Appendix C – Hydraulic Calculations

- Normal Depth Calculations – Onsite Streets
- Drop Inlet Calculations
- WSPG Model

Worksheet for ON3S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.840	%
Discharge	8.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+42.50	0.83
0+42.50	0.78
0+43.50	0.70
0+45.00	1.08

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+45.00, 1.08)	0.016

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	0.44	ft
Roughness Coefficient	0.016	
Elevation	0.44	ft
Elevation Range	0.00 to 1.08	ft
Flow Area	3.3	ft²
Wetted Perimeter	21.07	ft
Hydraulic Radius	0.15	ft
Top Width	20.97	ft
Normal Depth	0.44	ft
Critical Depth	0.45	ft
Critical Slope	0.693	%
Velocity	2.45	ft/s

Worksheet for ON3S

Results	
Velocity Head	0.09 ft
Specific Energy	0.53 ft
Froude Number	1.097
Flow Type	Supercritical

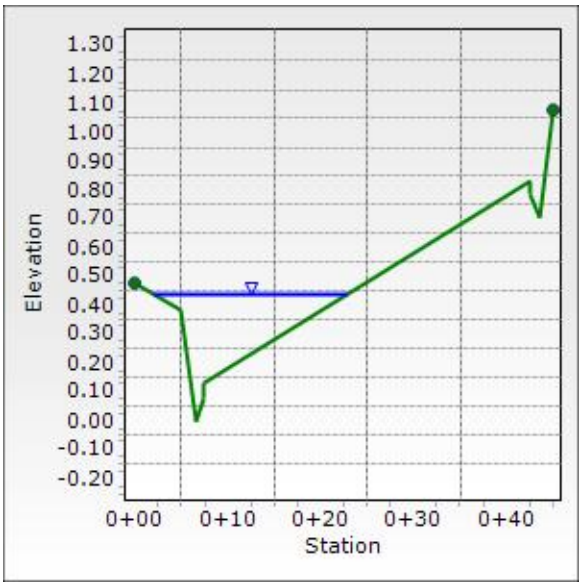
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.45 ft
Channel Slope	0.840 %
Critical Slope	0.693 %

Cross Section for ON3S

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.840 %
Normal Depth	0.44 ft
Discharge	8.00 cfs



Worksheet for ON8

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.890	%
Discharge	4.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.13
0+20.00	0.48
0+37.50	0.13
0+37.50	0.08
0+38.50	0.00
0+40.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+40.00, 0.38)	0.016

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	0.26	ft
Roughness Coefficient	0.016	
Elevation	0.26	ft
Elevation Range	0.00 to 0.48	ft
Flow Area	1.6	ft²
Wetted Perimeter	17.25	ft
Hydraulic Radius	0.09	ft
Top Width	17.08	ft
Normal Depth	0.26	ft
Critical Depth	0.29	ft
Critical Slope	0.799	%
Velocity	2.57	ft/s

Worksheet for ON8

Results	
Velocity Head	0.10 ft
Specific Energy	0.36 ft
Froude Number	1.502
Flow Type	Supercritical

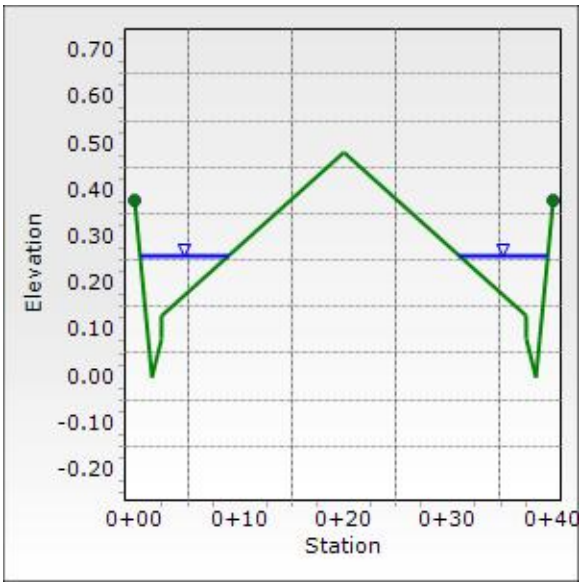
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.26 ft
Critical Depth	0.29 ft
Channel Slope	1.890 %
Critical Slope	0.799 %

XS for ON8

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.890 %
Normal Depth	0.26 ft
Discharge	4.00 cfs



Worksheet for ON13

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.890 %
Discharge	3.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.38
0+01.50	0.00
0+02.50	0.08
0+02.50	0.13
0+15.00	0.38
0+27.50	0.13
0+27.50	0.08
0+28.50	0.00
0+30.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.38)	(0+30.00, 0.38)	0.016

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	0.24 ft
Roughness Coefficient	0.016
Elevation	0.24 ft
Elevation Range	0.00 to 0.38 ft
Flow Area	1.2 ft²
Wetted Perimeter	15.17 ft
Hydraulic Radius	0.08 ft
Top Width	15.00 ft
Normal Depth	0.24 ft
Critical Depth	0.27 ft
Critical Slope	0.828 %
Velocity	2.41 ft/s

Worksheet for ON13

Results	
Velocity Head	0.09 ft
Specific Energy	0.33 ft
Froude Number	1.471
Flow Type	Supercritical

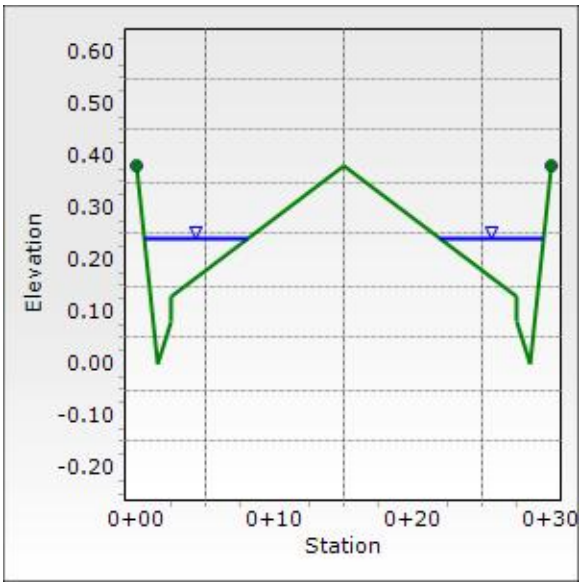
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.24 ft
Critical Depth	0.27 ft
Channel Slope	1.890 %
Critical Slope	0.828 %

XS for ON13

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.890 %
Normal Depth	0.24 ft
Discharge	3.00 cfs



Worksheet for ON14

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.500	%
Discharge	4.90	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+42.50	0.83
0+42.50	0.78
0+43.50	0.70
0+45.00	1.08

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+45.00, 1.08)	0.016

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	0.41	ft
Roughness Coefficient	0.016	
Elevation	0.41	ft
Elevation Range	0.00 to 1.08	ft
Flow Area	2.7	ft²
Wetted Perimeter	18.03	ft
Hydraulic Radius	0.15	ft
Top Width	17.92	ft
Normal Depth	0.41	ft
Critical Depth	0.38	ft
Critical Slope	0.715	%
Velocity	1.84	ft/s

Worksheet for ON14

Results	
Velocity Head	0.05 ft
Specific Energy	0.46 ft
Froude Number	0.839
Flow Type	Subcritical

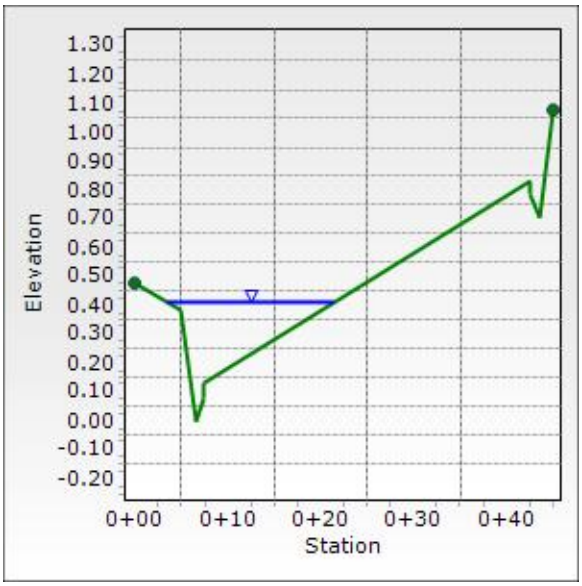
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.41 ft
Critical Depth	0.38 ft
Channel Slope	0.500 %
Critical Slope	0.715 %

XS for ON14

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Normal Depth	0.41 ft
Discharge	4.90 cfs



Type CM Drop Inlet Sizing in Sump

DI#3

Known:

D_p=	Ponding Depth at Inlet	0.33	ft
W=	Gutter Width	1.5	ft
L_g=	Length of Grate	12.5	ft
L_c=	Length of Curb Opening	14.5	ft
H_c=	Curb Opening Height	0.5	ft
C_{wc}=	Weir coefficient for curb opening	2.3	
C_{wg}=	Weir coefficient for grate	3.0	
C_o=	Orifice coefficient	0.67	
R_o=	Grate opening factor	0.60	
C_{fg}=	Clogging Factor for Grate	50	%
C_{fc}=	Clogging Factor for Curb Opening	50	%

Grate Capacity Calculations:

P_g=	Active grate weir length (agwl) = 2*W+Lg	15.50	ft
P_{agl}	Adjusted agwl = 2*(1-Cfg/100)*W+Lg	14.00	ft
A_g=	Grate area = W*L_g	18.75	ft^2
A_{aga}=	Adjusted open grate area = Ag*Ro*(1-Cfg/100)	5.63	ft^2
	check - If Dp<1.792*Aaga/Pagl; weir; else orifice	weir	
Q_{ig}=	Flow intercepted by grate If "weir" controls Qig=Cwg*Pagl*$Dp^{1.5}$ If "orifice" controls Qig=Co*Aaga*$(64.4*Dp)^{0.5}$	8.0	cfs

Curb Opening Capacity Calculations

Pc =	Active curb opening weir length (acowl) = Lc+1.8*W	17.20	ft
Pacl =	Adjusted acowl = Lc+1.8*(1-Cfc/100)*W	15.85	ft
Ac=	curb opening area (coa) = Lc*Hc	7.25	ft^2
A_{aca}=	Adjusted coa = Ac*(1-Cfc/100)	3.63	ft^2
	check - If Dp<Hc; weir; else orifice	weir	
Qic=	Flow intercepted by curb opening If "weir" controls Qic=Cwc*Pacl*Dp1.5 If "orifice" controls Qic=Co*Aaca*(64.4*Dp-Hc/2)0.5	7.0	cfs

Total Inlet Calculations

Qti =	Total flow intercepted = Qig+Qic	15.0	cfs
q =	Interception per unit ratio = Q_{ti}/L_g	1.03	cfs/ft

Type CM Drop Inlet Sizing on a C. G.

DI#4

Known:

Q_s=	Half Street Flow	4.9	cfs
S_o=	Longitudinal Slope	0.005	ft/ft
n=	Manning's Roughness Coefficient	0.016	
V_s=	Flow Velocity	1.84	fps
D=	Flow Depth	0.41	ft
S_x=	Street Transverse Slope	0.02	ft/ft
W=	Gutter Width	2	ft
a=	Gutter Depression	5.0	in
L_g=	Length of Grate	7.5	ft
L_c=	Length of Curb Opening	9.5	ft
C_{fg}=	Clogging Factor for Grate	50	%
C_{fc}=	Clogging Factor for Curb Opening	50	%

Grate Capacity Calculations:

R_f=	Frontal flow factor = $1-0.09*(V_s-V_o)$ if $V_s>V_o$; else $R_f=1$	1.00	
	V_o= Splash over velocity=$p+q*(L_g*(1-(C_{fg}/100)))-r*(L_g*(1-(C_{fg}/100)))^2+s*(L_g*(1-(C_{fg}/100)))^3$†	8.71	fps
E_o=	Grate flow ratio = Q_w/Q_s	0.28	
	Q_w= Frontal flow=A_w*V_s	1.36	cfs
	Q_x= Side flow = Q_s-Q_w	3.54	cfs
R_s=	Side flow factor = $1/(1+(0.15*V_s^{1.8})/(S_x*(L_g*(1-C_{fg}/100))^{2.3}))$	0.48	
Q_{ig}=	Flow intercepted = $[R_f*E_o+R_s*(1-E_o)]*Q_s$	3.1	cfs
	†p=1.76;q=3.12;r=0.45;s=0.03 (based on Bar P 1-1/8 grate)		

Curb Opening Capacity Calculations

S_e=	Equivalent cross slope = Sx+Sw*Eo	0.079	ft/ft
S_w=	Gutter cross slope = (0.137+afeet)/W	0.214	ft/ft
L_t=	Total interception L = $0.60*Q_s^{0.42}*So^{0.30}*(1/n*S_e)^{0.6}$	13.06	ft
Q_{ic}=	Flow intercepted = $(1-(1-(L_c*(1-C_{fc}/100))/L_t)^{1.8})*Q_s$	2.7	cfs

Total Inlet Calculations

Q_{ti}=	Total flow intercepted = $Q_{ig}+Q_{ic}$	4.9	cfs
Q_{tq}=	Flow bypass = Q_s-Q_{ti}	0.0	cfs
q=	Interception per unit ratio = Q_{ti}/L_g	0.52	cfs/ft
E_q=	Efficiency = (Qti/Qs)*100	100	%

Type CM Drop Inlet Sizing on a C. G.

DI#5

Known:

Q_s=	Half Street Flow	5.5	cfs
S_o=	Longitudinal Slope	0.0064	ft/ft
n=	Manning's Roughness Coefficient	0.016	
V_s=	Flow Velocity	2.07	fps
D=	Flow Depth	0.41	ft
S_x=	Street Transverse Slope	0.02	ft/ft
W=	Gutter Width	2	ft
a=	Gutter Depression	5.0	in
L_g=	Length of Grate	5.0	ft
L_c=	Length of Curb Opening	7.0	ft
C_{fg}=	Clogging Factor for Grate	50	%
C_{fc}=	Clogging Factor for Curb Opening	50	%

Grate Capacity Calculations:

R_f=	Frontal flow factor = $1-0.09*(V_s-V_o)$ if $V_s>V_o$; else $R_f=1$	1.00	
	V_o= Splash over velocity=$p+q*(L_g*(1-(C_{fg}/100)))-r*(L_g*(1-(C_{fg}/100)))^2+s*(L_g*(1-(C_{fg}/100)))^3$†	7.22	fps
E_o=	Grate flow ratio = Q_w/Q_s	0.28	
	Q_w= Frontal flow=A_w*V_s	1.52	cfs
	Q_x= Side flow = Q_s-Q_w	3.98	cfs
R_s=	Side flow factor = $1/(1+(0.15*V_s^{1.8})/(S_x*(L_g*(1-C_{fg}/100))^{2.3}))$	0.23	
Q_{ig}=	Flow intercepted = $[R_f*E_o+R_s*(1-E_o)]*Q_s$	2.4	cfs
	†p=1.76;q=3.12;r=0.45;s=0.03 (based on Bar P 1-1/8 grate)		

Curb Opening Capacity Calculations

S_e=	Equivalent cross slope = Sx+Sw*Eo	0.079	ft/ft
S_w=	Gutter cross slope = (0.137+afeet)/W	0.214	ft/ft
L_t=	Total interception L = $0.60*Q_s^{0.42}*So^{0.30}*(1/n*S_e)^{0.6}$	14.75	ft
Q_{ic}=	Flow intercepted = $(1-(1-(L_c*(1-C_{fc}/100))/L_t)^{1.8})*Q_s$	2.1	cfs

Total Inlet Calculations

Q_{ti}=	Total flow intercepted = $Q_{ig}+Q_{ic}$	4.6	cfs
Q_{tq}=	Flow bypass = Q_s-Q_{ti}	0.9	cfs
q=	Interception per unit ratio = Q_{ti}/L_g	0.65	cfs/ft
E_q=	Efficiency = (Qti/Qs)*100	83	%

Type CM Drop Inlet Sizing in Sump

DI#6

Known:

D_p=	Ponding Depth at Inlet	0.42	ft
W=	Gutter Width	1.5	ft
L_g=	Length of Grate	7.5	ft
L_c=	Length of Curb Opening	9.5	ft
H_c=	Curb Opening Height	0.5	ft
C_{wc}=	Weir coefficient for curb opening	2.3	
C_{wg}=	Weir coefficient for grate	3.0	
C_o=	Orifice coefficient	0.67	
R_o=	Grate opening factor	0.60	
C_{fg}=	Clogging Factor for Grate	50	%
C_{fc}=	Clogging Factor for Curb Opening	50	%

Grate Capacity Calculations:

P_g=	Active grate weir length (agwl) = 2*W+Lg	10.50	ft
P_{agl}	Adjusted agwl = 2*(1-Cfg/100)*W+Lg	9.00	ft
A_g=	Grate area = W*L_g	11.25	ft^2
A_{aga}=	Adjusted open grate area = Ag*Ro*(1-Cfg/100)	3.38	ft^2
	check - If Dp<1.792*Aaga/Pagl; weir; else orifice	weir	
Q_{ig}=	Flow intercepted by grate If "weir" controls Qig=Cwg*Pagl*$Dp^{1.5}$ If "orifice" controls Qig=Co*Aaga*$(64.4*Dp)^{0.5}$	7.3	cfs

Curb Opening Capacity Calculations

Pc =	Active curb opening weir length (acowl) = Lc+1.8*W	12.20	ft
Pacl =	Adjusted acowl = Lc+1.8*(1-Cfc/100)*W	10.85	ft
Ac=	curb opening area (coa) = Lc*Hc	4.75	ft^2
A_{aca}=	Adjusted coa = Ac*(1-Cfc/100)	2.38	ft^2
	check - If Dp<Hc; weir; else orifice	weir	
Qic=	Flow intercepted by curb opening If "weir" controls Qic=Cwc*Pacl*Dp1.5 If "orifice" controls Qic=Co*Aaca*(64.4*Dp-Hc/2)0.5	6.7	cfs

Total Inlet Calculations

Qti =	Total flow intercepted = Qig+Qic	14.0	cfs
q =	Interception per unit ratio = Q_{ti}/L_g	1.47	cfs/ft

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T1 DURANGO AND GRAND MONTECITO                                          0
T2 MAIN1
T3 KHA JOB# 092935040 BY:SS/MS
SO   1000.0002473.000 30                        2476.4
R    1031.5582473.189 30      .013                                  .000    .000 0
R    1035.5582473.226 30      .013                                  .000 -45.800 1
R    1104.9972474.086 30      .013                                  .000    .000 0
JX   1108.9972474.144 30 24   .013    9.500         2474.111        -67.5     81.600
R    1185.0732475.445 30      .013                                  .000    .000 0
JX   1189.0732475.510 24 30   .013   15.000         2475.478          8.7      -80.800
R    1402.1382478.856 24      .013                                  .000    .000 0
R    1406.1382478.935 24      .013                                  .000    .000 1
R    1619.2382483.996 24      .013                                  .000    .000 0
R    1624.2382484.145 24      .013                                  .000 -90.000 1
R    1681.2992486.200 24      .013                                  .000    .000 0
SH   1681.2992486.200 24
CD   6  4   0    .000   0.500     .000  .000  .000   .00
CD   8  4   0    .000   0.670     .000  .000  .000   .00
CD  12  4   0    .000   1.000     .000  .000  .000   .00
CD  18  4   0    .000   1.500     .000  .000  .000   .00
CD  24  4   0    .000   2.000     .000  .000  .000   .00
CD  30  4   0    .000   2.500     .000  .000  .000   .00
CD  36  4   0    .000   3.000     .000  .000  .000   .00
CD  42  4   0    .000   3.500     .000  .000  .000   .00
CD  48  4   0    .000   4.000     .000  .000  .000   .00
CD  54  4   0    .000   4.500     .000  .000  .000   .00
CD  60  4   0    .000   5.000     .000  .000  .000   .00
CD  66  4   0    .000   5.500     .000  .000  .000   .00
CD  72  4   0    .000   6.000     .000  .000  .000   .00
Q            14.000   .0
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Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2473.000	3.400	2476.400	38.50	7.84	.96	2477.36	.00	2.10	.00	2.500	.000	.00	0 .0
31.558	.0060					.0088	.28	3.40	.00	2.50	.013	.00	.00	PIPE
1031.558	2473.189	3.489	2476.678	38.50	7.84	.96	2477.63	.00	2.10	.00	2.500	.000	.00	0 .0
4.000	.0093					.0088	.04	3.49	.00	1.99	.013	.00	.00	PIPE
1035.558	2473.226	3.679	2476.905	38.50	7.84	.96	2477.86	.00	2.10	.00	2.500	.000	.00	0 .0
69.439	.0124					.0088	.61	3.68	.00	1.76	.013	.00	.00	PIPE
1104.997	2474.086	3.431	2477.517	38.50	7.84	.96	2478.47	.00	2.10	.00	2.500	.000	.00	0 .0
JUNCT STR	.0145					.0069	.03	.00	.00		.013	.00	.00	PIPE
1108.997	2474.144	4.158	2478.302	29.00	5.91	.54	2478.84	.00	1.84	.00	2.500	.000	.00	0 .0
76.076	.0171					.0050	.38	4.16	.00	1.31	.013	.00	.00	PIPE
1185.073	2475.445	3.237	2478.682	29.00	5.91	.54	2479.22	.00	1.84	.00	2.500	.000	.00	0 .0
JUNCT STR	.0162					.0044	.02	.00	.00		.013	.00	.00	PIPE
1189.073	2475.510	3.680	2479.190	14.00	4.46	.31	2479.50	.00	1.35	.00	2.000	.000	.00	0 .0
141.516	.0157					.0038	.54	3.68	.00	.99	.013	.00	.00	PIPE
1330.589	2477.732	2.000	2479.732	14.00	4.46	.31	2480.04	.00	1.35	.00	2.000	.000	.00	0 .0
10.266	.0157					.0035	.04	2.00	.00	.99	.013	.00	.00	PIPE
1340.855	2477.894	1.853	2479.747	14.00	4.61	.33	2480.08	.00	1.35	1.04	2.000	.000	.00	0 .0
HYDRAULIC JUMP														

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1340.855	2477.894	.953	2478.847	14.00	9.48	1.40	2480.24	.00	1.35	2.00	2.000	.000	.00	0 .0
12.637	.0157					.0181	.23	.95	1.94	.99	.013	.00	.00	PIPE
1353.492	2478.092	.953	2479.045	14.00	9.48	1.39	2480.44	.00	1.35	2.00	2.000	.000	.00	0 .0
29.190	.0157					.0193	.56	.95	1.94	.99	.013	.00	.00	PIPE
1382.682	2478.551	.918	2479.469	14.00	9.94	1.53	2481.00	.00	1.35	1.99	2.000	.000	.00	0 .0
19.456	.0157					.0219	.43	.92	2.08	.99	.013	.00	.00	PIPE
1402.138	2478.856	.886	2479.742	14.00	10.42	1.69	2481.43	.00	1.35	1.99	2.000	.000	.00	0 .0
4.000	.0198					.0235	.09	.89	2.23	.93	.013	.00	.00	PIPE
1406.138	2478.935	.882	2479.817	14.00	10.49	1.71	2481.53	.00	1.35	1.99	2.000	.000	.00	0 .0
85.720	.0237					.0237	2.04	.88	2.26	.88	.013	.00	.00	PIPE
1491.858	2480.971	.882	2481.853	14.00	10.49	1.71	2483.56	.00	1.35	1.99	2.000	.000	.00	0 .0
85.201	.0237					.0246	2.10	.88	2.26	.88	.013	.00	.00	PIPE
1577.059	2482.994	.863	2483.857	14.00	10.78	1.80	2485.66	.00	1.35	1.98	2.000	.000	.00	0 .0
42.179	.0237					.0273	1.15	.86	2.35	.88	.013	.00	.00	PIPE
1619.238	2483.996	.833	2484.829	14.00	11.30	1.98	2486.81	.00	1.35	1.97	2.000	.000	.00	0 .0

5.000	.0298					.0291	.15	.83	2.51	.83	.013	.00	.00	PIPE		
1624.238	2484.145	.834	2484.979	14.00	11.29	1.98	2486.96	.00	1.35	1.97	2.000	.000	.00	0	.0	
9.424	.0360					.0281	.26	.83	2.51	.79	.013	.00	.00	PIPE		

Program Package Serial Number: 7370

WATER SURFACE PROFILE LISTING Date: 7- 5-2024 Time:11:40: 7

DURANGO AND GRAND MONTECITO 0

MAIN1

KHA JOB# 092935040 BY:SS/MS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1633.663	2484.484	.848	2485.332	14.00	11.02	1.89	2487.22	.00	1.35	1.98	2.000	.000	.00	0	.0	
13.301	.0360					.0255	.34	.85	2.42	.79	.013	.00	.00	PIPE		
1646.964	2484.963	.880	2485.843	14.00	10.51	1.72	2487.56	.00	1.35	1.99	2.000	.000	.00	0	.0	
9.125	.0360					.0224	.20	.88	2.26	.79	.013	.00	.00	PIPE		
1656.089	2485.292	.912	2486.204	14.00	10.02	1.56	2487.76	.00	1.35	1.99	2.000	.000	.00	0	.0	
6.554	.0360					.0197	.13	.91	2.11	.79	.013	.00	.00	PIPE		
1662.643	2485.528	.947	2486.475	14.00	9.56	1.42	2487.89	.00	1.35	2.00	2.000	.000	.00	0	.0	
5.031	.0360					.0173	.09	.95	1.97	.79	.013	.00	.00	PIPE		
1667.675	2485.709	.982	2486.691	14.00	9.11	1.29	2487.98	.00	1.35	2.00	2.000	.000	.00	0	.0	
3.818	.0360					.0153	.06	.98	1.83	.79	.013	.00	.00	PIPE		
1671.492	2485.846	1.020	2486.866	14.00	8.69	1.17	2488.04	.00	1.35	2.00	2.000	.000	.00	0	.0	
2.994	.0360					.0135	.04	1.02	1.71	.79	.013	.00	.00	PIPE		
1674.486	2485.954	1.059	2487.013	14.00	8.28	1.07	2488.08	.00	1.35	2.00	2.000	.000	.00	0	.0	
2.271	.0360					.0119	.03	1.06	1.59	.79	.013	.00	.00	PIPE		
1676.757	2486.036	1.101	2487.137	14.00	7.90	.97	2488.11	.00	1.35	1.99	2.000	.000	.00	0	.0	
1.764	.0360					.0105	.02	1.10	1.47	.79	.013	.00	.00	PIPE		
1678.521	2486.100	1.144	2487.244	14.00	7.53	.88	2488.12	.00	1.35	1.98	2.000	.000	.00	0	.0	
1.272	.0360					.0093	.01	1.14	1.37	.79	.013	.00	.00	PIPE		

Program Package Serial Number: 7370

WATER SURFACE PROFILE LISTING Date: 7- 5-2024 Time:11:40: 7

DURANGO AND GRAND MONTECITO 0

MAIN1

KHA JOB# 092935040 BY:SS/MS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1679.793	2486.146	1.190	2487.336	14.00	7.18	.80	2488.14	.00	1.35	1.96	2.000	.000	.00	0	.0	
.854	.0360					.0082	.01	1.19	1.27	.79	.013	.00	.00	PIPE		
1680.647	2486.176	1.239	2487.415	14.00	6.85	.73	2488.14	.00	1.35	1.94	2.000	.000	.00	0	.0	
.492	.0360					.0073	.00	1.24	1.18	.79	.013	.00	.00	PIPE		
1681.139	2486.194	1.291	2487.485	14.00	6.53	.66	2488.15	.00	1.35	1.91	2.000	.000	.00	0	.0	
.160	.0360					.0064	.00	1.29	1.09	.79	.013	.00	.00	PIPE		
1681.299	2486.200	1.348	2487.547	14.00	6.22	.60	2488.15	.00	1.35	1.88	2.000	.000	.00	0	.0	

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T1 DURANGO AND GRAND MONTECITO                                          0
T2 MAIN_LAT1
T3 KHA JOB# 092935040 BY:SS/MS
SO   1000.0002475.478 30                        2479.2
R    1032.7722475.806 30      .013                                .000    .000 0
R    1036.7722475.901 30      .013                                .000 -64.300 1
R    1055.3232476.596 30      .013                                .000    .000 0
SH   1055.3232476.596 30
CD   6  4   0    .000   0.500     .000  .000  .000   .00
CD   8  4   0    .000   0.670     .000  .000  .000   .00
CD  12  4   0    .000   1.000     .000  .000  .000   .00
CD  18  4   0    .000   1.500     .000  .000  .000   .00
CD  24  4   0    .000   2.000     .000  .000  .000   .00
CD  30  4   0    .000   2.500     .000  .000  .000   .00
CD  36  4   0    .000   3.000     .000  .000  .000   .00
CD  42  4   0    .000   3.500     .000  .000  .000   .00
CD  48  4   0    .000   4.000     .000  .000  .000   .00
CD  54  4   0    .000   4.500     .000  .000  .000   .00
CD  60  4   0    .000   5.000     .000  .000  .000   .00
CD  66  4   0    .000   5.500     .000  .000  .000   .00
CD  72  4   0    .000   6.000     .000  .000  .000   .00
Q             15.000   .0
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Program Package Serial Number: 7370

WATER SURFACE PROFILE LISTING Date: 7- 5-2024 Time:11:54:29

DURANGO AND GRAND MONTECITO 0

MAIN_LAT1

KHA JOB# 092935040 BY:SS/MS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2475.478	3.722	2479.200	15.00	3.06	.14	2479.34	.00	1.31	.00	2.500	.000	.00	0 .0
32.772	.0100					.0013	.04	3.72	.00	1.05	.013	.00	.00	PIPE
1032.772	2475.806	3.438	2479.244	15.00	3.06	.14	2479.39	.00	1.31	.00	2.500	.000	.00	0 .0
4.000	.0237					.0013	.01	3.44	.00	.83	.013	.00	.00	PIPE
1036.772	2475.901	3.386	2479.287	15.00	3.06	.14	2479.43	.00	1.31	.00	2.500	.000	.00	0 .0
18.551	.0375					.0013	.02	3.39	.00	.74	.013	.00	.00	PIPE
1055.323	2476.596	2.716	2479.312	15.00	3.06	.14	2479.46	.00	1.31	.00	2.500	.000	.00	0 .0

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T1 DURANGO AND GRAND MONTECITO                                          0
T2 MAIN2
T3 KHA JOB# 092935040 BY:SS/MS
SO   1000.0002474.111 24                        2478.4
R    1032.1052476.230 24      .013                                  .000    .000 0
JX   1036.1052476.381 18 18   .013    4.9           2476.362         33.2    -11.800
R    1193.1572477.953 18      .013                                  .000    .000 0
R    1197.1572477.994 18      .013                                  .000  61.400 1
R    1216.2322478.186 18      .013                                  .000    .000 0
SH   1216.2322478.186 18
CD   6  4   0    .000   0.500     .000  .000  .000   .00
CD   8  4   0    .000   0.670     .000  .000  .000   .00
CD  12  4   0    .000   1.000     .000  .000  .000   .00
CD  18  4   0    .000   1.500     .000  .000  .000   .00
CD  24  4   0    .000   2.000     .000  .000  .000   .00
CD  30  4   0    .000   2.500     .000  .000  .000   .00
CD  36  4   0    .000   3.000     .000  .000  .000   .00
CD  42  4   0    .000   3.500     .000  .000  .000   .00
CD  48  4   0    .000   4.000     .000  .000  .000   .00
CD  54  4   0    .000   4.500     .000  .000  .000   .00
CD  60  4   0    .000   5.000     .000  .000  .000   .00
CD  66  4   0    .000   5.500     .000  .000  .000   .00
CD  72  4   0    .000   6.000     .000  .000  .000   .00
Q             4.600   .0
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DURANGO AND GRAND MONTECITO 0
MAIN2
KHA JOB# 092935040 BY:SS/MS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2474.111	4.289	2478.400	9.50	3.02	.14	2478.54	.00	1.10	.00	2.000	.000	.00	0 .0
32.105	.0660					.0018	.06	4.29	.00	.55	.013	.00	.00	PIPE
1032.105	2476.230	2.227	2478.457	9.50	3.02	.14	2478.60	.00	1.10	.00	2.000	.000	.00	0 .0
JUNCT STR	.0378					.0018	.01	.00	.00		.013	.00	.00	PIPE
1036.105	2476.381	2.151	2478.532	4.60	2.60	.11	2478.64	.00	.82	.00	1.500	.000	.00	0 .0
80.455	.0100					.0019	.15	2.15	.00	.69	.013	.00	.00	PIPE
1116.560	2477.186	1.500	2478.686	4.60	2.60	.11	2478.79	.00	.82	.00	1.500	.000	.00	0 .0
15.595	.0100					.0018	.03	1.50	.00	.69	.013	.00	.00	PIPE
1132.155	2477.342	1.360	2478.702	4.60	2.73	.12	2478.82	.00	.82	.87	1.500	.000	.00	0 .0
8.272	.0100					.0017	.01	1.36	.35	.69	.013	.00	.00	PIPE
1140.427	2477.425	1.280	2478.705	4.60	2.86	.13	2478.83	.00	.82	1.06	1.500	.000	.00	0 .0
6.676	.0100					.0019	.01	1.28	.41	.69	.013	.00	.00	PIPE
1147.103	2477.492	1.213	2478.705	4.60	3.00	.14	2478.85	.00	.82	1.18	1.500	.000	.00	0 .0
5.541	.0100					.0021	.01	1.21	.46	.69	.013	.00	.00	PIPE
1152.643	2477.547	1.155	2478.702	4.60	3.15	.15	2478.86	.00	.82	1.26	1.500	.000	.00	0 .0
4.874	.0100					.0023	.01	1.16	.52	.69	.013	.00	.00	PIPE
1157.517	2477.596	1.102	2478.698	4.60	3.30	.17	2478.87	.00	.82	1.32	1.500	.000	.00	0 .0
4.169	.0100					.0026	.01	1.10	.57	.69	.013	.00	.00	PIPE

DURANGO AND GRAND MONTECITO 0
MAIN2
KHA JOB# 092935040 BY:SS/MS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1161.686	2477.638	1.054	2478.692	4.60	3.46	.19	2478.88	.00	.82	1.37	1.500	.000	.00	0 .0
3.552	.0100					.0029	.01	1.05	.62	.69	.013	.00	.00	PIPE
1165.239	2477.674	1.010	2478.684	4.60	3.63	.21	2478.89	.00	.82	1.41	1.500	.000	.00	0 .0
3.168	.0100					.0032	.01	1.01	.68	.69	.013	.00	.00	PIPE
1168.407	2477.705	.968	2478.673	4.60	3.81	.23	2478.90	.00	.82	1.44	1.500	.000	.00	0 .0
.161	.0100					.0036	.00	.97	.73	.69	.013	.00	.00	PIPE
1168.568	2477.707	.929	2478.636	4.60	4.00	.25	2478.88	.00	.82	1.46	1.500	.000	.00	0 .0
HYDRAULIC JUMP														
1168.568	2477.707	.694	2478.401	4.60	5.75	.51	2478.91	.00	.82	1.50	1.500	.000	.00	0 .0
24.589	.0100					.0097	.24	.69	1.39	.69	.013	.00	.00	PIPE
1193.157	2477.953	.707	2478.660	4.60	5.62	.49	2479.15	.00	.82	1.50	1.500	.000	.00	0 .0
4.000	.0103					.0093	.04	.71	1.34	.69	.013	.00	.00	PIPE
1197.157	2477.994	.712	2478.705	4.60	5.57	.48	2479.19	.00	.82	1.50	1.500	.000	.00	0 .0
10.875	.0101					.0087	.09	.71	1.32	.69	.013	.00	.00	PIPE
1208.032	2478.104	.734	2478.838	4.60	5.35	.44	2479.28	.00	.82	1.50	1.500	.000	.00	0 .0

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    5.337    .0101                                        .0078      .04      .73    1.24     .69    .013       .00   .00  PIPE
         |        |        |        |        |            |        |        |        |        |      |      |      |      |
  1213.369  2478.157     .762  2478.919      4.60    5.10     .40  2479.32     .00     .82     1.50    1.500     .000   .00   0   .0
       -|-      -|-      -|-      -|-      -|-     -|-     -|-      -|-     -|-      -|-      -|-     -|-     -|-     -|-     |-
    2.378    .0101                                        .0068      .02      .76    1.16     .69    .013       .00   .00  PIPE
♠ FILE: MAIN2.WSW                          W S P G W - CIVILDESIGN Version 14.11                                        PAGE    3
                          Program Package Serial Number: 7370
                                                WATER SURFACE PROFILE LISTING                  Date: 7- 3-2024  Time: 6:26: 6
                        DURANGO AND GRAND MONTECITO                                                0
                          MAIN2
                            KHA JOB# 092935040 BY:SS/MS
 ********************************************************************************************************************** ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|      |No Wth
  Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
       -|-      -|-      -|-      -|-      -|-     -|-     -|-      -|-     -|-      -|-      -|-     -|-     -|-    -|
  L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF    |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
 *********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |               |         |       |        |        |       |       |      |
  1215.746  2478.181     .791  2478.972      4.60    4.86     .37  2479.34     .00     .82     1.50    1.500     .000   .00   0   .0
       -|-      -|-      -|-      -|-      -|-     -|-     -|-      -|-     -|-      -|-      -|-     -|-     -|-     -|-     |-
     .486    .0101                                        .0060      .00      .79    1.08     .69    .013       .00   .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
  1216.232  2478.186     .824  2479.010      4.60    4.63     .33  2479.34     .00     .82     1.49    1.500     .000   .00   0   .0
       -|-      -|-      -|-      -|-      -|-     -|-     -|-      -|-     -|-      -|-      -|-     -|-     -|-     -|-     |-
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T1 DURANGO AND GRAND MONTECITO                                          0
T2 MAIN2_LAT1
T3 KHA JOB# 092935040 BY:SS/MS
SO   1000.0002476.362 18                        2478.6
R    1026.1752477.158 18      .013                                 .000    .000 0
SH   1026.1752477.158 18
CD   6  4   0    .000   0.500     .000  .000  .000   .00
CD   8  4   0    .000   0.670     .000  .000  .000   .00
CD  12  4   0    .000   1.000     .000  .000  .000   .00
CD  18  4   0    .000   1.500     .000  .000  .000   .00
CD  24  4   0    .000   2.000     .000  .000  .000   .00
CD  30  4   0    .000   2.500     .000  .000  .000   .00
CD  36  4   0    .000   3.000     .000  .000  .000   .00
CD  42  4   0    .000   3.500     .000  .000  .000   .00
CD  48  4   0    .000   4.000     .000  .000  .000   .00
CD  54  4   0    .000   4.500     .000  .000  .000   .00
CD  60  4   0    .000   5.000     .000  .000  .000   .00
CD  66  4   0    .000   5.500     .000  .000  .000   .00
CD  72  4   0    .000   6.000     .000  .000  .000   .00
Q              4.900   .0
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Program Package Serial Number: 7370

WATER SURFACE PROFILE LISTING Date: 7- 3-2024 Time: 6:34:24

DURANGO AND GRAND MONTECITO 0

MAIN2_LAT1

KHA JOB# 092935040 BY:SS/MS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2476.362	2.238	2478.600	4.90	2.77	.12	2478.72	.00	.85	.00	1.500	.000	.00	0 .0
26.143	.0304					.0022	.06	2.24	.00	.53	.013	.00	.00	PIPE
1026.143	2477.157	1.500	2478.657	4.90	2.77	.12	2478.78	.00	.85	.00	1.500	.000	.00	0 .0
.032	.0304					.0021	.00	1.50	.00	.53	.013	.00	.00	PIPE
1026.175	2477.158	1.498	2478.656	4.90	2.77	.12	2478.78	.00	.85	.10	1.500	.000	.00	0 .0

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