EXISTING 36" CMP AT BASIN O1

Culvert Calculator

Entered Data:

Shape ..... Circular
Number of Barrels 1
Solving for ..... Headwater
Chart Number 2
Scale Number 1
Chart Description ..... CORRUGATED METAL PIPE CULVERT
Scale Description ..... HEADWALL
Flowrate ..... 44.0000 cfs
Manning's n 0.0240
Roadway Elevation ..... 895.4000 ft
Inlet Elevation ..... 891.9000 ft
Outlet Elevation ..... 889.9000 ft
Diameter ..... 36.0000 in
Length ..... 48.3000 ft
Entrance Loss 0.0000
Tailwater ..... 2.3000 ft

Computed Results:

Headwater ..... 895.3786 ft From Inlet
Slope ..... 0.0414 ft/ft
Velocity ..... 10.8694 fps

APPENDIX 01

CLUB ESTATES TM 5499 - SR76 STORM DRAIN

PROPOSED STORM DRAIN SYSTEM AT BASIN O1

```
+++ Commands Read From File C:®HYDRA®SR76-2-36.HDA
  JOB
  SWI2
  NEW1ST BARREL AT INLET
  PDA.024 18 6 2 2 .01
  HGL1
  FLO44.3
  PIP55.31 894.5 894.7 889.9 887.5 -36
+++ Tc =    .0 minutes
+++ CA =    .0
  PNC1 3 5 97.7 0
  HOL1
  NEW2ND BARREL AT INLET
  FLO44.3
  PIP55.31 894.5 894.7 889.9 887.5 -36
+++ Tc =    .0 minutes
+++ CA =    .0
  PNC2 3 5 97.7 0
  REC1
  PIP152.93 894.7 891.6 887.2 883.9 -48
+++ Tc =    .0 minutes
+++ CA =    .0
  PNC3 4 5 87.5 0
  PIP347.5 891.6 869.0 883.6 864 -48
+++ Tc =    .0 minutes
+++ CA =    .0
  PNC4 5 0 180 2
  TWE865.9
  END
 END OF RUN.
```

CLUB ESTATES TM 5499 - SR76 STORM DRAIN

*** 1ST BARREL AT INLET Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/sec)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
1	55	36	889.90	.04339	4.6	1.3	11.1	44.30	59		
			887.50		7.2	4.0	10.7	75.46			

LENGTH = 55. TOTAL LENGTH = 55.

*** 2ND BARREL AT INLET Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/sec)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
2	55	36	889.90	.04339	4.6	1.3	11.1	44.30	59		
			887.50		7.2	4.0	10.7	75.46			
3	153	48	887.20	.02158	7.5	3.2	10.1	88.60	77		
			883.90		7.7	3.4	9.1	114.60			
4	348	48	883.60	.05640	8.0	3.7	14.6	88.60	48		
			864.00		5.0	.7	14.7	185.28			

LENGTH = 556. TOTAL LENGTH = 611.

CLUB ESTATES TM 5499 - SR76 STORM DRAIN

Hydraulic Gradeline Computations

Pipe #	Downstream Node #	Hydraulic Gradeline Elev.	Crown Elev.	Possible Surcharge	Ground Elev.	Super-critical
1	3	890.25	890.50	N	894.70	Y
2	3	890.25	890.50	N	894.70	Y
3	4	887.10	887.90	N	891.60	Y
4	5	865.95	868.00	N	869.00	Y

Pipe #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation
1	1	894.41	894.50
2	2	894.41	894.50

PROPOSED TRAP. CHANNEL AT END 48" CMP ~ BASIN O1

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	88.6000 cfs
Slope	0.0175 ft/ft
Manning's n	0.0350
Height	30.0000 in
Bottom width	24.0000 in
Left slope	0.3300 ft/ft
Right slope	0.3300 ft/ft

Computed Results:

Depth	23.1897 in
Velocity	5.8360 fps
Flow area	15.1815 ft2
Flow perimeter	171.9988 in
Hydraulic radius	12.7102 in
Top width	164.5439 in
Area	23.9394 ft2
Perimeter	215.4624 in
Percent full	77.2992 %

Critical Information

Critical depth	22.9534 in
Critical slope	0.0184 ft/ft
Critical velocity	5.9413 fps
Critical area	14.9127 ft2
Critical perimeter	170.4905 in
Critical hydraulic radius	12.5956 in
Critical top width	163.1116 in
Specific energy	2.4618 ft
Minimum energy	2.8692 ft
Froude number	0.9778
Flow condition	Subcritical

PROPOSED TRAP. CHANNEL AT BASIN O1

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	88.6000 cfs
Slope	0.0580 ft/ft
Manning's n	0.0350
Height	30.0000 in
Bottom width	24.0000 in
Left slope	0.3300 ft/ft
Right slope	0.3300 ft/ft

Computed Results:

Depth	17.8791 in
Velocity	9.1277 fps
Flow area	9.7067 ft2
Flow perimeter	138.1058 in
Hydraulic radius	10.1210 in
Top width	132.3582 in
Area	23.9394 ft2
Perimeter	215.4624 in
Percent full	59.5970 %

Critical Information

Critical depth	22.9534 in
Critical slope	0.0184 ft/ft
Critical velocity	5.9413 fps
Critical area	14.9127 ft2
Critical perimeter	170.4905 in
Critical hydraulic radius	12.5956 in
Critical top width	163.1116 in
Specific energy	2.7847 ft
Minimum energy	2.8692 ft
Froude number	1.7154
Flow condition	Supercritical

EXISTING 30" CMP AT BASIN O2

Culvert Calculator

Entered Data:

Shape ..... Circular
Number of Barrels 1
Solving for ..... Headwater
Chart Number 2
Scale Number 1
Chart Description ..... CORRUGATED METAL PIPE CULVERT
Scale Description ..... HEADWALL
Flowrate ..... 46.0000 cfs
Manning's n 0.0240
Roadway Elevation ..... 883.8000 ft
Inlet Elevation ..... 878.8500 ft
Outlet Elevation ..... 875.5100 ft
Diameter ..... 30.0000 in
Length ..... 53.9000 ft
Entrance Loss 0.0000
Tailwater ..... 1.5700 ft

Computed Results:

Headwater ..... 883.8257 ft From Inlet
Slope ..... 0.0620 ft/ft
Velocity ..... 12.6126 fps

PROPOSED 2-30" CMP AT BASIN O2

Culvert Calculator

Entered Data:

Shape ..... Circular
Number of Barrels 2
Solving for ..... Headwater
Chart Number 2
Scale Number 1
Chart Description ..... CORRUGATED METAL PIPE CULVERT
Scale Description ..... HEADWALL
Flowrate ..... 69.7000 cfs
Manning's n 0.0240
Roadway Elevation ..... 883.8000 ft
Inlet Elevation ..... 879.8700 ft
Outlet Elevation ..... 875.5100 ft
Diameter ..... 30.0000 in
Length ..... 70.4000 ft
Entrance Loss 0.0000
Tailwater ..... 1.5700 ft

Computed Results:

Headwater ..... 883.4279 ft From Inlet
Slope ..... 0.0619 ft/ft
Velocity ..... 11.9119 fps

APPENDIX 02

PROPOSED TRAP CHANNEL AT BASIN O2

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	69.7000 cfs
Slope	0.0590 ft/ft
Manning's n	0.0350
Height	36.0000 in
Bottom width	24.0000 in
Left slope	0.2500 ft/ft
Right slope	0.2500 ft/ft

Computed Results:

Depth	14.8003 in
Velocity	8.1507 fps
Flow area	8.5514 ft2
Flow perimeter	146.0464 in
Hydraulic radius	8.4316 in
Top width	142.4024 in
Area	42.0000 ft2
Perimeter	320.8636 in
Percent full	41.1119 %

Critical Information

Critical depth	18.8433 in
Critical slope	0.0192 ft/ft
Critical velocity	5.3601 fps
Critical area	13.0036 ft2
Critical perimeter	179.3855 in
Critical hydraulic radius	10.4385 in
Critical top width	174.7461 in
Specific energy	2.2658 ft
Minimum energy	2.3554 ft
Froude number	1.6927
Flow condition	Supercritical

EXISTING 24" CMP AT BASIN O3

Culvert Calculator

Entered Data:

Shape ..... Circular
Number of Barrels 1
Solving for ..... Headwater
Chart Number 2
Scale Number 1
Chart Description ..... CORRUGATED METAL PIPE CULVERT
Scale Description ..... HEADWALL
Flowrate ..... 28.0000 cfs
Manning's n 0.0240
Roadway Elevation ..... 885.8000 ft
Inlet Elevation ..... 881.5000 ft
Outlet Elevation ..... 875.3000 ft
Diameter ..... 24.0000 in
Length ..... 54.1000 ft
Entrance Loss 0.0000
Tailwater ..... 1.2000 ft

Computed Results:

Headwater ..... 885.7760 ft From Inlet
Slope ..... 0.1146 ft/ft
Velocity ..... 14.1825 fps

PROPOSED 27" CMP AT BASIN O3

Culvert Calculator

Entered Data:

Shape ..... Circular
Number of Barrels 1
Solving for ..... Headwater
Chart Number 2
Scale Number 1
Chart Description ..... CORRUGATED METAL PIPE CULVERT
Scale Description ..... HEADWALL
Flowrate ..... 31.3000 cfs
Manning's n 0.0240
Roadway Elevation ..... 885.8000 ft
Inlet Elevation ..... 881.5000 ft
Outlet Elevation ..... 875.3000 ft
Diameter ..... 27.0000 in
Length ..... 54.1000 ft
Entrance Loss 0.0000
Tailwater ..... 1.2000 ft

Computed Results:

Headwater ..... 885.2722 ft From Inlet
Slope ..... 0.1146 ft/ft
Velocity ..... 14.6372 fps

APPENDIX 03

PROPOSED TRAP CHANNEL AT BASIN O3

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	31.3000 cfs
Slope	0.0270 ft/ft
Manning's n	0.0350
Height	24.0000 in
Bottom width	24.0000 in
Left slope	0.3300 ft/ft
Right slope	0.3300 ft/ft

Computed Results:

Depth	13.3125 in
Velocity	5.2621 fps
Flow area	5.9482 ft2
Flow perimeter	108.9613 in
Hydraulic radius	7.8609 in
Top width	104.6817 in
Area	16.1212 ft2
Perimeter	177.1699 in
Percent full	55.4687 %

Critical Information

Critical depth	14.0855 in
Critical slope	0.0211 ft/ft
Critical velocity	4.7986 fps
Critical area	6.5227 ft2
Critical perimeter	113.8951 in
Critical hydraulic radius	8.2468 in
Critical top width	109.3670 in
Specific energy	1.5397 ft
Minimum energy	1.7607 ft
Froude number	1.1235
Flow condition	Supercritical

EXISTING 48" CMP AT BASIN O4

Culvert Calculator
Entered Data:

Shape ..... Circular
Number of Barrels 1
Solving for ..... Headwater
Chart Number 2
Scale Number 1
Chart Description ..... CORRUGATED METAL PIPE CULVERT
Scale Description ..... HEADWALL
Flowrate ..... 148.0000 cfs
Manning's n 0.0240
Roadway Elevation ..... 857.5000 ft
Inlet Elevation ..... 849.5000 ft
Outlet Elevation ..... 848.3000 ft
Diameter ..... 48.0000 in
Length ..... 58.7000 ft
Entrance Loss 0.0000
Tailwater ..... 3.0000 ft (d_c from Trap. Chl. Basin O6)

Computed Results:

Headwater ..... 857.4763 ft From Inlet
Slope ..... 0.0204 ft/ft
Velocity ..... 11.7775 fps

EXISTING TRAP CHANNEL AT BASIN O5

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	114.5000 cfs
Slope	0.0526 ft/ft
Manning's n	0.0350
Height	26.0000 in
Bottom width	48.0000 in
Left slope	0.5000 ft/ft
Right slope	0.5000 ft/ft

Computed Results:

Depth	19.1910 in
Velocity	9.9459 fps
Flow area	11.5122 ft2
Flow perimeter	133.8249 in
Hydraulic radius	12.3875 in
Top width	124.7641 in
Area	18.0556 ft2
Perimeter	164.2755 in
Percent full	73.8117 %

Critical Information

Critical depth	25.1313 in
Critical slope	0.0177 ft/ft
Critical velocity	6.6767 fps
Critical area	17.1491 ft2
Critical perimeter	160.3908 in
Critical hydraulic radius	15.3966 in
Critical top width	148.5254 in
Specific energy	3.1365 ft
Minimum energy	3.1414 ft
Froude number	1.6664
Flow condition	Supercritical

EXISTING TRAP CHANNEL AT BASIN O6

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	153.2000 cfs
Slope	0.0250 ft/ft
Manning's n	0.0350
Height	48.0000 in
Bottom width	12.0000 in
Left slope	0.5000 ft/ft
Right slope	0.5000 ft/ft

Computed Results:

Depth	33.6375 in
Velocity	8.2729 fps
Flow area	18.5182 ft2
Flow perimeter	162.4317 in
Hydraulic radius	16.4169 in
Top width	146.5502 in
Area	36.0000 ft2
Perimeter	226.6625 in
Percent full	70.0782 %

Critical Information

Critical depth	36.1841 in
Critical slope	0.0174 ft/ft
Critical velocity	7.2265 fps
Critical area	21.1999 ft2
Critical perimeter	173.8201 in
Critical hydraulic radius	17.5629 in
Critical top width	156.7363 in
Specific energy	3.8667 ft
Minimum energy	4.5230 ft
Froude number	1.1844
Flow condition	Supercritical

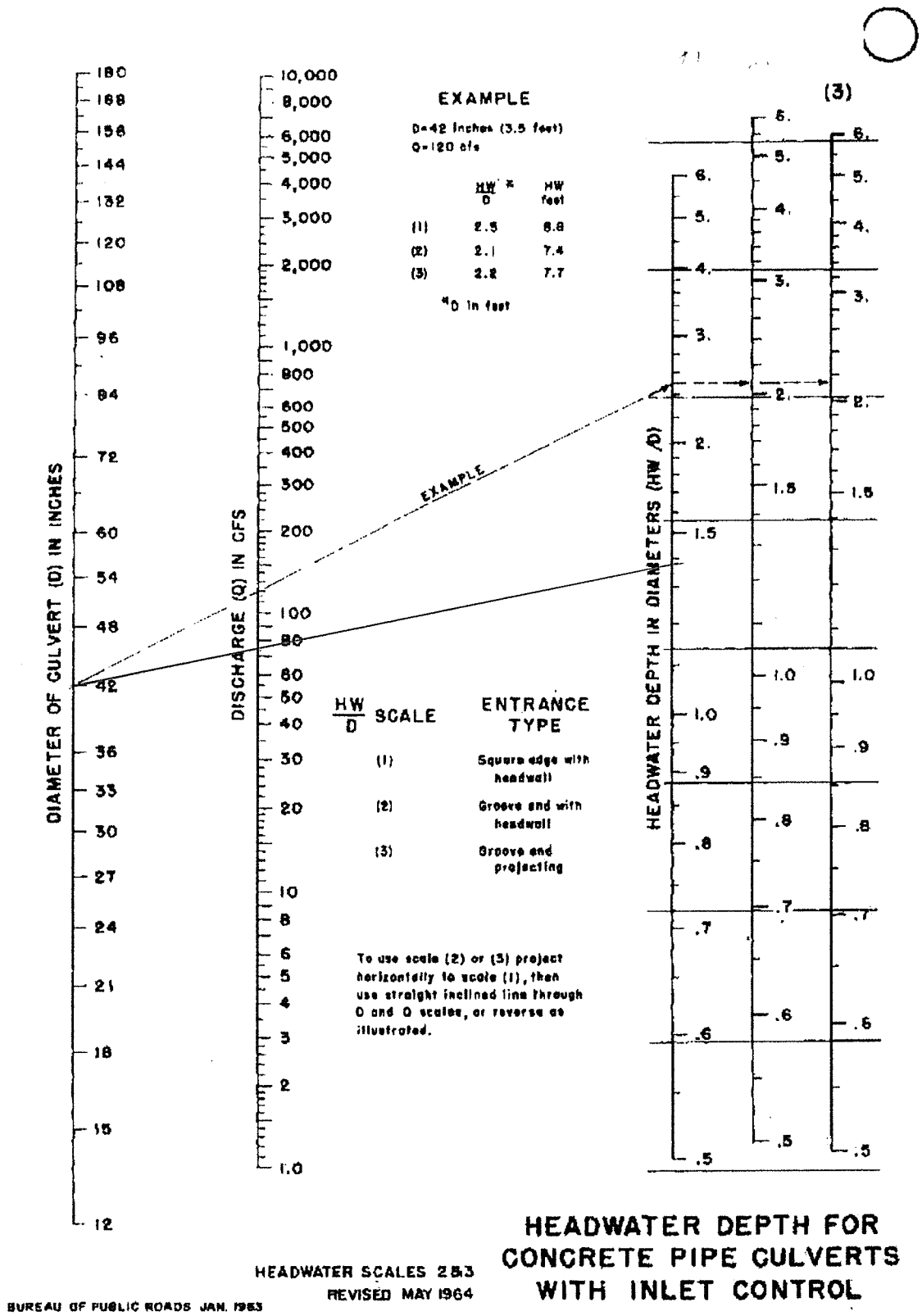


Figure 4-3 Sample Inlet Control Nomograph

Mannings Formula

$Q = a \times 1.486/n \times R^{2/3} \times S^{1/2}$

Input Data:			Results:		
Area =	11.12	ft^2	Hydraulic Radius =	0.34	ft
Mannings 'n' =	.015		Flow Rate =	53.33	cfs
Wetted Perimeter =	33.01	ft	Velocity =	4.8	ft/s
Slope =	.01	ft/ft			

STREET "C" ~ FULL STREET SECTION

Figure 2-2

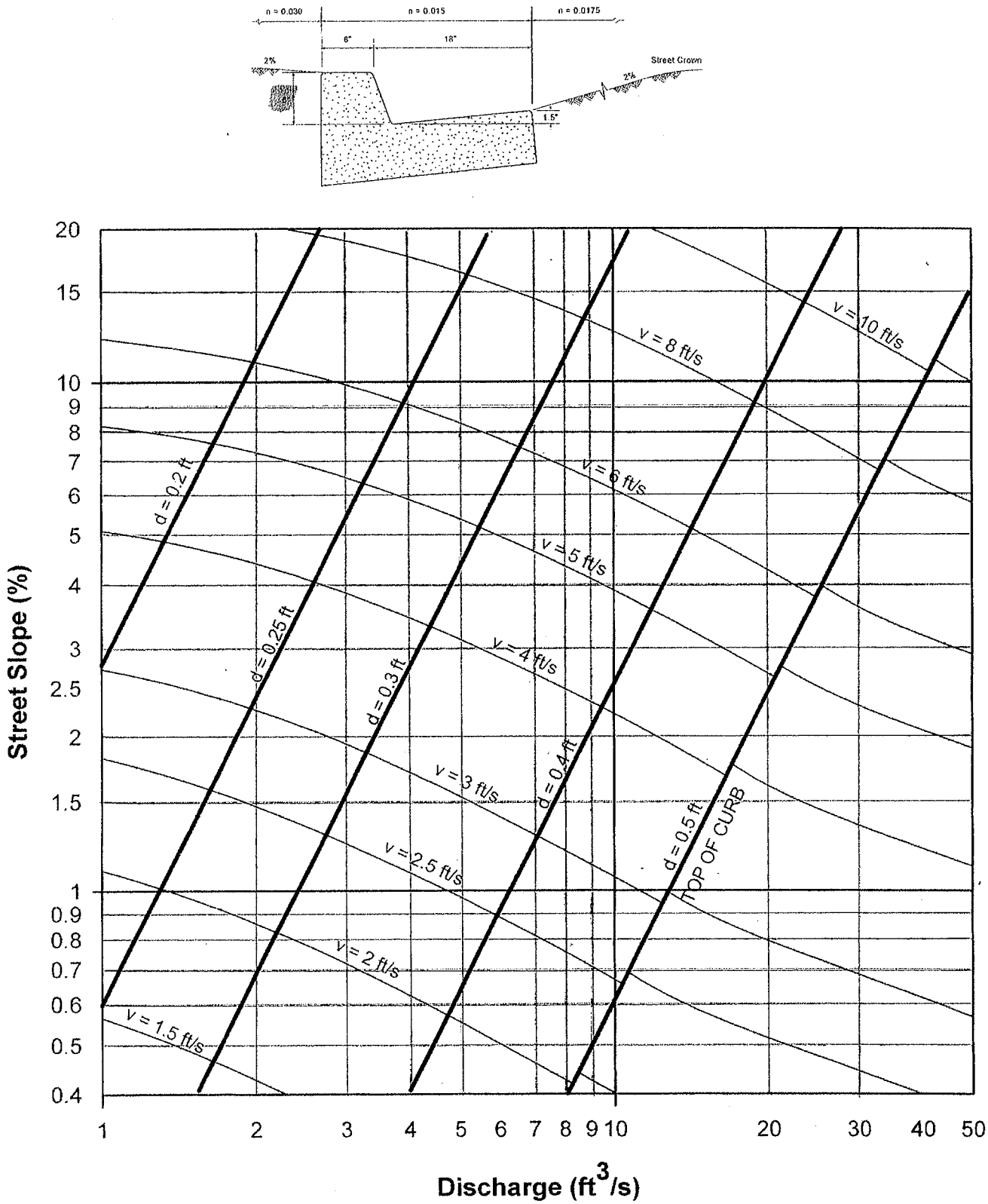


Figure 2-2 6-inch Gutter and Roadway Discharge-Velocity Chart

Mannings Formula

$Q = a \times 1.486/n \times R^{2/3} \times S^{1/2}$

Input Data:			Results:		
Area =	16.22	ft^2	Hydraulic Radius =	0.29	ft
Mannings 'n' =	.015		Flow Rate =	69.73	cfs
Wetted Perimeter =	56.74	ft	Velocity =	4.3	ft/s
Slope =	.01	ft/ft			

EXISTING NON-CIRCULATION ELEMENT RESIDENTIAL ROAD
~ FULL STREET SECTION ~

Mannings Formula

$Q = a \times 1.486/n \times R^{2/3} \times S^{1/2}$

Input Data:			Results:		
Area =	16.22	ft^2	Hydraulic Radius =	0.29	ft
Mannings 'n' =	.015		Flow Rate =	40.06	cfs
Wetted Perimeter =	56.74	ft	Velocity =	2.47	ft/s
Slope =	.0033	ft/ft			

SR 76 Post-Development Model Nodes 02 and 03 Drainage Features

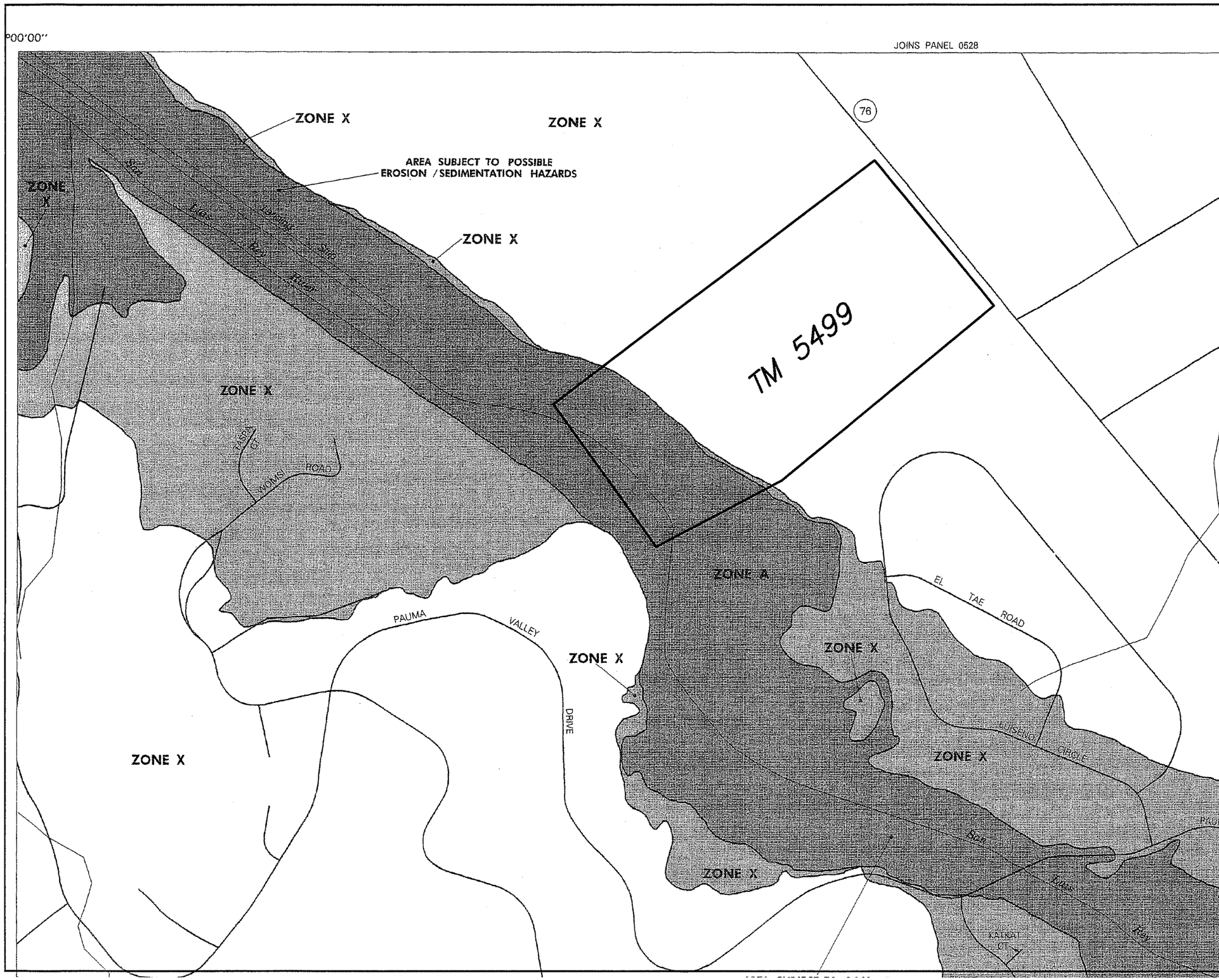
Characterization of Flows along Highway shoulders and outfalls

The natural topography and existing improvements along the project frontage is rolling and presents two sump drainage locations. The required pavement widening must necessarily follow these patterns. Drainage berms are proposed along the edges of the paved shoulders to direct flows from the road crown away from any existing or manufactured slopes to asphalt downdrains on either side of each inlet and outlet headwall location. The outfall flows will enter the proposed earthen trapezoidal channels which continue toward the river confluence.

Drainage which will flow along the berm on the southeast bound offsite right turn lane will enter the existing asphalt improved driveway which is adjacent to the project's northwest property corner. This flow, however, will be a welcome reduction of the existing flows. Currently all of the flow from Basin 01 reaches that point and continues southwesterly toward the river. This project is proposing a storm drain system which will direct the Basin 01 flows to the proposed earthen channel along the project northwesterly boundary. Any overtopping of the existing asphalt improved driveway will move onto the project site which will be picked up in the proposed earthen channel.

The overall strategy of project drainage design is one of improving the existing conditions both onsite and offsite for the neighboring properties. The reduction of present drainage burdens for adjacent properties is definitely a goal worth pursuing. At the same time, marked improvements in water quality treatment and flow control should be achieved with the creation of the three proposed earthen channels taking the place of the current unmanaged, untreated and unruly flows.

Please see Sheet 2 of the project Preliminary Grading Plan (enclosed) for paving and drainage details including cross sections, plan views and notations.



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 536 OF 2375

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY, UNINCORPORATED AREAS	060284	0536	F

MAP NUMBER 06073C0536 F

EFFECTIVE DATE: JUNE 19, 1997

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX F

EXISTING ASPHALT LINED CHANNEL AT NODE Z

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	50.2000 cfs
Slope	0.0460 ft/ft
Manning's n	0.0160
Height	17.0000 in
Bottom width	0.0000 in
Left slope	0.1400 ft/ft
Right slope	0.2000 ft/ft

Computed Results:

Depth	10.2976 in
Velocity	11.2280 fps
Flow area	4.4710 ft2
Flow perimeter	126.7796 in
Hydraulic radius	5.0783 in
Top width	125.0426 in
Area	12.1850 ft2
Perimeter	209.2961 in
Percent full	60.5743 %

Critical Information

Critical depth	16.0270 in
Critical slope	0.0043 ft/ft
Critical velocity	4.6352 fps
Critical area	10.8301 ft2
Critical perimeter	197.3166 in
Critical hydraulic radius	7.9037 in
Critical top width	194.6132 in
Specific energy	2.8173 ft
Minimum energy	2.0034 ft
Froude number	3.0219
Flow condition	Supercritical