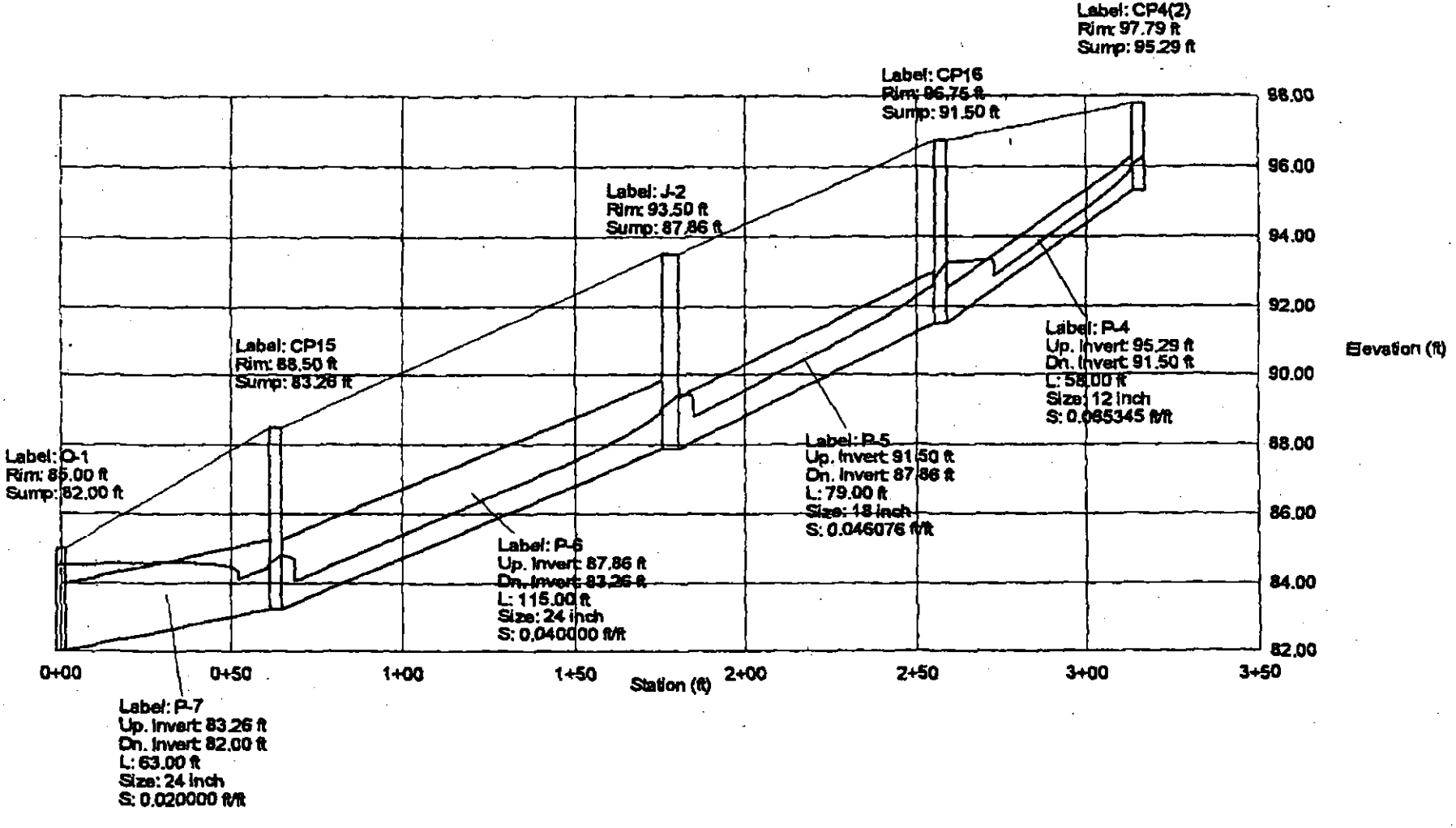
DEA TABLE

Label	Dn. Node	Up. Node	Up. Invert (ft)	Up. Gr Elev. (ft)	HGL In (ft)	EGL In (ft)	Dn. Invert (ft)	Dn. Gr. Elev. (ft)	HGL Out (ft)	EGL Out (ft)	Size	L (ft)	S (ft/ft)	Total Flow Out (cfs)	Des. Cap. (cfs)	Avg. v (ft/s)	Up. Cover (ft)
CP4(1)					96.28	96.39			96.02	96.39				3.10			
P-1	CP3	CP4(1)	95.27	97.77	96.02	96.39	93.03	96.85	94.40	94.64	12 inch	56.00	0.040000	N/A	7.72	4.41	1.50
CP4(2)					96.28	96.39			96.03	96.39				3.00			
P-4	CP16	CP4(2)	95.29	97.79	96.03	96.39	91.50	96.75	93.27	93.49	12 inch	58.00	0.065345	N/A	9.87	4.31	1.50
CP3					94.40	94.64			94.04	94.49				6.80			
P-8	CP16	CP3	93.03	96.85	94.04	94.49	91.50	96.75	93.27	93.50	18 inch	244.00	0.006270	N/A	9.01	4.61	2.32
CP16					93.27	93.49			92.76	93.48				10.80			
P-5	J-2	CP16	91.50	96.75	92.76	93.48	87.86	93.50	89.43	90.01	18 inch	79.00	0.046076	N/A	24.43	6.46	3.75
J-2					89.43	90.01			89.04	89.53				10.80			
P-6	CP15	J-2	87.86	93.50	89.04	89.53	83.26	88.50	84.82	85.08	24 inch	115.00	0.040000	N/A	49.01	4.86	3.64
CP15					84.82	85.10			84.54	85.10				12.70			
P-7	O-1	CP15	83.26	88.50	84.54	85.10	82.00	85.00	84.50	84.75	24 inch	63.00	0.020000	N/A	34.66	5.01	3.24
O-1					84.50	84.75			84.50	84.50				12.70			

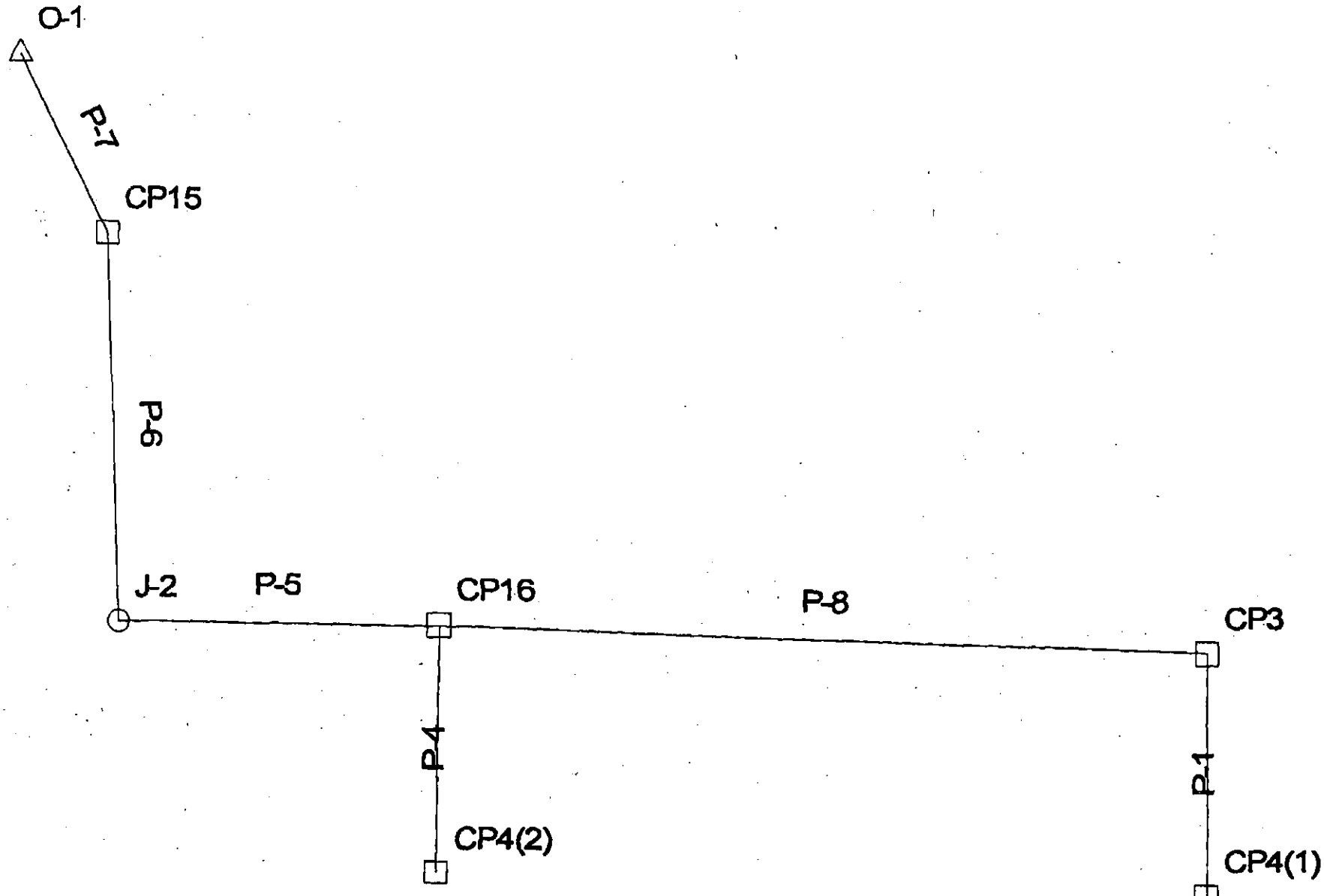
Profile
Scenario: 10-YR



Profile
Scenario: 10-YR



Scenario: 100-YR

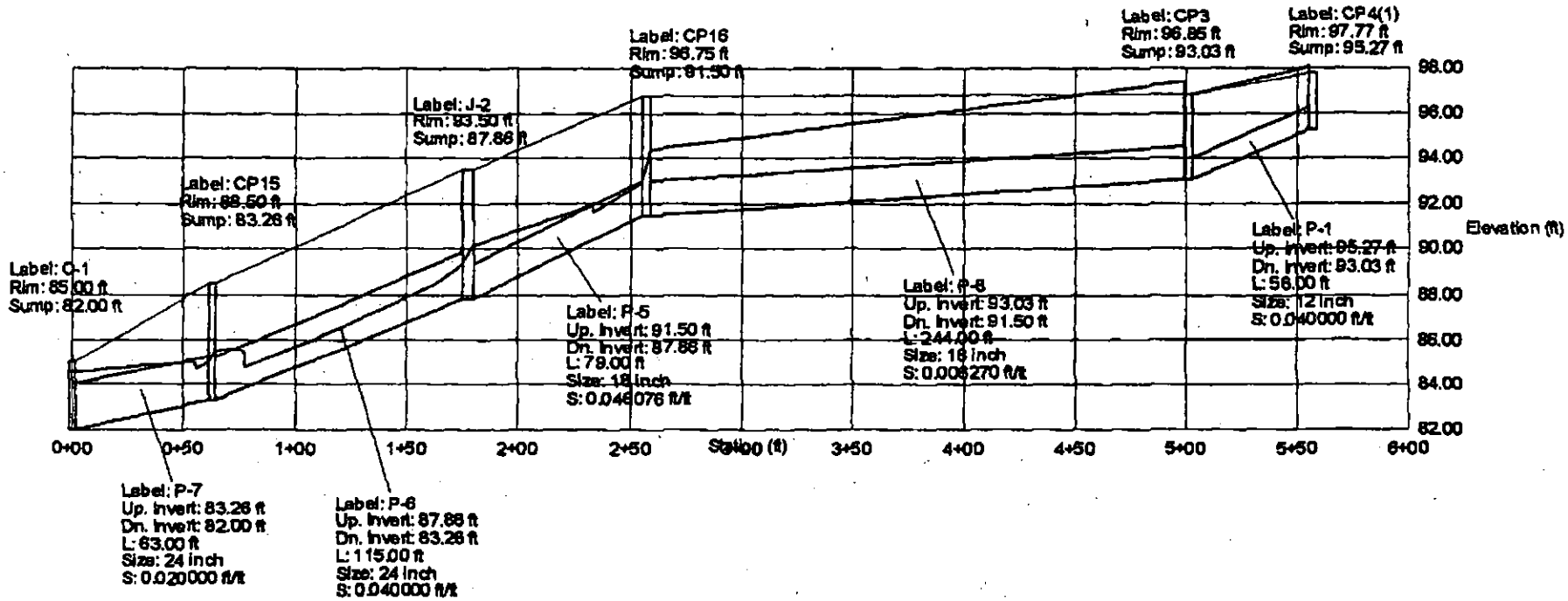


Scenario: 100-YR

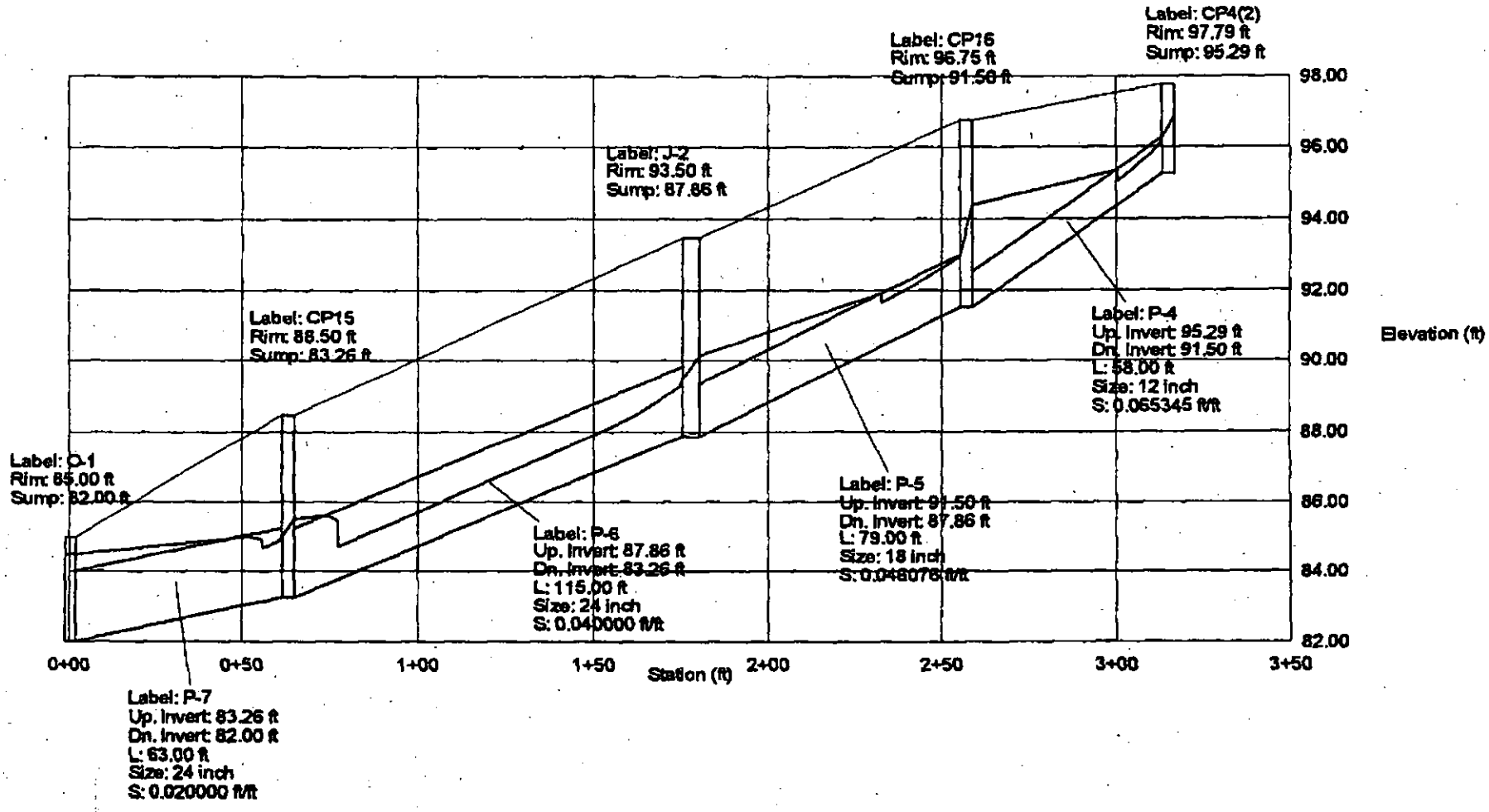
DEA TABLE

Label	Dn. Node	Up. Node	Up. Invert (ft)	Up. Gr Elev. (ft)	HGL In (ft)	EGL In (ft)	Dn. Invert (ft)	Dn. Gr. Elev. (ft)	HGL Out (ft)	EGL Out (ft)	Size	L (ft)	S (ft/ft)	Total Flow Out (cfs)	Dsn. Cap. (cfs)	Avg. v (ft/s)	Up. Cover (ft)
CP4(1)					97.77	98.59			97.77	98.59				5.70			
P-1	CP3	CP4(1)	95.27	97.77	98.07	98.89	93.03	96.85	96.85	97.67	12 inch	56.00	0.040000	N/A	7.72	7.26	1.50
CP4(2)					96.83	97.09			96.24	97.09				5.70			
P-4	CP16	CP4(2)	95.29	97.79	96.24	97.09	91.50	96.75	94.40	95.22	12 inch	58.00	0.065345	N/A	9.87	7.33	1.50
CP3					96.85	97.67			96.85	97.65				12.70			
P-8	CP16	CP3	93.03	96.85	97.44	98.25	91.50	96.75	94.40	95.21	18 inch	244.00	0.006270	N/A	9.01	7.19	2.32
CP16					94.40	95.21			92.97	95.02				20.20			
P-5	J-2	CP16	91.50	96.75	92.97	95.02	87.86	93.50	90.16	92.19	18 inch	79.00	0.046076	N/A	24.43	11.46	3.75
J-2					90.16	92.19			89.47	90.33				20.20			
P-6	CP15	J-2	87.86	93.50	89.47	90.33	83.26	88.50	85.52	86.17	24 inch	115.00	0.040000	N/A	49.01	6.93	3.64
CP15					85.52	86.17			84.99	86.05				23.90			
P-7	O-1	CP15	83.26	88.50	84.99	86.05	82.00	85.00	84.50	85.40	24 inch	63.00	0.020000	N/A	34.66	7.94	3.24
O-1					84.50	85.40			84.50	84.50				23.90			

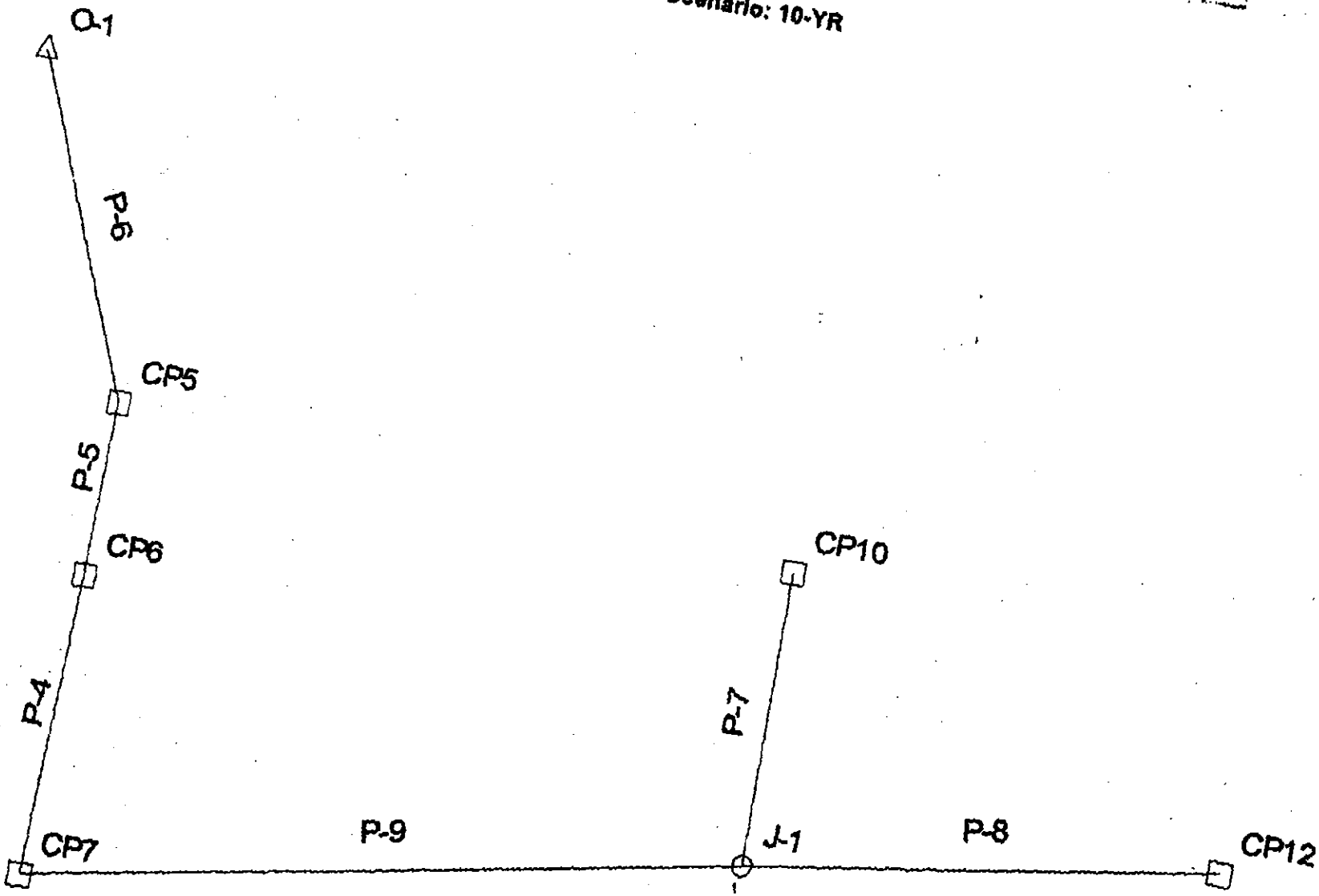
Profile
Scenario: 100-YR



Profile
Scenario: 100-YR



Scenario: 10-YR



Title: McDowell Mountain Marketplace
a:\dm\ont\t0002\stm\onsite1.stm
02/27/01 02:00:27 PM

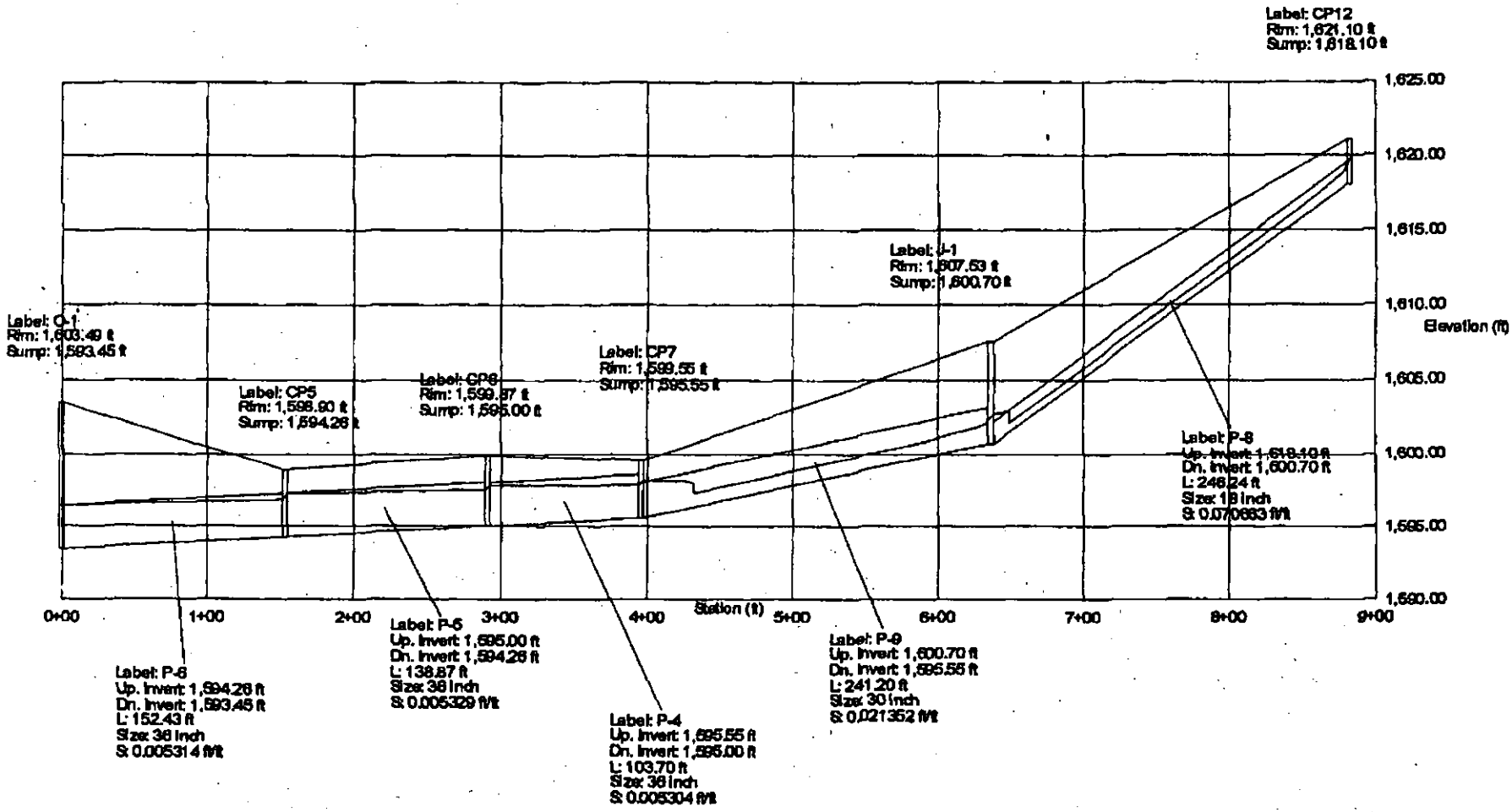
David Evans and Associates, Inc.
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666
Project Engineer:

Scenario: 10-YR

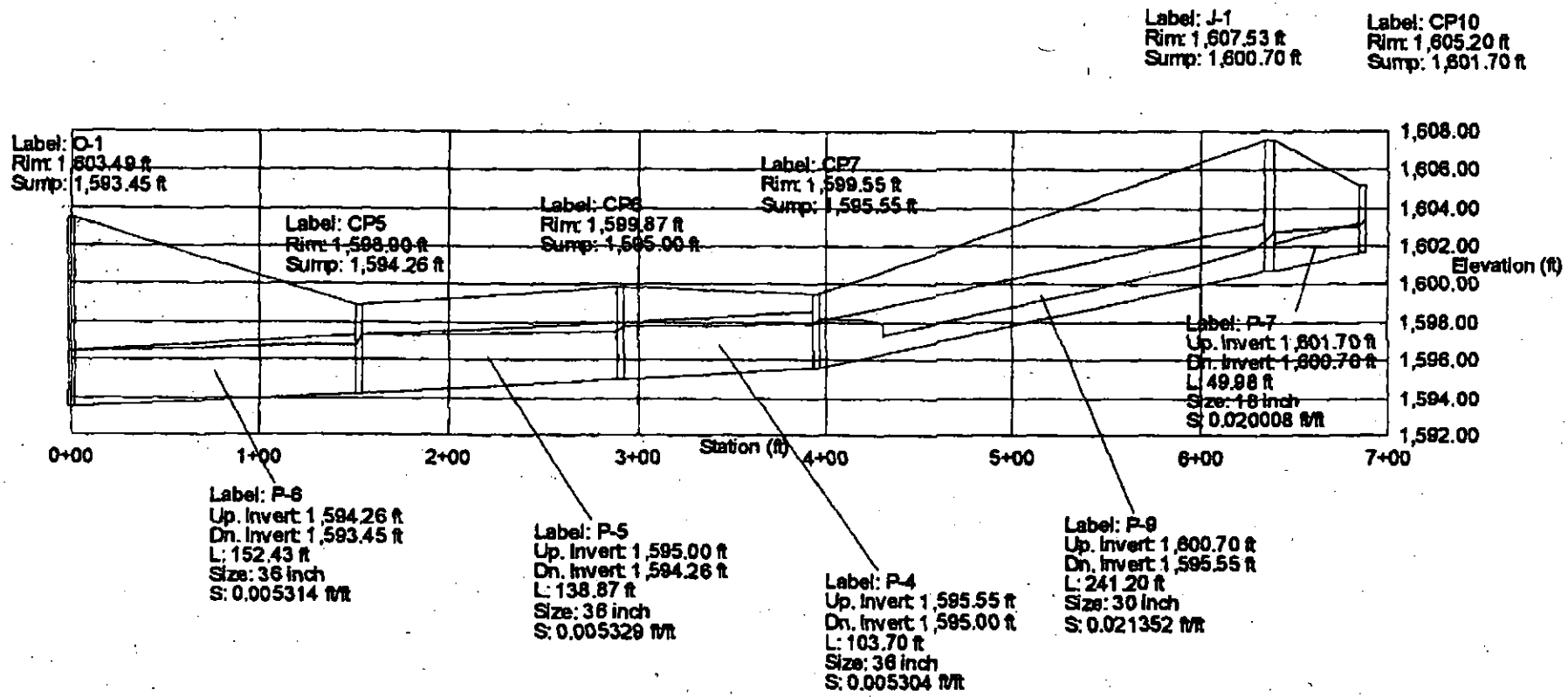
DEA TABLE

Label	Dn. Node	Up. Node	Up. Invert (ft)	Up. Gr Elev. (ft)	HGL In (ft)	EGL In (ft)	Dn. Invert (ft)	Dn. Gr. Elev. (ft)	HGL Out (ft)	EGL Out (ft)	Size	L (ft)	S (ft/ft)	Total Flow Out (cfs)	Des. Cap. (cfs)	Avg. v (ft/s)	Up. Cover (ft)
CP12					1,620.07	1,620.23			1,619.41	1,620.23				11.90			
P-8	J-1	CP12	1,618.10	1,621.10	1,619.41	1,620.23	1,600.70	1,607.53	1,602.75	1,603.45	18 inch	246.24	0.070683	N/A	30.25	7.00	1.50
CP10					1,603.40	1,603.56			1,603.05	1,603.56				9.60			
P-7	J-1	CP10	1,601.70	1,605.20	1,603.05	1,603.56	1,600.70	1,607.53	1,602.75	1,603.21	18 inch	49.98	0.020008	N/A	16.10	5.59	2.00
J-1					1,602.75	1,603.21			1,602.28	1,602.95				21.50			
P-9	CP7	J-1	1,600.70	1,607.53	1,602.28	1,602.95	1,595.55	1,599.55	1,598.18	1,598.47	30 inch	241.20	0.021352	N/A	64.93	5.49	4.33
CP7					1,598.18	1,598.47			1,597.87	1,598.25				29.10			
P-4	CP6	CP7	1,595.55	1,599.55	1,597.87	1,598.25	1,595.00	1,599.87	1,597.81	1,598.09	36 inch	103.70	0.005304	N/A	52.62	4.59	1.00
CP6					1,597.81	1,598.09			1,597.49	1,597.95				34.20			
P-5	CP5	CP6	1,595.00	1,599.87	1,597.49	1,597.95	1,594.26	1,598.90	1,597.30	1,597.66	36 inch	138.87	0.005329	N/A	52.74	5.15	1.87
CP5					1,597.30	1,597.66			1,596.82	1,597.51				42.80			
P-6	O-1	CP5	1,594.26	1,598.80	1,596.82	1,597.51	1,593.45	1,603.49	1,596.45	1,597.02	36 inch	152.43	0.005314	N/A	52.67	6.36	1.64
O-1					1,596.45	1,597.02			1,596.45	1,596.45				42.80			

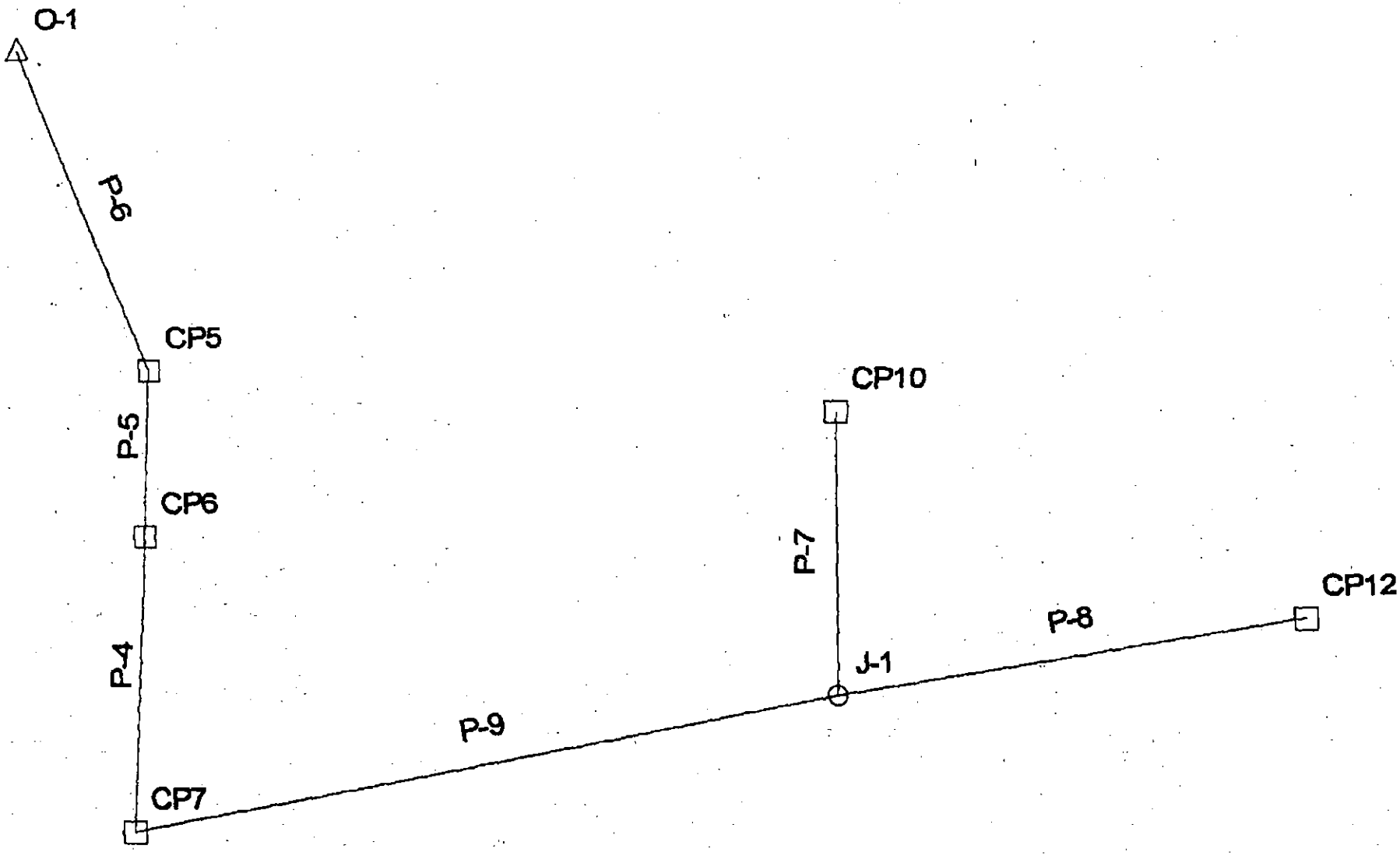
Profile
Scenario: 10-YR



Profile
Scenario: 10-YR



Scenario: 100-YR

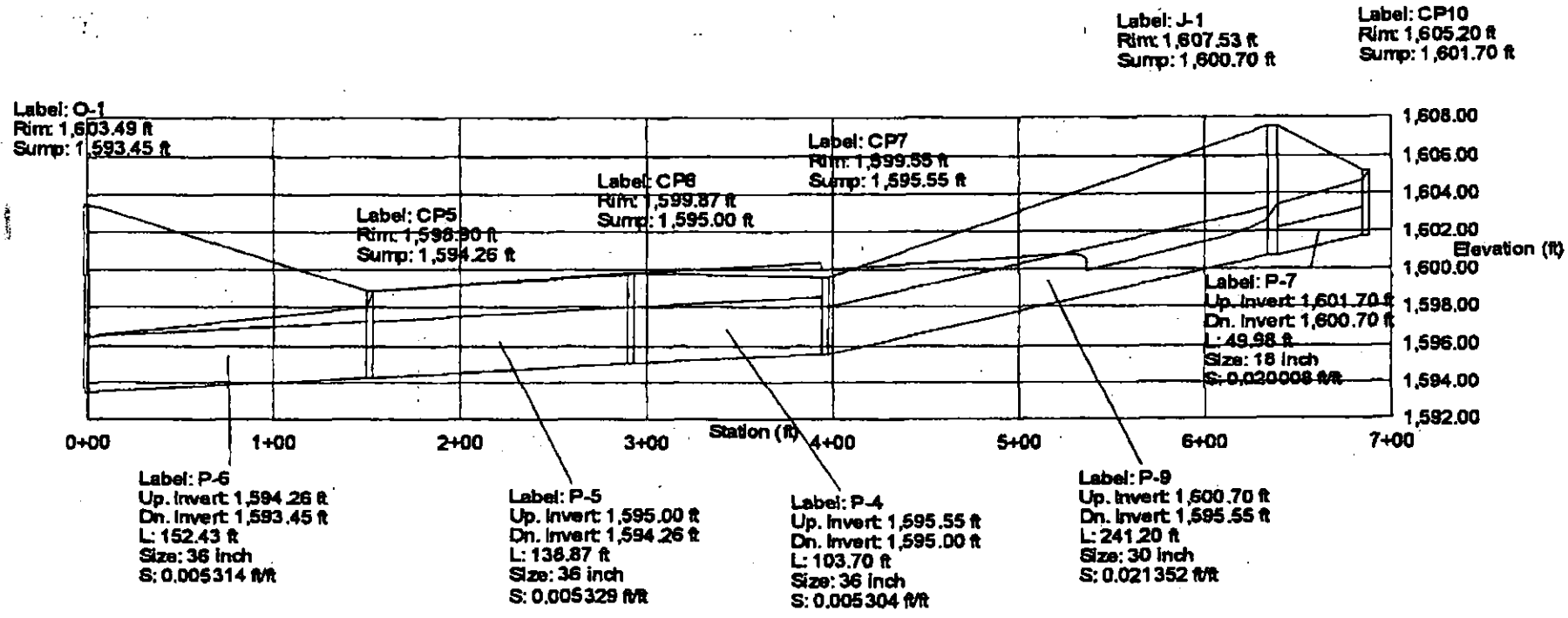


Scenario: 100-YR

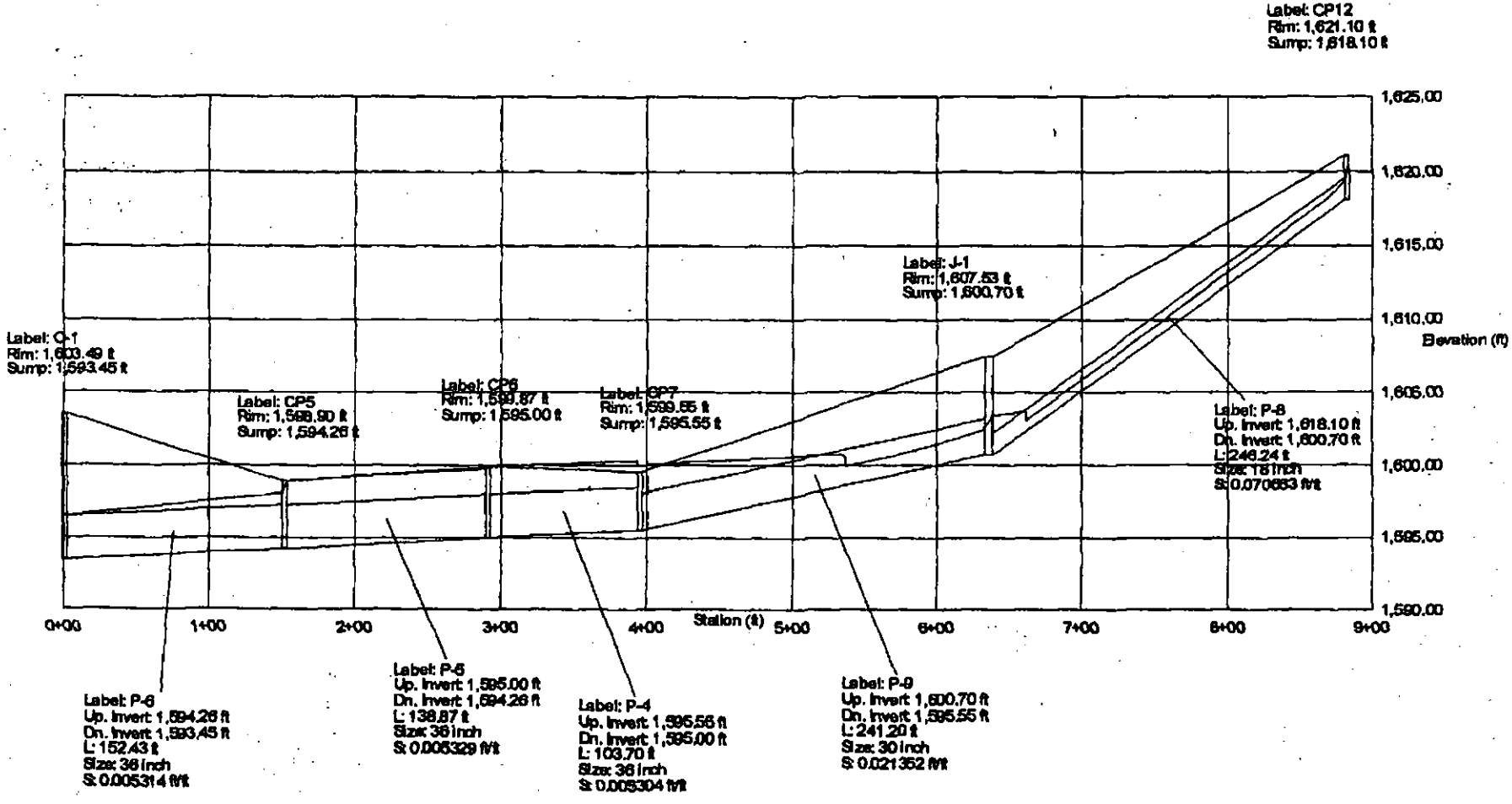
DEA TABLE

Label	Dn. Node	Up. Node	Up. Invert (ft)	Up. Gr Elev. (ft)	HGL In (ft)	EGL In (ft)	Dn. Invert (ft)	Dn. Gr. Elev. (ft)	HGL Out (ft)	EGL Out (ft)	Size	L (ft)	S (ft/ft)	Total Flow Out (cfs)	Des. Cap. (cfs)	Avg. v (ft/s)	Up. Cover (ft)
CP12					1,620.49	1,620.73			1,619.51	1,620.73				15.30			
P-8	J-1	CP12	1,618.10	1,621.10	1,619.51	1,620.73	1,600.70	1,607.53	1,603.37	1,604.54	18 inch	246.24	0.070863	N/A	30.25	8.76	1.50
CP10					1,605.20	1,606.27			1,604.64	1,606.27				18.10			
P-7	J-1	CP10	1,601.70	1,605.20	1,604.64	1,606.27	1,600.70	1,607.53	1,603.37	1,605.00	18 inch	49.88	0.020008	N/A	16.10	10.24	2.00
J-1					1,603.37	1,604.54			1,602.67	1,603.68				33.40			
P-9	CP7	J-1	1,600.70	1,607.53	1,602.67	1,603.68	1,595.55	1,599.55	1,600.05	1,600.77	30 inch	241.20	0.021352	N/A	64.93	7.43	4.33
CP7					1,600.05	1,600.77			1,600.05	1,600.76				47.80			
P-4	CP6	CP7	1,595.55	1,599.55	1,600.32	1,601.03	1,595.00	1,599.87	1,599.87	1,600.56	36 inch	103.70	0.005304	N/A	52.62	6.76	1.00
CP6					1,599.87	1,600.81			1,599.78	1,600.81				57.50			
P-5	CP5	CP6	1,595.00	1,599.87	1,599.78	1,600.81	1,594.26	1,598.90	1,598.90	1,599.93	36 inch	138.87	0.005329	N/A	52.74	8.13	1.87
CP5					1,598.90	1,599.93			1,598.04	1,599.73				73.70			
P-6	O-1	CP5	1,594.26	1,598.90	1,598.04	1,599.73	1,593.45	1,603.49	1,596.45	1,598.14	36 inch	152.43	0.005314	N/A	52.67	10.43	1.64
O-1					1,596.45	1,598.14			1,596.45	1,596.45				73.70			

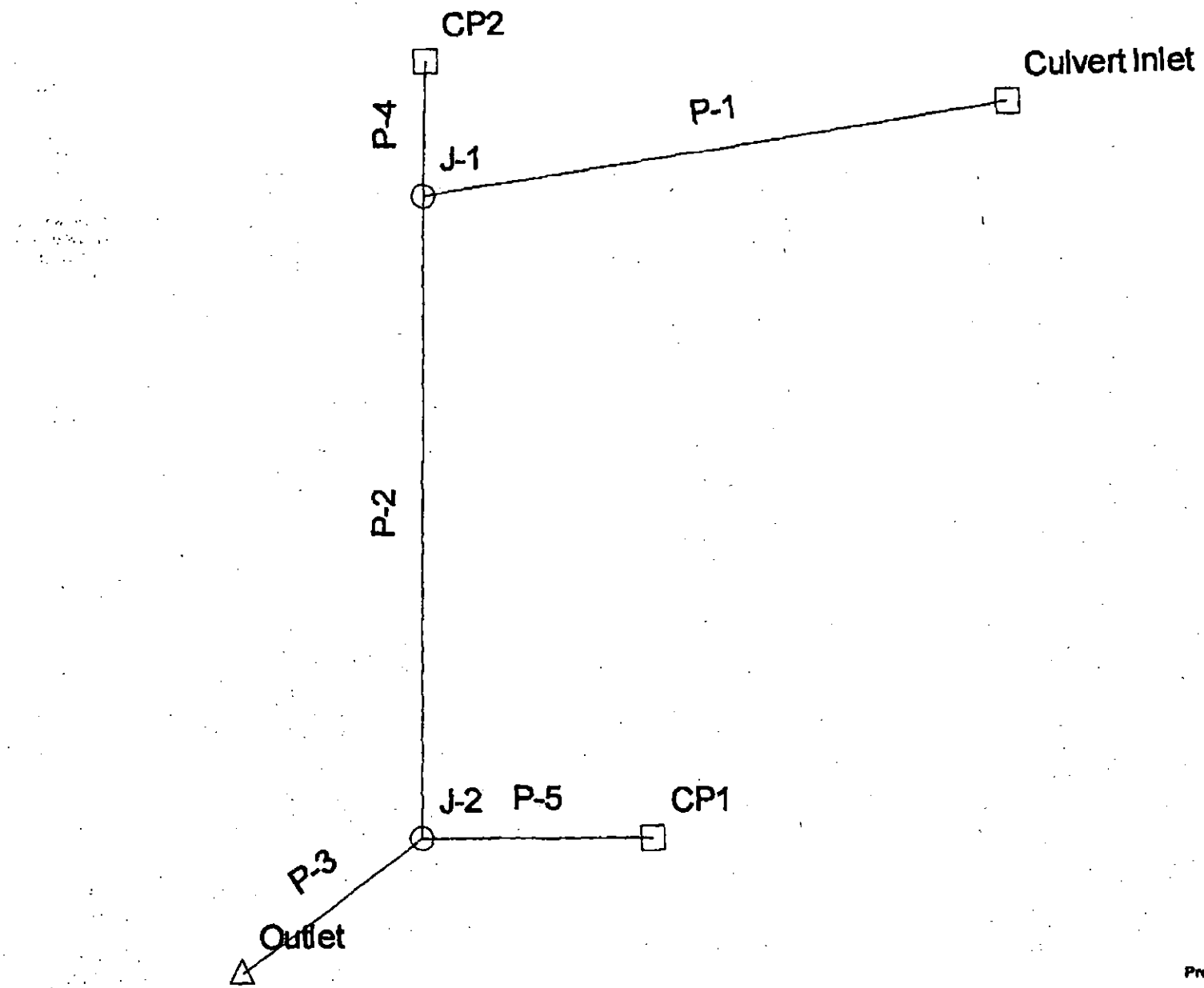
Profile
Scenario: 100-YR



Profile
Scenario: 100-YR



Scenario: 100-YR



Title: McDowell Mountain Marketplace
s:\dm\cntr0002\stm\offsite3.stm
02/27/01 01:47:46 PM

David Evans and Associates, Inc.

37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

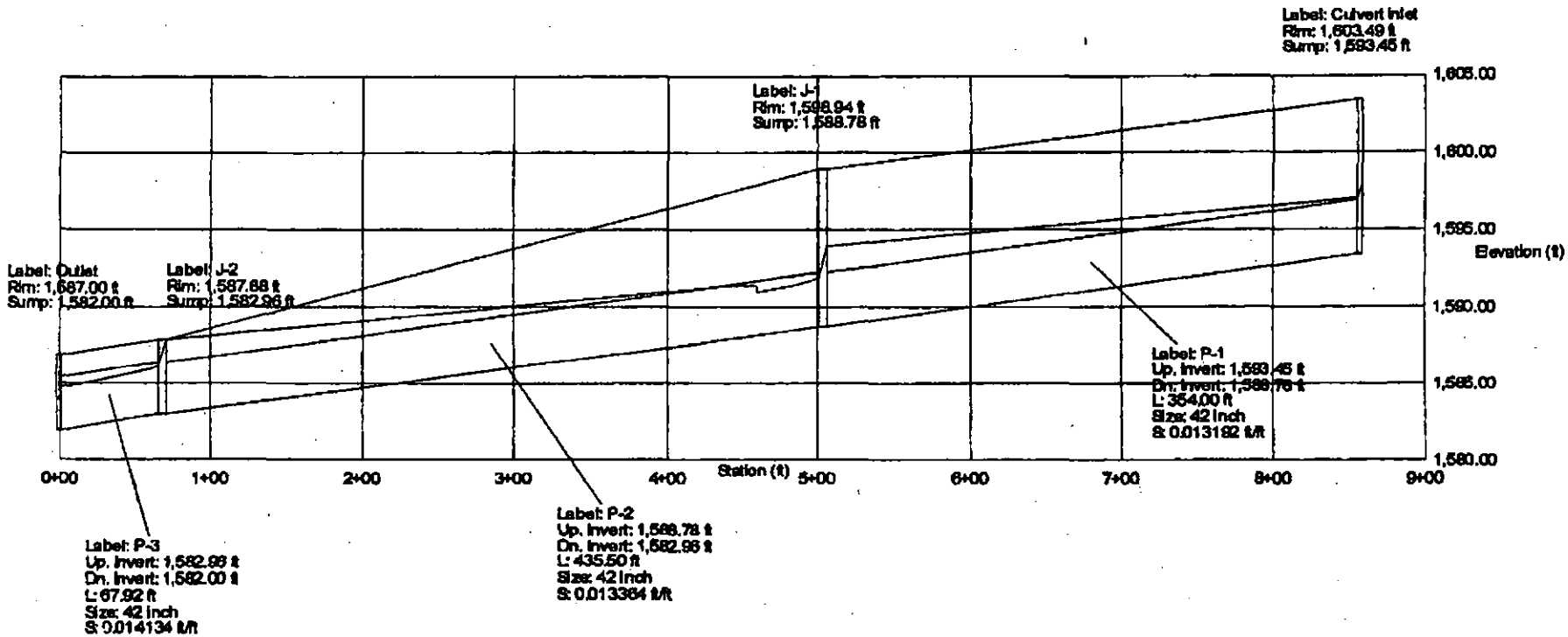
Project Engineer: Geoffrey Brownell
StormCAD v4.1.1 [4.2014]

Scenario: 100-YR

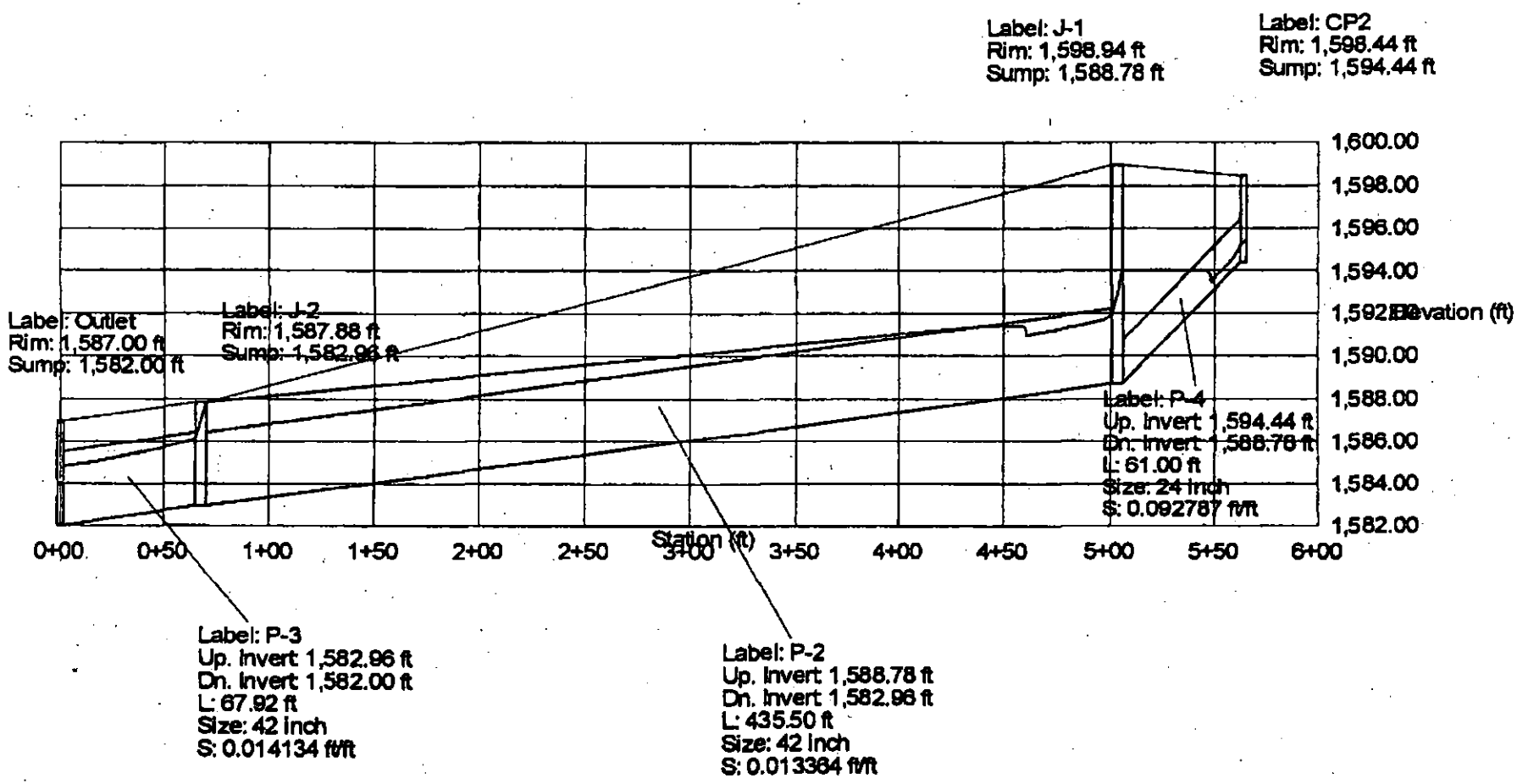
DEA TABLE

Label	Dn. Node	Up. Node	Up. Invert (ft)	Up. Gr Elev. (ft)	HGL In (ft)	EGL In (ft)	Dn. Invert (ft)	Dn. Gr. Elev. (ft)	HGL Out (ft)	EGL Out (ft)	Size	L (ft)	S (ft/ft)	Total Flow Out (cfs)	Des. Cap. (cfs)	Avg. V (ft/s)	Up. Cover (ft)
Culvert In					1,597.93	1,598.79			1,597.07	1,598.79				101.00			
P-1	J-1	Culvert In	1,593.45	1,603.49	1,597.07	1,598.79	1,588.78	1,598.94	1,594.03	1,595.75	42 inch	354.00	0.013192	N/A	125.18	10.50	6.54
CP2					1,595.47	1,595.53			1,595.24	1,595.53				5.10			
P-4	J-1	CP2	1,594.44	1,598.44	1,595.24	1,595.53	1,588.78	1,598.94	1,594.03	1,594.07	24 inch	61.00	0.092787	N/A	74.65	3.00	2.00
CP1					1,587.45	1,587.79			1,587.45	1,587.79				8.30			
P-5	J-2	CP1	1,583.95	1,587.45	1,587.91	1,588.25	1,582.96	1,587.88	1,587.88	1,588.22	18 inch	5.00	0.198000	N/A	50.63	4.70	2.00
J-1					1,594.03	1,594.07			1,591.91	1,594.03				106.10			
P-2	J-2	J-1	1,588.78	1,598.94	1,591.91	1,594.03	1,582.96	1,587.88	1,587.88	1,589.77	42 inch	435.50	0.013364	N/A	125.99	11.35	6.66
J-2					1,587.88	1,588.55			1,586.17	1,588.55				114.40			
P-3	Outlet	J-2	1,582.96	1,587.88	1,586.17	1,588.55	1,582.00	1,587.00	1,584.78	1,587.81	42 inch	67.92	0.014134	N/A	129.57	13.18	1.42
Outlet					1,584.00	1,587.81			1,584.00	1,584.00				114.40			

Profile
Scenario: 100-YR



Profile
Scenario: 100-YR

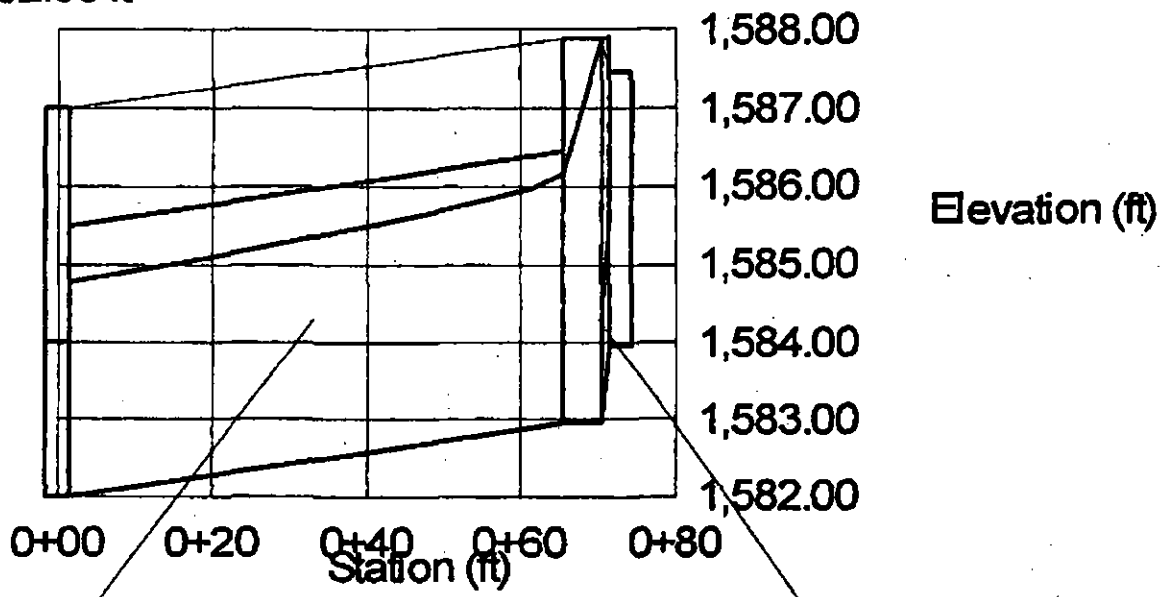


Profile
Scenario: 100-YR

Label: J-2
Rim: 1,587.88 ft
Sump: 1,582.96 ft

Label: Outlet
Rim: 1,587.00 ft
Sump: 1,582.00 ft

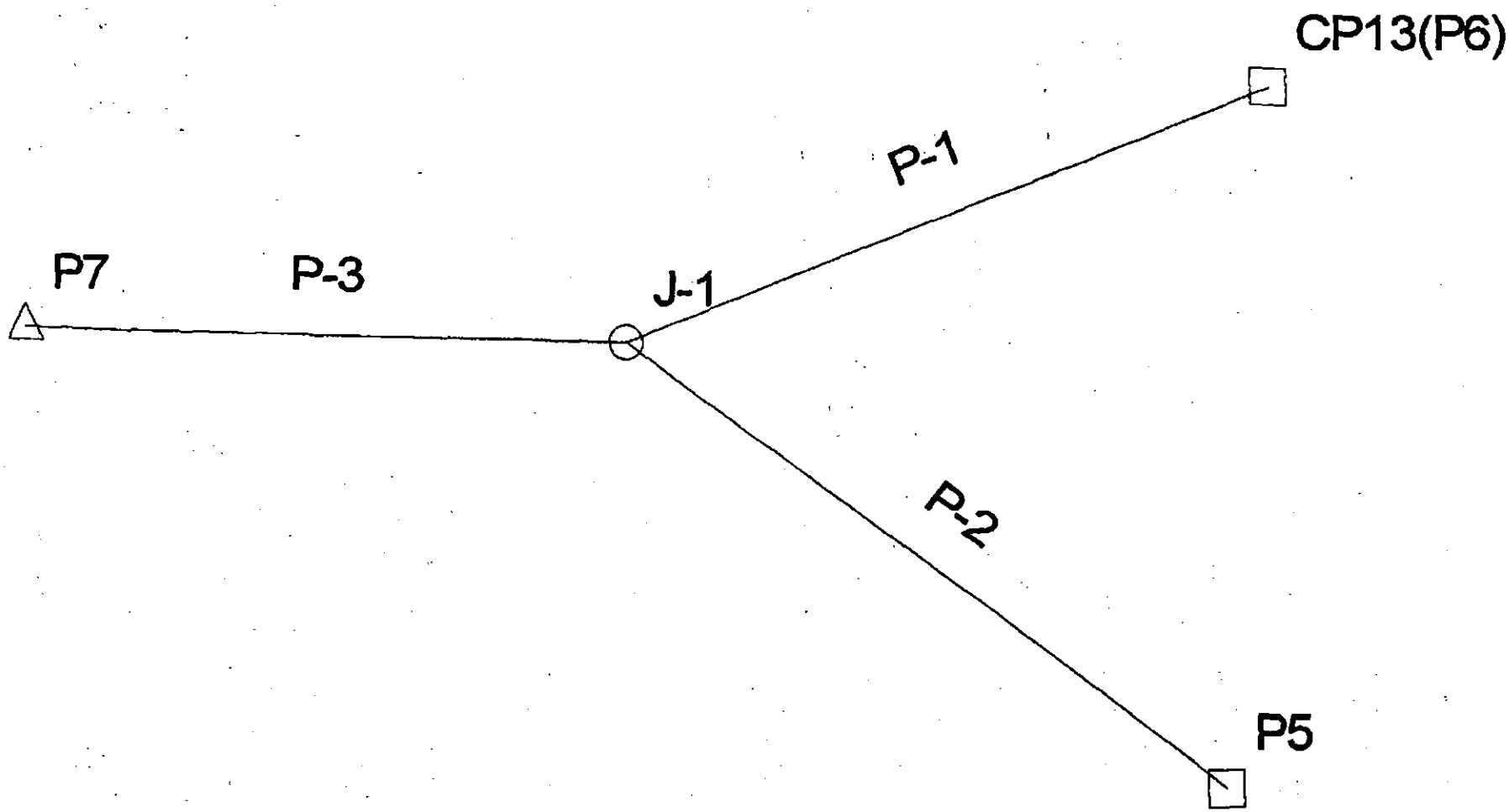
Label: CP1
Rim: 1,587.45 ft
Sump: 1,583.95 ft



Label: P-3
Up. Invert: 1,582.96 ft
Dn. Invert: 1,582.00 ft
L: 67.92 ft
Size: 42 inch
S: 0.014134 ft/ft

Label: P-5
Up. Invert: 1,583.95 ft
Dn. Invert: 1,582.96 ft
L: 5.00 ft
Size: 18 inch
S: 0.198000 ft/ft

Scenario: 100-YR

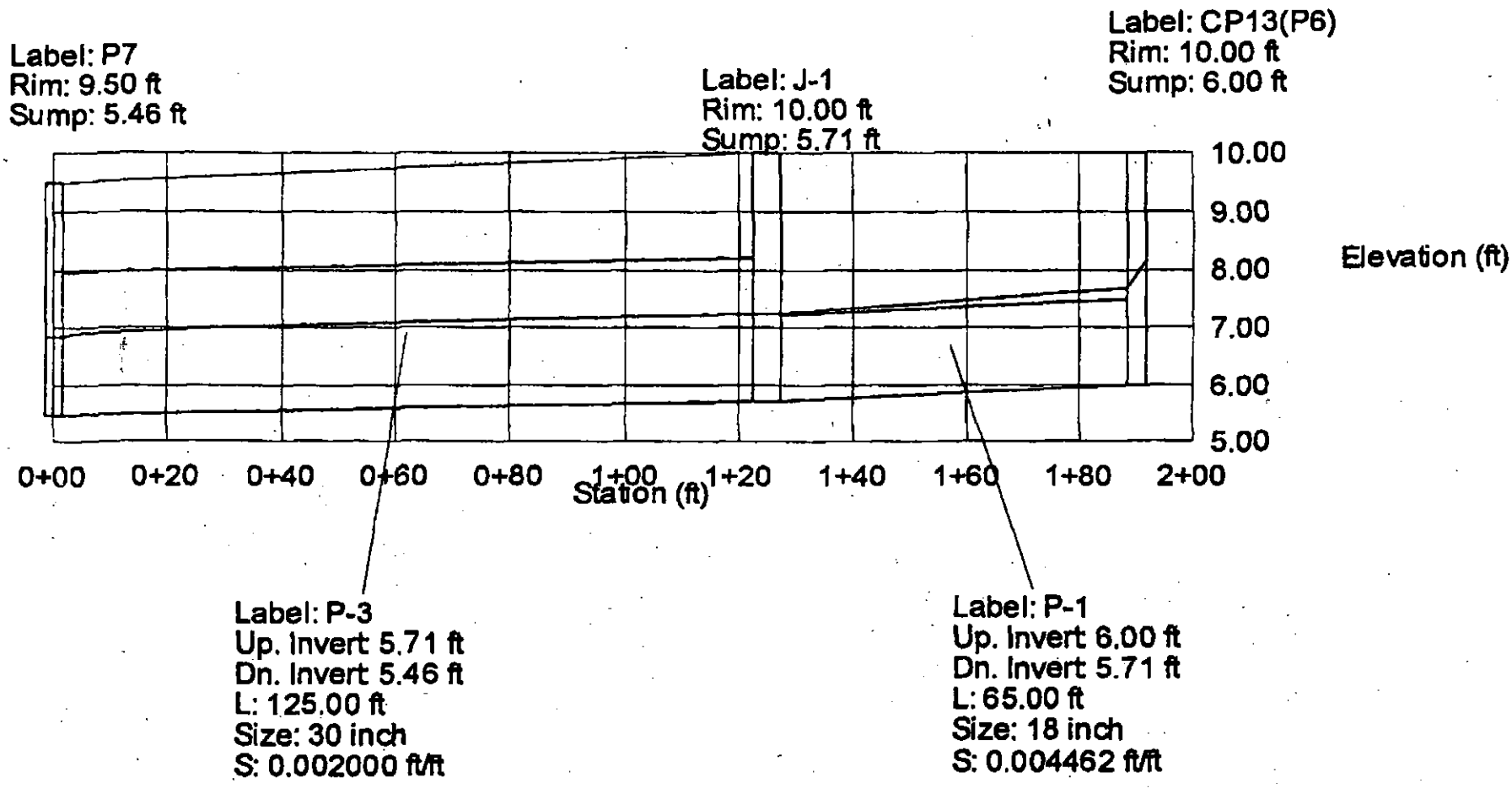


Scenario: 100-YR

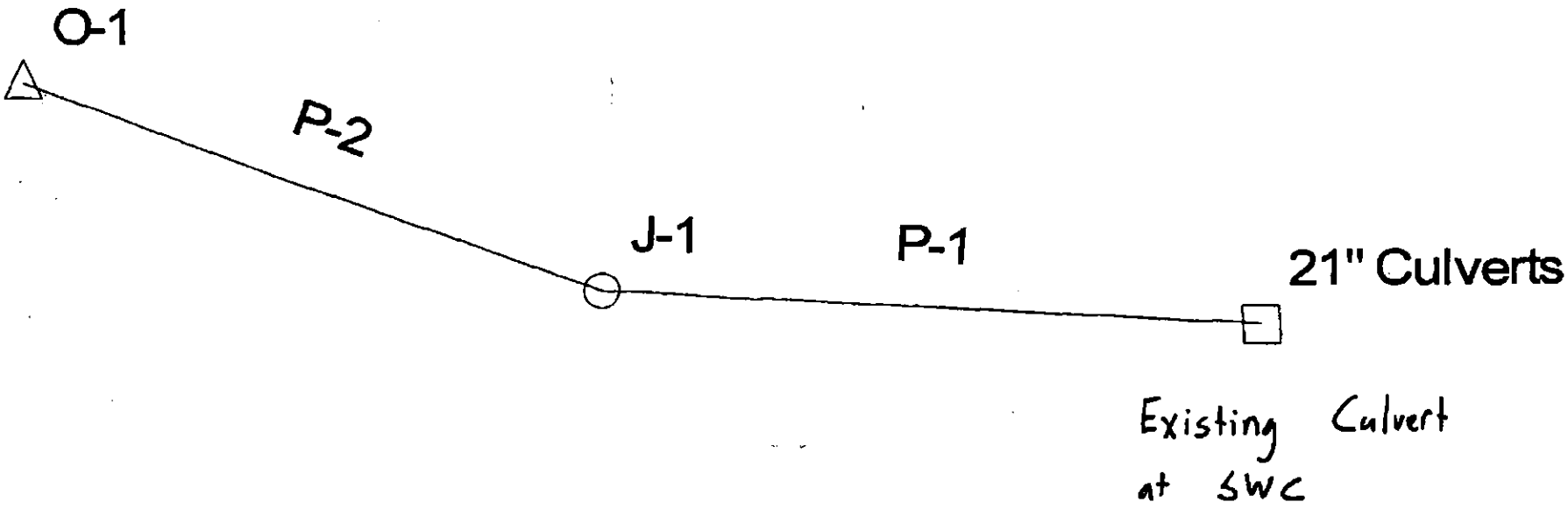
DEA TABLE

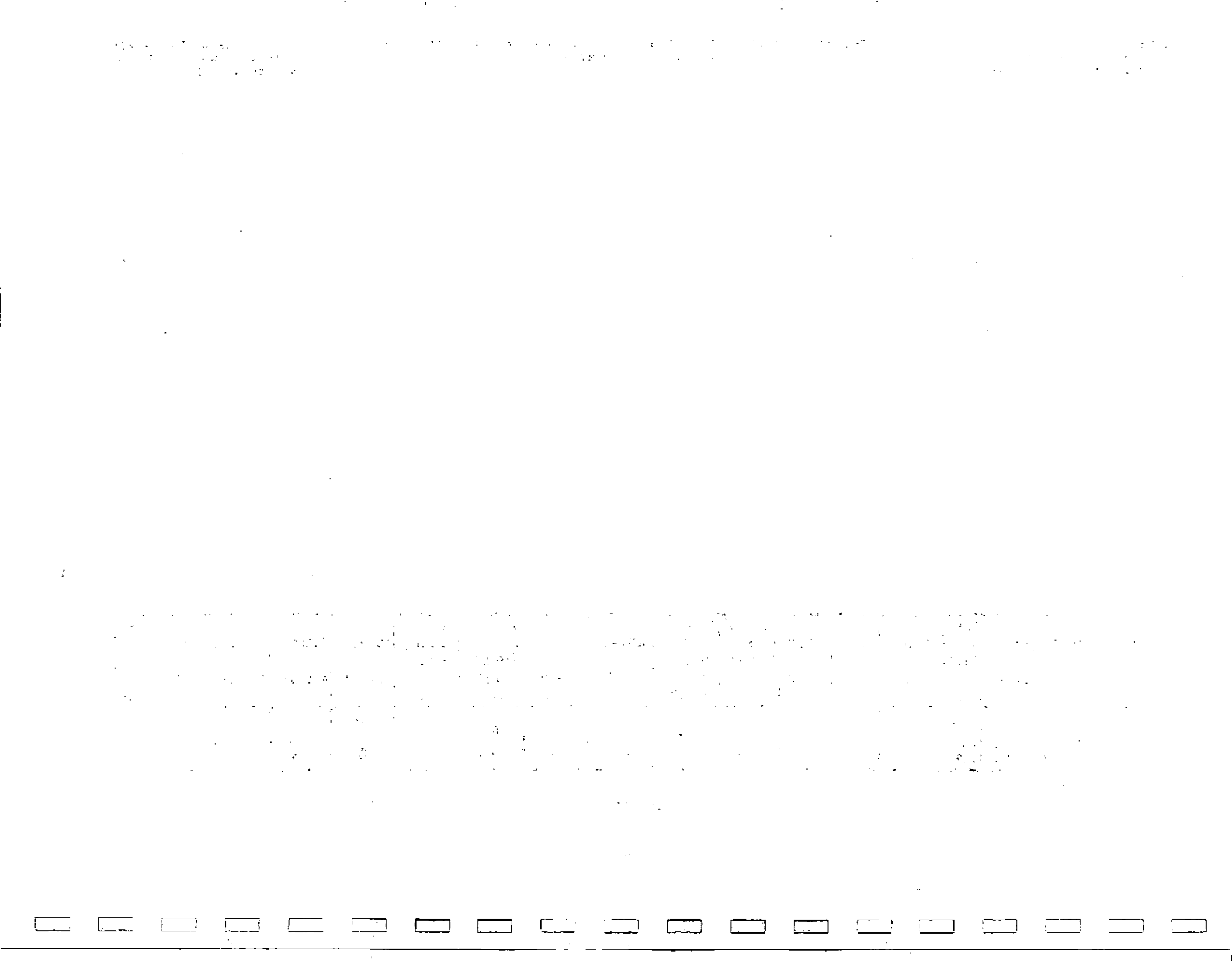
Label	Dn. Node	Up. Node	Up. Invert (ft)	Up. Gr Elev. (ft)	HGL In (ft)	EGL In (ft)	Dn. Invert (ft)	Dn. Gr. Elev. (ft)	HGL Out (ft)	EGL Out (ft)	Size	L (ft)	S (ft/ft)	Total Flow Out (cfs)	Des. Cap. (cfs)	Avg. v (ft/s)	Up. Cover (ft)
P5					7.51	7.56			7.39	7.56				5.60			
P-2	J-1	P5	6.00	10.00	7.39	7.56	5.71	10.00	7.25	7.41	18 inch	97.00	0.002990	N/A	7.47	3.22	2.50
CP13(P6)					8.14	8.33			7.69	8.33				11.30			
P-1	J-1	CP13(P6	6.00	10.00	7.69	8.33	5.71	10.00	7.25	7.88	18 inch	65.00	0.004462	N/A	9.12	6.39	2.50
J-1					7.25	7.69			7.25	7.69				16.90			
P-3	P7	J-1	5.71	10.00	7.25	7.69	5.46	9.50	6.85	7.41	30 inch	125.00	0.002000	N/A	23.85	5.68	1.79
P7					6.85	7.41			6.85	6.85				16.90			

Profile
Scenario: 100-YR



Scenario: 100-YR

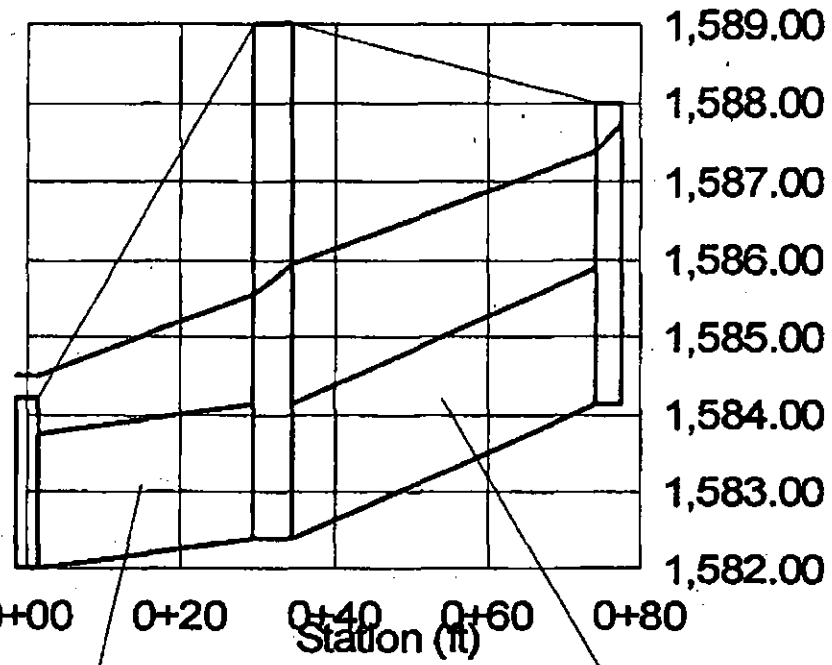




Profile
Scenario: 100-YR

Label: J-1
Rim: 1,589.00 ft
Sump: 1,582.39 ft

Label: 21" Culverts
Rim: 1,588.00 ft
Sump: 1,584.14 ft



Label: O-1
Rim: 1,584.20 ft
Sump: 1,582.00 ft

Label: P-2
Up. Invert: 1,582.39 ft
Dn. Invert: 1,582.00 ft
L: 32.00 ft
Size: 21 inch
S: 0.012188 ft/ft

Label: P-1
Up. Invert: 1,584.14 ft
Dn. Invert: 1,582.39 ft
L: 44.00 ft
Size: 21 inch
S: 0.039773 ft/ft

Bell Channel
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Bell Channel-2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

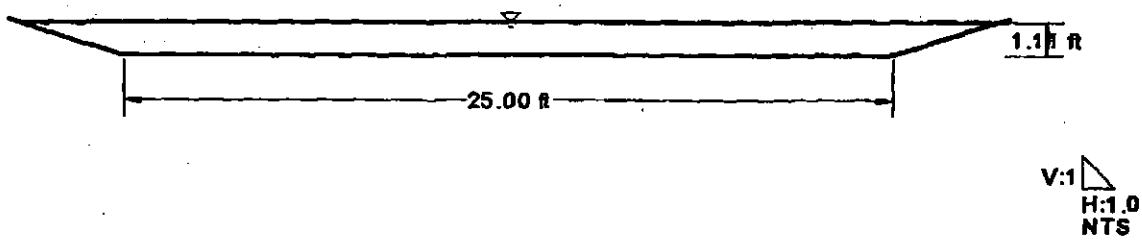
Input Data		
Mannings Coefficient	0.050	
Slope	0.020000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	25.00	ft
Discharge	130.00	cfs

Results		
Depth	1.11	ft
Flow Area	31.4	ft²
Wetted Perimeter	32.00	ft
Top Width	31.64	ft
Critical Depth	0.91	ft
Critical Slope	0.039307	ft/ft
Velocity	4.15	ft/s
Velocity Head	0.27	ft
Specific Energy	1.37	ft
Froude Number	0.73	
Flow Type	Subcritical	

Bell Channel
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	Bell Channel-2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.050	
Slope	0.020000	ft/ft
Depth	1.11	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	25.00	ft
Discharge	130.00	cfs



Culvert Designer/Analyzer Report
Bell Channel

Analysis Component			
Storm Event	Check	Discharge	130.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	0.00 cfs	Check Discharge	130.00 cfs

Tailwater properties: Irregular Channel			
Slope	0.030000 ft/ft	Mannings Coefficient	0.045

Roughness Segments		
Start Station (ft)	End Station (ft)	Mannings Coefficient
0.00	34.00	0.045

Natural Channel Points	
Station (ft)	Elevation (ft)
0.00	4.00
14.00	1.00
28.00	1.00
34.00	4.00

Tailwater conditions for Check Storm.			
Discharge	130.00 cfs	Depth	1.25 ft
Velocity	5.72 ft/s		

Name	Description	Discharge	HW Elev	Velocity
Weir	Broad Crested	130.00 cfs	3.61 ft	N/A

Culvert Designer/Analyzer Report
Bell Channel

Component:Weir

Hydraulic Component(s): Broad Crested			
Discharge	130.00 cfs	Allowable HW Elevation	3.61 ft
Weir Coefficient	3.30 US	Length	25.00 ft
Crest Elevation	0.00 ft	Headwater Elevation	3.61 ft

Culvert Designer/Analyzer Report
CP9 - Culvert @ SWC

Analysis Component			
Storm Event	Check	Discharge	31.20 cfs

Peak Discharge Method: User-Specified			
Design Discharge	0.00 cfs	Check Discharge	31.20 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	2.50 ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	2-21 inch Circular	31.20 cfs	1,587.45 ft	7.97 ft/s
Weir	Not Considered	N/A	N/A	N/A

Plus bend loss at manhole:

$$H = K_b \frac{V^2}{2g}$$

$K_b = 0.25$ (Figure 4.13, Modern Sewer Design, 1995)

$V = 7.97$ ft/s

$H = 0.25$ ft

HW Elev = 1587.45 + 0.25 = <u>1587.70</u>

Culvert Designer/Analyzer Report
CP8 - Culvert @ SWC

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,587.45 ft	Discharge	31.20 cfs
Inlet Control HW Elev	1,587.45 ft	Tailwater Elevation	2.50 ft
Outlet Control HW Elev	1,587.00 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.89		

Grades			
Upstream Invert	1,584.14 ft	Downstream Invert	1,581.20 ft
Length	76.00 ft	Constructed Slope	0.038684 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.33 ft
Slope Type	Steep	Normal Depth	1.33 ft
Flow Regime	Supercritical	Critical Depth	1.46 ft
Velocity Downstream	7.97 ft/s	Critical Slope	0.032059 ft/ft

Section			
Section Shape	Circular	Manninge Coefficient	0.024
Section Material	CMP	Span	1.75 ft
Section Size	21 inch	Rise	1.75 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	1,587.00 ft	Upstream Velocity Head	0.82 ft
Ke	0.70	Entrance Loss	0.58 ft

Inlet Control Properties			
Inlet Control HW Elev	1,587.45 ft	Flow Control	Submerged
Inlet Type	Mitered to slope	Area Full	4.8 ft²
K	0.02100	HDS 5 Chart	2
M	1.33000	HDS 5 Scale	2
C	0.04630	Equation Form	1
Y	0.75000		

APPENDIX E
(HEC-RAS Output Sheets)

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X    X  XXXXXX   XXXX       XXXX      XX     XXXX
X    X  X       X    X      X  X     X  X    X
X    X  X       X           X  X     X   X   X
XXXXXX  XXXX    X      XXX  XXX      XXXXX   XXXX
X    X  X       X           X  X     X   X      X
X    X  X       X    X      X  X     X   X      X
X    X  XXXXXX   XXXX       X   X    X   X  XXXXX
```

PROJECT DATA
Project Title: South Channel
Project File : SOUTHCHAN.prj
Run Date and Time: 2/28/01 9:41:58 AM

Project in English units

PLAN DATA

Plan Title: South Channel
Plan File : C:\HEC\RAS\SOUTHCHAN.p01

Geometry Title: South Channel
Geometry File : s:\DRN\cntr0002\hec-ras\SOUTHCHAN.G01

Flow Title : South Channel
Flow File : s:\DRN\cntr0002\hec-ras\SOUTHCHAN.F01

Plan Summary Information:
Number of: Cross Sections = 5 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: South Channel
Flow File : s:\DRN\cntr0002\hec-ras\SOUTHCHAN.F01

Flow Data (cfs)

River	Reach	RS	PF 1
Reach #1	Reach #1	619.51	31.2
South Channel	1	619.51	31.2

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
South Channel	1	PF 1		Known WS = 1587.9

GEOMETRY DATA

Geometry Title: South Channel
Geometry File : s:\DRN\cntr0002\hec-ras\SOUTHCHAN.G01

CROSS SECTION RIVER: South Channel
REACH: 1 RS: 619.51

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1606	3.82	1604	5.73	1603	19.98	1602	25.16	1602
28.73	1603	32.31	1604	40.15	1606				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	5.73	.05	28.73	.06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

5.73	28.73	162.17	170.79	173.3	.1	.3

CROSS SECTION RIVER: South Channel
REACH: 1 RS: 448.72

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1601	12.72	1599	16.52	1598	30.11	1597	31.28	1597
34.44	1598	36.87	1599	41.63	1601				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	16.52	.05	31.28	.06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

16.52	31.28	204.14	203.49	200.72	.1	.3

CROSS SECTION RIVER: South Channel
REACH: 1 RS: 245.23

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1594	4.33	1593	8.66	1592	17.51	1591	19.3	1591
24.2	1592	28.37	1593	32.44	1594				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	8.66	.05	24.2	.06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

8.66	24.2	181.52	188.2	187.62	.1	.3

CROSS SECTION RIVER: South Channel
REACH: 1 RS: 57.03

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1589	20.61	1588	31.24	1587	37.23	1586	39.16	1586
48.78	1587	52.89	1588	57.49	1589				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	31.24	.05	48.78	.06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

31.24	48.78	55.18	57.03	59.66	.1	.3

CROSS SECTION RIVER: South Channel
REACH: 1 RS: 0

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1588	36.9	1586	47.96	1586	56.86	1588

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	36.9	.05	47.96	.06

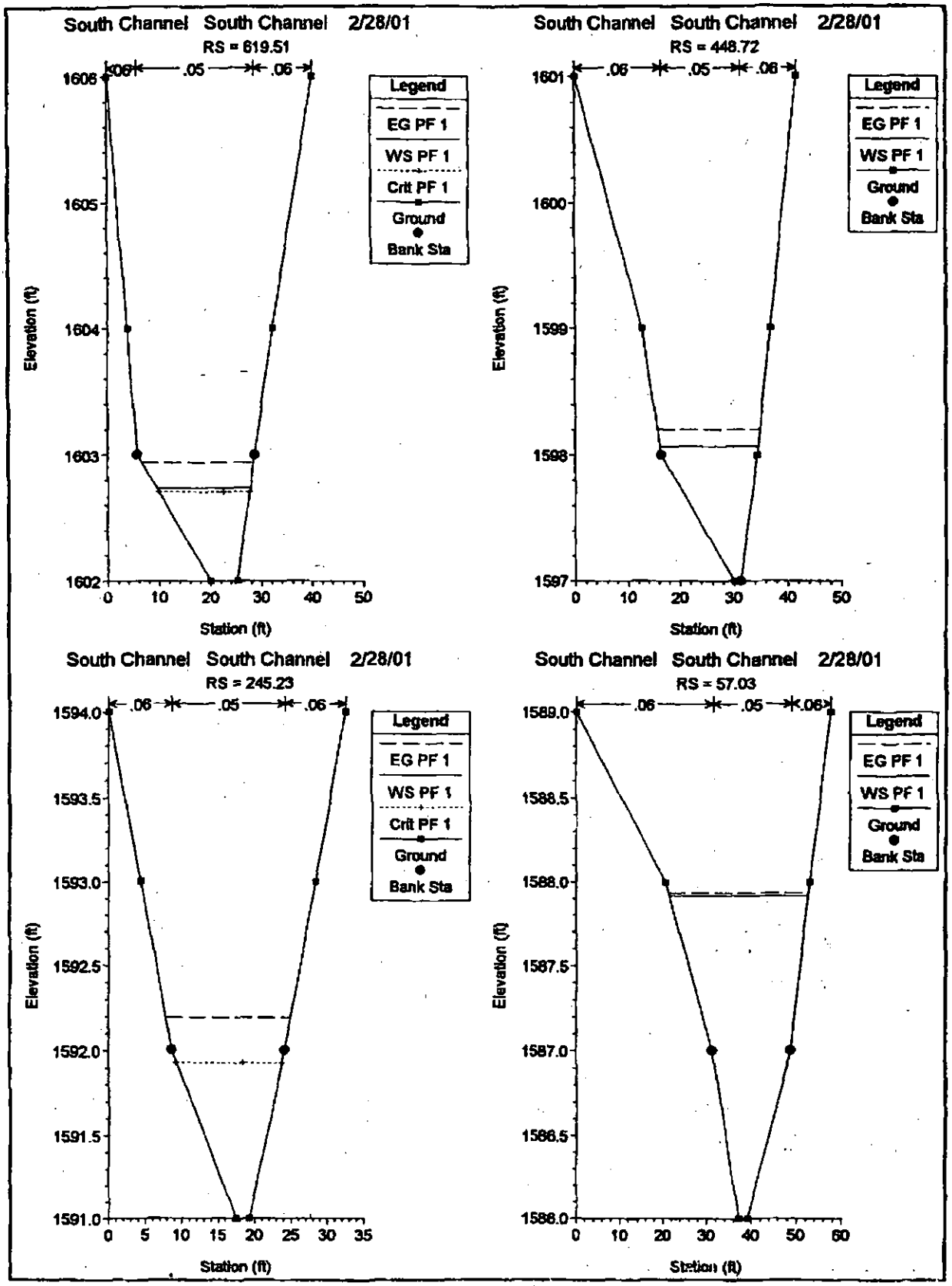
Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
36.9	47.96	64.36	66.3	75.54	.1	.3

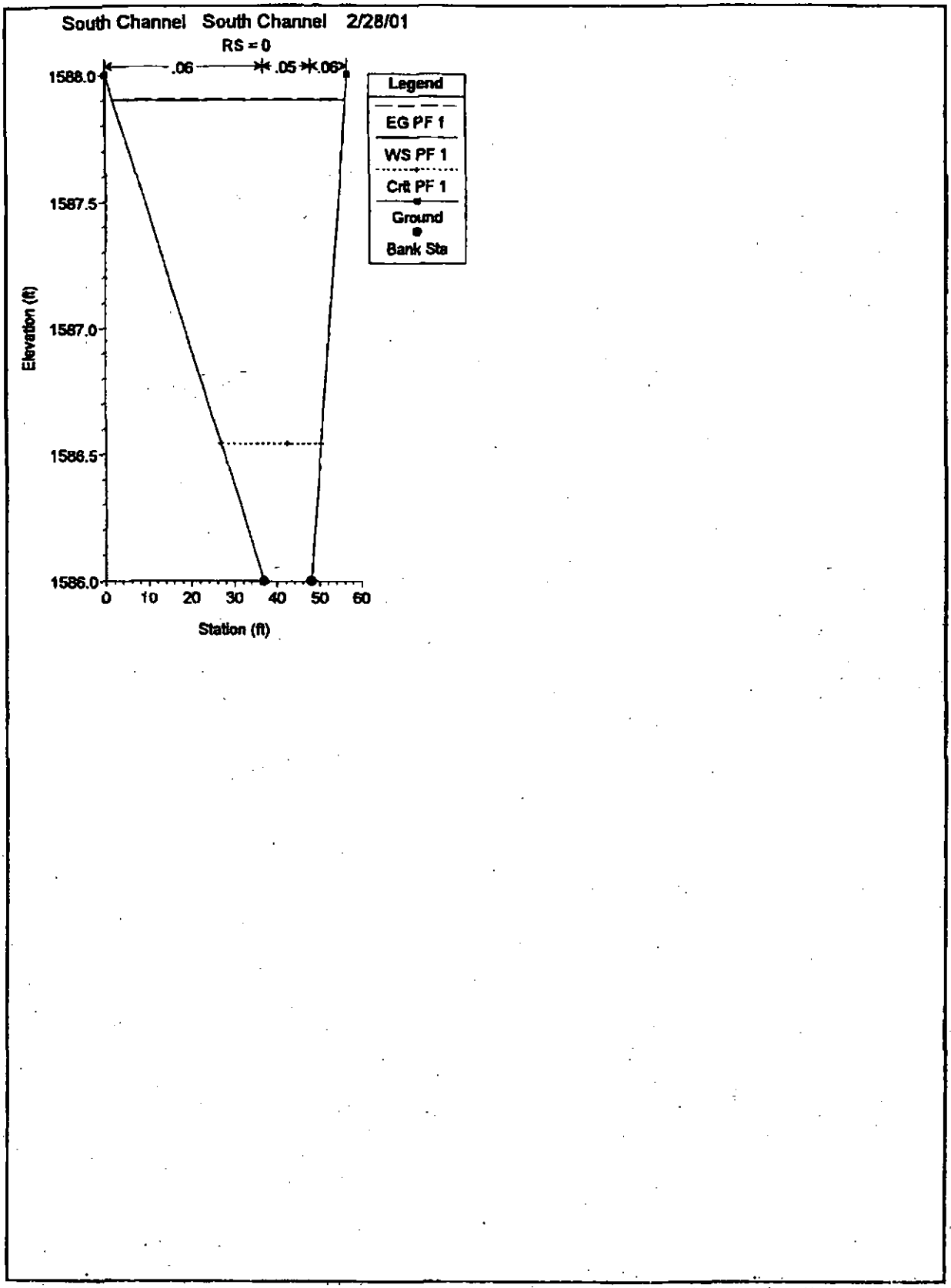
Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	619.51	31.20	1602.00	1602.73	1602.70	1602.94	0.040774	3.62	8.62	18.28	0.93
1	448.72	31.20	1597.00	1598.07		1598.20	0.020136	3.02	10.79	18.35	0.68
1	265.23	31.20	1591.00	1591.93	1591.93	1592.19	0.046901	4.13	7.55	14.52	1.01
1	57.03	31.20	1586.00	1587.92		1587.93	0.000840	1.11	31.97	31.03	0.16
1	0	31.20	1586.00	1587.90	1586.54	1587.91	0.000258	0.73	62.35	54.57	0.09

HEC-RAS Plan: South Channe River: South Channel Reach: 1

	31.20	1602.00	1602.73	1602.70	1602.94	0.040774	3.62	8.62	18.28	0.93
	31.20	1597.00	1598.07		1598.20	0.020136	3.02	10.79	18.35	0.68
	31.20	1591.00	1591.93	1591.93	1592.18	0.046901	4.13	7.55	14.52	1.01
	31.20	1586.00	1587.92		1587.93	0.000840	1.11	31.97	31.03	0.16
	31.20	1586.00	1587.90	1586.54	1587.91	0.000258	0.73	62.35	54.57	0.09


South Channel South Channel 2/28/01
RS = 619.51
.06
.05
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
South Channel South Channel 2/28/01
RS = 448.72
.06
.05
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
South Channel South Channel 2/28/01
RS = 245.23
.06
.05
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
South Channel South Channel 2/28/01
RS = 57.03
.06
.05
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


South Channel South Channel 2/28/01
RS = 0
.06
.05
.06
1588.0
1587.5
1587.0
1586.5
1586.0
Elevation (ft)
0
10
20
30
40
50
60
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Appendix E: Preliminary G&D Plan

1) Preliminary Grading & Drainage Plan prepared by RICK (2017)

Appendix F: Warning & Disclaimer of Liability

Appendix 4-C

Warning and Disclaimer of Liability

The Drainage and Floodplain Regulations and Ordinances of the City of Scottsdale are intended to "minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding caused by the surface runoff of rainfall" (Scottsdale Revised Code §37-16).

As defined in S.R.C. §37-17, a flood plain or "*Special flood hazard* area means an area having flood and/or flood related erosion hazards as shown on a FHBM or FIRM as zone A, AO, A1-30, AE, A99, AH, or E, and those areas identified as such by the floodplain administrator, delineated in accordance with subsection 37-18(b) and adopted by the floodplain board." It is possible that a property could be inundated by greater frequency flood events or by a flood greater in magnitude than a 100-year flood. Additionally, much of the Scottsdale area is a dynamic flood area; that is, the floodplains may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY PURSUANT TO S.R.C §37-22
"The degree of flood protection provided by the requirements in this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by manmade or natural causes. This article (Chapter 37, Article II) shall not create liability on the part of the city, any officer or employee thereof, or the federal government for any flood damages that result from reliance on this article or any administrative decision lawfully made thereunder."

Compliance with Drainage and Floodplain Regulations and Ordinances does not insure complete protection from flooding. The Floodplain Regulations and Ordinances meet established local and federal standards for floodplain management, but neither this review nor the Regulations and Ordinances take into account such flood related problems as natural erosion, streambed meander or man-made obstructions and diversions, all of which may have an adverse affect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above. If I am an agent for an owner I have made the owner aware of and explained this disclaimer.

556-PA-2017	Joe Cirone, P.E.	12/13/2017
Plan Check No.	Owner or Agent	Date

Appendix G: Digital Data (CD)