

APPENDIX C

Quantity and Cost Estimates -

Hydraulic Data and Results for
Proposed Culverts and Channels –
Flow Master and Culvert Master Model Output

Proposed Improvement P1
Proposed Improvement P2A
Proposed Improvement P2B
Proposed Improvement P3A
Proposed Improvement P3B
Proposed Improvement P4
Proposed Improvement P5
Proposed Improvement P6
Proposed Improvement P7
Proposed Improvement P8
Proposed Improvement P9

TABLE C1
PROPOSED STORM INLET DATA AND CAPACITY
EI Pueblo Road Drainage Analysis

AHYMO Analysis Point Number	Description of PROPOSED Street or Location of Inlets	PROPOSED - Inlet Type - All grate bar openings are : (Grate Types = P 1-7/8" W x 4 "L) EXCEPT for 42" W x 48" L grates which have bar openings 5-1/2" W x 3-3/4"L bar opening	Number of Inlets	Street Top Elev.	Street Bot. Elev.	Distance	Street Slope at Inlet	AHYMO _97 Hydro-graph Number (BEFORE DIVIDE HYD)	100-yr. Peak Discharge (BEFORE DIVIDE HYD) and assumption of Q per inlet	Gutter Width	Gutter Cross Slope	Road Cross Slope	"n"	Local Depression Depth	Local Depression Width	Grate Width	Grate Length	Grate Clogging Factor	Curb Opening Length	Efficiency (Flow Master Result)	Inlet Capacity per Inlet (Flow Master Result)	Total Capacity per Inlet Type	Peak Discharge = Total Capacity all inlets at Analysis Point	AHYMO Analysis Point Number
(a)	(a)	(a) (b)	(a) (b)	(c)	(c)	(c)	(ft/ft)	(d)	(d)	(ft)	(ft/ft)	(ft/ft)		(in.)	(ft)	(ft)	(ft)	(%)	(ft)	(%)	(cfs)	(cfs)	(cfs)	
PROPOSED IMPROVEMENT P1																								(a)
AP 1.92	1 inlet on EI Pueblo Rd. at east side of N. Div. Chan.	60" L x 16" W x 6" H Curb Inlet	1	5074	5072	102	0.01961	1.92	27cfs on 1 side of road, 27 at 1st inlet	1.33	0.02	0.02	0.013	2.75	1.33	1.33	5	15	5	28	7.46	7.46		
AP 1.92	1 inlet on EI Pueblo Rd. at east side of N. Div. Chan.	60" L x 16" W x 6" H Curb Inlet	1	5074	5072	102	0.01961	1.92	19.54 cfs bypass flow from 1st inlet	1.33	0.02	0.02	0.013	2.75	1.33	1.33	5	15	5	36	6.05	6.05		
AP 1.92	1 inlet on EI Pueblo Rd. at east side of N. Div. Chan.	60" L x 16" W x 6" H Curb Inlet	1	5074	5072	102	0.01961	1.92	13.49 cfs bypass flow from 2nd inlet	1.33	0.02	0.02	0.013	2.75	1.33	1.33	5	15	5	36	4.74	4.74		
Failed attempt - even with 3 inlets would still have 8.75 cfs bypas flow - Therefore - to divert all water from road, assume 1 curb cut and depressed ditch inlet on N. side of EI Pueblo Rd. and 1 40 ft. curb cut on south side to open ditch																								1.92
TOTAL																								
AP 1.92	1 median inlet between EI Pueblo Rd.n. side and PDN traffic barrier wall	42"W x 48"L Median Inlet	1	---	---	---	---	1.92	27 cfs to depressed median inlet	3.5	0.02	0.02	0.015	0.01	3.5	3.5	4	15	----	85	27	27		
Conclusion - Divert all water from road, assume 1- 40 ft. curb cut and depressed ditch inlet on N. side of EI Pueblo Rd. and 1 - 40 ft. curb cut on south side to open ditch																								1.92
PROPOSED IMPROVEMENT P5																								
AP 16.92	E. bound PDN 1 Inlet just east of N. Div. Chan.)	42"W x 48"L Median Inlet	1	5076	5074	170	0.01176	16.92	8, 8/1 inlet	3.5	0.02	0.02	0.015	0.01	3.5	3.5	4	0	----	68	5	5		
Conclusion - Build 1 median type inlet 20 ft. upstream of existing median inlet, join new basin to existing basin with a 24-inch cmp																								
TOTAL																								5
TOTAL																								16.92

TABLE C1
PROPOSED STORM INLET DATA AND CAPACITY
 El Pueblo Road Drainage Analysis

AHYMO Analysis Point Number	Description of PROPOSED Street or Location of Inlets	PROPOSED - Inlet Type - All grate bar openings are : (Grate Types = P 1-7/8" W x 4 "L) EXCEPT for 42" W x 48" L grates which have bar openings 5-1/2" W x 3-3/4" L bar opening	Number of Inlets	Curb Opening Length	Efficiency (Flow Master Result)	Inlet Capacity per inlet (Flow Master Result)	Total Capacity per Inlet Type	Peak Discharge = Total Capacity all inlets at Analysis Point	AHYMO Analysis Point No.
		W is perpendicular to flow, L is with flow direction		(ft)	(%)	(cfs)	(cfs)	(cfs)	
(a)	(a)	(a) (b)	(a) (b)			(e)	(e)		(a)
AP 23.99	N. PDN frontage rd. 1 Inlet just east of driveway at curb of turn bay	60" L x 16" W x 6" H Curb Inlet	1	5	36	3.78	3.78		
Conclusion - Build 3 curb inlets just upstream of existing private driveway road. Assume 2.49 cfs									
TOTAL								12.73	
PROPOSED IMPROVEMENT P8									23.99
AP 22.92	N. PDN frontage rd. 1 Inlet just east of driveway to pump station (just east of N. Div. Chan.)	24" W x 40" L Median Inlet	1	5	---	1.37	1.37		
Conclusion - Build 1 median inlet upstream of existing concrete driveway N. side of N. PDN frontage									
TOTAL								1.37	22.92
PROPOSED IMPROVEMENT P9									
AP 18.92	W. bound PDN 1- Inlet just east of N. Div. Chan.)	42"W x 48"L Median Inlet	1	---	74	2.95	2.95		
Conclusion - Build 1 median type inlet 20 ft. upstream of existing n									
TOTAL								2.95	18.92

(a) See Figure 1 for Drainage Basin Map and Figure 2 for Analysis Point
 (b) All inlet locations, types and dimensions assumed for this concept
 (c) Elevation and length data to compute slope approaching inlet determined
 (d) See AHYMO_97 model summary table for peak discharge results.
 Computed with the Flow Master Program - see Appendix for output

Proposed Improvement P1

TABLE 6

PROPOSED IMPROVEMENT P1
84" RCP at the North Diversion Channel
Conceptual Level Cost Estimate
EI Pueblo Road Drainage Analysis

No.	Item	Unit	Quantity	Unit Cost	Cost
1	Construction Staking	LS	1.0	2,000 (\$/unit)	2,000 (\$)
2	NPDES	LS	1.0	2,000	2,000
3	Reseeding	LS	1.0	2,000	2,000
4	Grading < 2'	SY	410.0	8	3,280
5	a Section "A" Structural Reinforced Concrete Headwall, Retaining walls and conc. Run-down from EI Pueblo Rd.	CY	82.0	600	49,200
6	a Section "B" Concrete Channel Lining 8" thick with reinforcement (this item was removed and replaced with only base course)	SF	0.0	15	0
7	Base course as overflow/weir	SY	248.0	10	2,480
8	Structural Concrete Water Quality Weir	CY	12.0	600	7,200
9	84" RCP Class IV (furnish & place in open trench, cip)	LF	58.0	475	27,550
10	Trenching backfill & compaction, over 60" sewer pipe, over 8' to 12' in depth, pipe not incl., compl.	LF	58.0	150	8,700
11	Sawcut, Remove & Dispose Concrete Channel	CY	4.0	100	400
12	Remove & Dispose Concrete Headwall & R/R Ties	LS	1.0	2,000	2,000
13	Remove & Dispose 30" CMP includes trenching	LF	58.0	40	2,320
14	b Cold milling asphalt cement pavement overlay, 2.5" thickness (includes disposal of millings comp.) From N. Div. Channel to railroad tracks)	SY	1,413.0	5	7,065
15	b Type Double A catch basin, cip.	EA	4.0	5,000	20,000
16	b 18" RCP Class IV (furnish & place in open trench, cip)	LF	60.0	36	2,160
17	b Trenching backfill & compaction for 18" RCP, 18-36" sewer pipe up to 8 ft. depth, pipe not incl., compl.	LF	60.0	25	1,500
18	b 24" RCP Class IV (furnish & place in open trench, cip)	LF	50.0	40	2,000
19	b Trenching backfill & compaction for 24" RCP, 18-36" sewer pipe up to 8 ft. depth, pipe not incl., compl.	LF	50.0	25	1,250
20	b Traffic Control (includes, signs, flagman, maintenance, etc.)	LS	1.0	3,000	3,000
21	b Misc. items (striping, concrete cutting and disposal (for new inlets, etc.)	LS	1.0	3,000	3,000
	Sub-Total				149,105
22	Mobilization/Demobilization (assume % of all bid items)	%	7.0	10,437	10,437
	Sub-Total				159,542
	Contingency and soft costs	%	20.0	31,908	31,908
	TOTAL				191,451
a	See Figure 5 in map pocket for locations of Sections A and B				
b	Cost Items for Construction in EI Pueblo Rd.				39,975

Culvert Calculator Report
P1 - Prop Improv 1 - 1-84" RCP at N. Div. Chan.-solve for ~~Q~~ HEADWATER

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	5.072.00 ft	Headwater Depth/Height	1.22
Computed Headwater Elev.	5.073.56 ft	Discharge	364.00 cfs
Inlet Control HW Elev.	5.073.23 ft	Tailwater Elevation	5.069.20 ft
Outlet Control HW Elev.	5.073.56 ft	Control Type	Entrance Control

THIS IS QPP
IF 42" CMB
UNDER PASSED
DEL NOTE IS

BLOCKED

AND

ALL FLOW FROM
EL PUEBLO RD.
THAT NOW SPILLS
ACROSS N. DIV.
CHANNEL

CHANNEL

IS COLLECTED

AT EX. 30" CMB

AT N. DIV.

CHANNEL.

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	84 inch	Rise	7.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	5.073.56 ft	Upstream Velocity Head	2.35 ft
Ke	0.50	Entrance Loss	1.18 ft

Inlet Control Properties

Inlet Control HW Elev.	5.073.23 ft	Flow Control	Transition
Inlet Type	Square edge w/headwall	Area Full	38.5 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
P1 - Prop Improv 1 - 1-84" RCP at N. Div. Chan.-solve for Q

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	5,072.00 ft	Headwater Depth/Height	1.00
Computed Headwater Elev.	5,072.00 ft	Discharge	266.47 cfs
Inlet Control HW Elev.	5,071.52 ft	Tailwater Elevation	5,069.20 ft
Outlet Control HW Elev.	5,072.00 ft	Control Type	Entrance Control

Grades

Upstream Invert	5,065.00 ft	Downstream Invert	5,064.20 ft
Length	58.00 ft	Constructed Slope	0.013793 ft/ft

Hydraulic Profile

Profile	Composite S1S2	Depth, Downstream	5.00 ft
Slope Type	Sleep	Normal Depth	2.88 ft
Flow Regime	N/A	Critical Depth	4.29 ft
Velocity Downstream	9.06 ft/s	Critical Slope	0.003627 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	84 Inch	Rise	7.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	5,072.00 ft	Upstream Velocity Head	1.81 ft
Ke	0.50	Entrance Loss	0.90 ft

Inlet Control Properties

Inlet Control HW Elev.	5,071.52 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	38.5 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

NOTE -

Q100 AT

THIS

CULVERT

WILL

BE 364

286 CFS

IN FUTURE

IF

THE EXISTING

42" CULVERT

UNDER

PAVED OEL

NORTH

IS BLOCKED

AND ALL FLOW
FROM EL PUEBLO RD

THERE - ASSUME THAT AN 84" CMP

WILL TAKE 100-YR. Q FOR FINAL DESIGN

WITH POSSIBLY 286 364-266 = 98

286 CFS SPILL OVER TOP
98

4 1 Culvert Calculator Report
P - Prop Improv - 60" RCP at N. Div. Chan.-solve for Q to conc. chan. inv.

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	5,071.00 ft	Headwater Depth/Height	1.20
Computed Headwater Elev.	5,071.00 ft	Discharge	152.75 cfs
Inlet Control HW Elev.	5,070.74 ft	Tailwater Elevation	5,068.20 ft
Outlet Control HW Elev.	5,071.00 ft	Control Type	Entrance Control

(a)

Grades			
Upstream Invert	5,065.00 ft	Downstream Invert	5,064.20 ft
Length	58.00 ft	Constructed Slope	0.013793 ft/ft

Hydraulic Profile			
Profile	Composite S1 S2	Depth, Downstream	4.00 ft
Slope Type	Sleep	Normal Depth	2.50 ft
Flow Regime	N/A	Critical Depth	3.54 ft
Velocity Downstream	9.07 ft/s	Critical Slope	0.004752 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	5,071.00 ft	Upstream Velocity Head	1.64 ft
Ke	0.50	Entrance Loss	0.82 ft

Inlet Control Properties			
Inlet Control HW Elev.	5,070.74 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	19.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

(a) SOLVE FOR Q IN EXCESS OF CULVERT CAPACITY
THAT WILL SPILL OVER CONC. EMERGENCY OVERFLOW
SECTION/ Q100 = 238 CFS
153 CFS
85 SEE NEXT PAGES

Culvert Calculator Report

1 1
P - Prop Improv - 48" RCP at N. Div. Chan.-solve for Q to conc. chan. inv.

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	5,070.00 ft	Headwater Depth/Height	1.25
Computed Headwater Elev.	5,070.00 ft	Discharge	92.87 cfs
Inlet Control HW Elev.	5,069.84 ft	Tailwater Elevation	5,068.20 ft
Outlet Control HW Elev.	5,070.00 ft	Control Type	Entrance Control

48" =
PIPE TOO SMALL
ASSUMES
NOT ENOUGH
Q

Grades

Upstream Invert	5,065.00 ft	Downstream Invert	5,064.20 ft
Length	58.00 ft	Constructed Slope	0.013793 ft/ft

Hydraulic Profile

Profile	Composites1S2	Depth, Downstream	4.00 ft
Slope Type	Sleep	Normal Depth	2.12 ft
Flow Regime	N/A	Critical Depth	2.92 ft
Velocity Downstream	7.39 ft/s	Critical Slope	0.005354 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 Inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	5,070.00 ft	Upstream Velocity Head	1.39 ft
Ke	0.50	Entrance Loss	0.69 ft

Inlet Control Properties

Inlet Control HW Elev.	5,069.84 ft	Flow Control	Transition
Inlet Type	Square edge w/headwall	Area Full	12.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

P1

~~PH~~ - AP 1.98 conc. weir overflow at N. Div. Chan.

Project Description

Solve For Headwater Elevation

Input Data

Discharge	85.00	ft ³ /s
Crest Elevation	5070.00	ft
Tailwater Elevation	5068.00	ft
Crest Surface Type	Paved	
Crest Breadth	58.00	ft
Crest Length	5.00	ft

Results

Headwater Elevation	5073.15	ft	APPROX.
Headwater Height Above Crest	3.15	ft	
Tailwater Height Above Crest	-2.00	ft	EL. OF
Weir Coefficient	3.04	US	
Submergence Factor	1.00		
Adjusted Weir Coefficient	3.04	US	EL PUEBLO RD
Flow Area	15.75	ft ²	
Velocity	5.40	ft/s	
Wetted Perimeter	11.30	ft	
Top Width	5.00	ft	

THEFORE - ASSUME 60" RCD IS
SMALLEST PIPE ACCEPTABLE TO
AVOID FLOODING EL PUEBLO RD.

Proposed Improvement P1

IF

**Upstream Improvements
are not built**

AP 1.92 Qp100 = 53 cfs

= estimated Qp in El Pueblo Rd. that will flow west
across the North Diversion Channel

<

AP 1.92/2nd. curb inlet

AP 1

AP 1.9

Proposed Improvement P2A

&

Proposed Improvement P2B

PBB

2

Proposed Improvement P3A

&

Proposed Improvement P3B

Proposed Improvement P4

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P4

Proposed Improvement P5

**In east bound Paseo Del Norte
Just east of the N. Div. Channel**

Add 1 NMDOT median type inlet just east of existing
median inlet located just east of N. Diversion Channel
and join to the existing inlet

AP 16.92 Qp100= 8cfs

Proposed

Proposed

