City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

January 27, 1999

Scott McGee, P.E.
Isaacson & Arfman, PA
128 Monroe NE
Albuquerque, NM 87109

Re: Resubmitted Grading and Drainage Plan Sheets 4, 5 and 6 of 45 (3 Sheets) stamped December 31, 1998 by Scott McGee, P.E., that are to be included in the:

Master Drainage Report for Tres Placitas A-13/D-12 (A 254 Lot single family residential subdivision) Albuquerque, NM - November, 1998, Isaacson & Arfman, P.A. - report stamped November 10, 1998 by Scott McGee, P.E.

Dear Mr. McGee:

According to our consultant the referenced submittal has addressed all our comments, therefore this revised plan is approved. Keep in mind that this plan will need to be approved by DRB as required by the City Subdivision Ordinance. Recommend that you request approval of the revised grading plan with your final plat action. Regarding your rough grading permit request, please forward the original mylar with all the construction notes and a signature block for our sign-off.

Our consultant did raise a concern regarding a discrepancy between the grading plan and the preliminary plat attached to the DRC plan set (see attached letter). Please correct any discrepancy between these two documents.

Sincerely,

Fred J. Aguirre, P.E.
City Hydrologist
Public Works Department

Attachment: Letter

c: file

MASTER DRAINAGE REPORT

FOR

TRES PLACITAS

A 254 LOT SINGLE FAMILY RESIDENTIAL SUBDIVISION

ALBUQUERQUE, NEW MEXICO
NOVEMBER 1998

Prepared by:

ISAACSON & ARFMAN, P.A.
128 Monroe Street NE
Albuquerque, NM 87108
(505) 268-8828

Scott M McGee 11/10/98

Scott M. McGee, PE **Date**

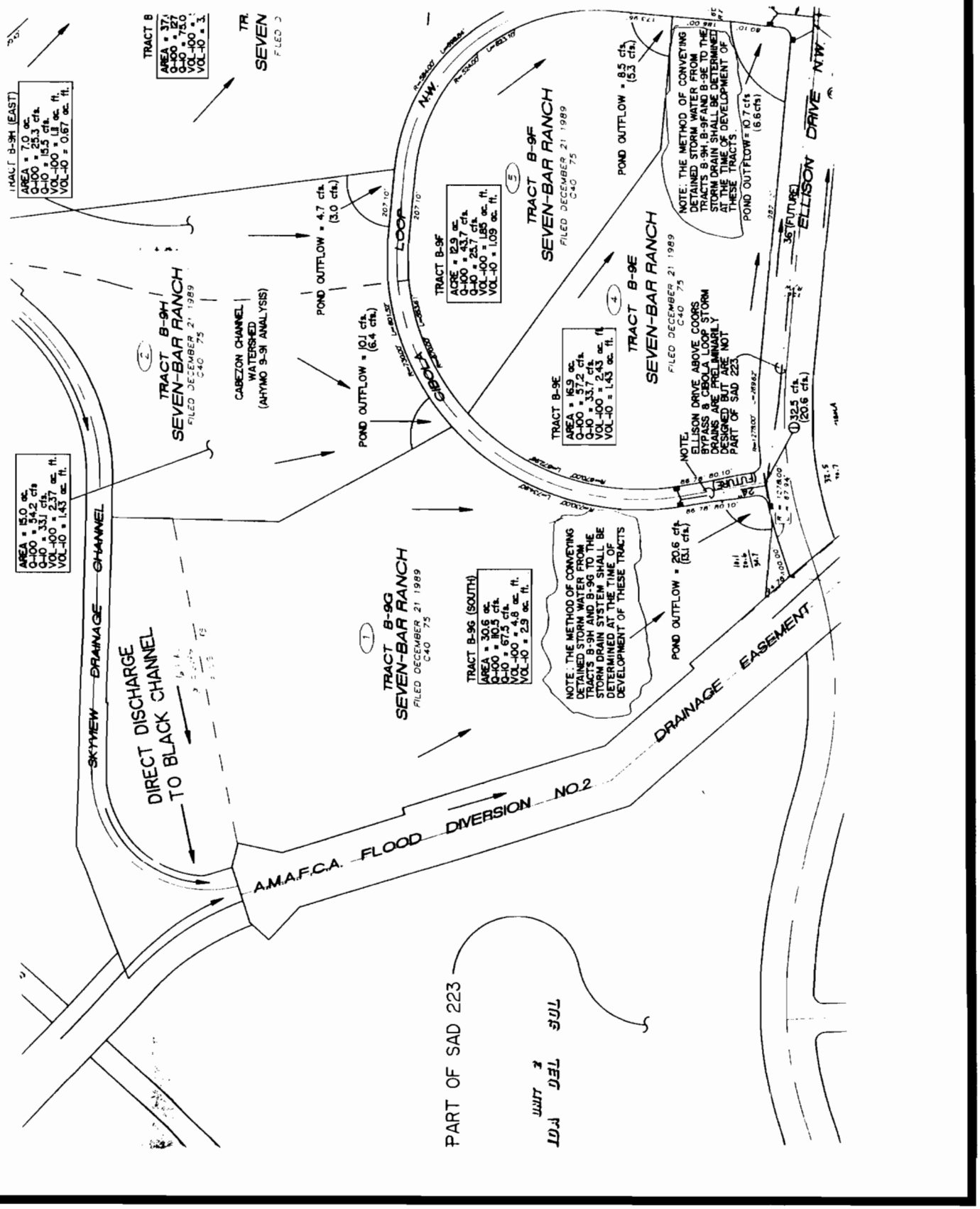
TABLE OF CONTENTS

INTRODUCTION

This report shall serve as a Master Drainage Report for Tres Placitas Subdivision, which will consist of 254 single family lots. The drainage for this area was previously discussed within SAD No. 223. As shown on the attached portion of the SAD map, part of this site will drain to Black's Diversion Channel and the remainder will flow south along Cibola Loop to Ellison Drive. The allowable discharge into Ellison Drive as determined by the SAD report is 20.60 cfs.

The drainage solution outlined in the following report varies slightly from the approved SAD No. 223 solution. This variation, however, does not increase the total discharge into the Ellison Drive Storm Drain or to the downstream detention facility. Since the existing infrastructure is not compromised in any way, and since the SAD map states that the method of conveying storm waters from Tract B-9G shall be determined at the time of development, the drainage solution offered is in compliance with SAD No. 223.

The proposed variation with the SAD is that flows will be detained in an offsite pond instead of in an onsite pond. Runoff which discharges to the east will be allowed to enter either Cibola Loop or directly to a storm drain which will convey the flows to the pond. Runoff discharging to the Black's Diversion Channel will be allowed free discharge (see Appendix B).


TRACT B-9H (EAST)
AREA = 7.0 ac.
Q-100 = 25.3 cfs.
Q-10 = 15.5 cfs.
VOL-100 = 1.8 ac. ft.
VOL-10 = 0.67 ac. ft.
TRACT B
AREA = 37.
Q-100 = 127
Q-10 = 75.0
VOL-100 = 3.
VOL-10 = 1.
TR.
SEVEN
FILED
TRACT B-9H
SEVEN-BAR RANCH
FILED DECEMBER 21 1989
C40 75
CABEZON CHANNEL
WATERSHED
(AHYMO 9-91 ANALYSIS)
POND OUTFLOW = 4.7 cfs.
(3.0 cfs.)
POND OUTFLOW = 10.1 cfs.
(6.4 cfs.)
AREA = 15.0 ac.
Q-100 = 34.2 cfs
Q-10 = 33.1 cfs.
VOL-100 = 2.37 ac. ft.
VOL-10 = 1.43 ac. ft.
SKYVIEW DRAINAGE CHANNEL
DIRECT DISCHARGE
TO BLACK CHANNEL
TRACT B-9G
SEVEN-BAR RANCH
FILED DECEMBER 21 1989
C40 75
TRACT B-9G (SOUTH)
AREA = 30.6 ac.
Q-100 = 110.5 cfs.
Q-10 = 67.5 cfs.
VOL-100 = 4.8 ac. ft.
VOL-10 = 2.9 ac. ft.
NOTE: THE METHOD OF CONVEYING
DETAINED STORM WATER FROM
TRACTS B-9H AND B-9G TO THE
STORM DRAIN SYSTEM SHALL BE
DETERMINED AT THE TIME OF
DEVELOPMENT OF THESE TRACTS
POND OUTFLOW = 20.6 cfs.
(11.1 cfs.)
A.M.A.F.C.A. FLOOD DIVERSION NO.2
DRAINAGE EASEMENT
PART OF SAD 223
UNIT 3 DEL SOL
TRACT B-9F
AREA = 12.9 ac.
Q-100 = 43.7 cfs.
Q-10 = 25.7 cfs.
VOL-100 = 1.85 ac. ft.
VOL-10 = 1.09 ac. ft.
TRACT B-9F
SEVEN-BAR RANCH
FILED DECEMBER 21 1989
C40 75
POND OUTFLOW = 8.5 cfs.
(5.3 cfs.)
NOTE: THE METHOD OF CONVEYING
DETAINED STORM WATER FROM
TRACTS B-9H, B-9F AND B-9E TO THE
STORM DRAIN SHALL BE DETERMINED
AT THE TIME OF DEVELOPMENT OF
THESE TRACTS.
POND OUTFLOW = 10.7 cfs.
(6.6 cfs.)
TRACT B-9E
AREA = 16.9 ac.
Q-100 = 57.2 cfs.
Q-10 = 33.7 cfs.
VOL-100 = 2.43 ac. ft.
VOL-10 = 1.43 ac. ft.
TRACT B-9E
SEVEN-BAR RANCH
FILED DECEMBER 21 1989
C40 75
NOTE,
ELLISON DRIVE ABOVE COORS
BYPASS & CIBOLA LOOP STORM
DRAINS ARE PRELIMINARILY
DESIGNED BUT ARE NOT
PART OF SAD 223.
32.5 cfs.
(20.6 cfs.)
36'(FUTURE)
ELLISON DRIVE N.W.
CIBOLA LOOP N.W.

I. PROJECT INFORMATION

LEGAL DESCRIPTION: Tract B-9G, Seven Bar Ranch
(12/21/89, Vol. C40 Folio 75)
Tract B-9H-1A, Seven Bar Ranch, (07/11/07, Vol. 97C Folio 216)
Tract 2, Cibola High School (05/17/83, Vol. C21 Folio 71)

ENGINEER: Isaacson & Arfman, P.A.
128 Monroe Street NE
Albuquerque, NM 87108
Attn: Fred C. Arfman, PE
(505) 268-8828

SURVEYOR: Aldrich Land Surveying, Inc.
Attn: Tim Aldrich, NMPLS No. 7719
(505) 884-1990

BENCHMARK: NGS Monument "Black 2"
Elevation: 5213.93

EXISITING ZONING: R-T

PROPOSED ZONING: SU-1 for PRD

NUMBER OF PROPOSED LOTS: 254

TOTAL AREA: 42.0 Ac.
1,829,520 Sq. Ft.

II. SITE CHARACTERISTICS

FLOOD HAZARD: No portion of this site lies within the 500-year floodplain as determined by Panel No. 35001C0108 of the September 20, 1996 Edition of the F.E.M.A. Maps (see attached). The 100-year flood zone is confined to the Black's Diversion Channel and the Skyview Drainage Channel Easement located to the north and west of the property.

SOIL TYPE: Panel 10 of the SCS Bernalillo County Soil Survey notes that site soils are Bluepoint loamy fine sand and Kokan gravelly sand, both of which are Type 'A' hydrologic soils.

EXISTING CONDITIONS: This site is currently undeveloped and mostly undisturbed with native ground cover, typical of the City's west side (Land Treatment A). The site slopes toward the southeast at an average of 2.5 percent. A stockpile of excess material generated during the construction of the subdivision to the northeast has been placed along the northwestern quarter of the property.

The site is bordered by the Black's Diversion Channel on the west and the Skyview Drainage Channel to the north. Cibola Loop and Ellison Drive are located to the east and south respectively. Storm water generated on site flows to the southeast property corner. The runoff then continues southeast across undeveloped land to an existing downstream detention facility. Offsite storm waters generated within the subdivision to the east (Tract B-9H) are blocked from entering the site by a concrete perimeter wall. That subdivisions' developed runoff is detained, and then released to the east along Cibola Loop at the rate of 11.62 cfs. The park along its west boundary has free discharge to the south at a rate of 3.18 cfs.

Ellison Drive has been partially developed along the property frontage. A 24" diameter storm drain stub exists at the intersection of (West) Cibola Loop and Ellison Drive There is also a 30" diameter

storm drain stub in Ellison Drive which ends just west of (East) Cibola Loop. Cibola Loop has not been developed along the property frontage yet.

PROPOSED CONDITIONS:

The site is planned to be developed as a single unit with 254 lots. A portion of the land adjacent to the Black's Diversion Channel and Skyview Drainage Channel will be dedicated to AMAFCA with the final plat of this site. The previously approved outflow rate of 20.6 cfs to Ellison Drive will be achieved by the construction of an offsite detention pond.

The northeastern quarter of the site (Miera Drive to the east) will drain to the east and enter Cibola Loop at Analysis Point 19 (AP 19). Runoff from the 5-acre park will be decreased to account for onsite water harvesting by incorporating small depressed areas within the site grading. Flows exiting the park will discharge through a 12" sidewalk culvert (maximum Q = 4 cfs, refer to attached FlowMaster sheet) into Cuba Road. Runoff will then be carried via street flow along Cibola Loop to Analysis Point 20 (AP 20) (see Table 2 for street flow depth calculations). At this point the flows will be collected by two sump inlets (see the Sump Calculation Sheet) and conveyed east via storm drain to the detention facility.

All of the land south of Cuba Road will drain via street flow to the southeast property corner (AP 21). Flow depths for the streets are listed in Table 2. At the southeast property corner the runoff will be collected by a sump inlet and conveyed via storm drain to the detention facility.

The runoff from Analysis Points 20 and 21 will combine and flow east to the detention facility located to the south of Cibola Loop within Tract B-9E, Seven Bar Ranch. The Owner of this tract (COA) has agreed to the location of this pond and will grant the necessary drainage easements to accommodate this facility. The pond and outfall line have both been sized to accommodate the developed conditions of Tract B-9E.

The maximum outflow from the pond was limited to 34.25 cfs. This discharge rate was obtained by combining the allowable discharge rates (as outlined in SAD No. 223) for Tres Placitas (20.6 cfs), a portion of Tract B-9E (8.67 cfs), Cibola Loop developed flows (1.8 cfs), and the parks flows from Tract B-9H (3.18 cfs). Developed flows from Tres Placitas will divide at the western edge of the pond. An 18" diameter storm drain will run along the pond boundary to allow nuisance flows (up to 17.26 cfs) to bypass the pond. A larger 36" diameter line will direct the remaining flows into the pond. This line is designed to be completely dry (inv @ pond = 81.37) when the pond reaches its maximum water surface elevation. The pond will be

drained by an 18" diameter outlet pipe. This line and the bypass pipe will contribute to a 30" diameter line which will connect to the existing 30" diameter stub located at East Cibola Loop. All storm drain calculations including HGL and Manhole Rim elevations are located in the FlowMaster sheets. An emergency spillway will be located at the eastern pond edge. In the case of an overflow situation flows will enter Ellison Drive and flow to the east.

The northwestern portion of the property (from Miera Drive to the west) will be graded to drain to Black's Diversion Channel. This area will be allowed to discharge freely at a developed flow rate of 35.48 cfs. A hydrologic analysis of the effects that Tres Placitas will have on the Diversion Channel has been provided in Appendix B. All runoff while on site will be carried via the streets (refer to Table 2). At Analysis Point 10 (AP 10) an inlet functioning in sump condition will collect all of the flows and convey them via storm drain to Black's Diversion Channel (see attached Sump Capacity Calculations). An emergency overflow swale will be graded from the inlet to the Diversion Channel. All necessary onsite drainage easements will be granted to the City of Albuquerque. Please refer to the attached FlowMaster sheets for storm drain sizing calculations.

CONCLUSIONS & RECOMMENDATIONS

Tres Placitas is planned to be developed as a single unit. Onsite and offsite runoffs have been addressed as to how the subdivision will have a cohesive drainage solution. The Summary Tables provide a more in depth study of the street capacities, drainage basins, and inlet capacities. Attached FlowMaster calculation sheets show storm sizing calculations. Please refer to the Appendices for further supplemental information.

The recommendations for Tres Placitas construction are presented below:

- A detention facility located in the southwest corner of Tract B-9E will be constructed with this development. This pond will be covered by a City of Albuquerque Agreement and Covenant.
- Berms or swale points shall be graded around the site as shown on the grading plan.
- Lots running parallel to Cibola Loop shall be graded to be close in elevation to future street grades.
- All required storm drain and the storm drain outfall to the Black Diversion Channel shall be included as part of the required infrastructure.
- All required storm drains along Cibola Loop and parallel to Ellison Drive shall be included as part required infrastructure.
- Adjacent lots may share a common lot line drainage swale (see Typical Lot Grading Detail).
- The site will not be allowed to have any rear yard ponding (see Typical Lot Grading Detail).

TABLE 1
ONSITE BASIN SUMMARY

Basin ID	Area (Sq. Mi.)	Contributing Basins	AP #	Cumulative Area (Sq. Mi.)	% A	% B	% C	% D	Basin Q (cfs)	Cumula-tive Q (cfs)
100	.00310	100	AP1	.00310	0	20	20	60	7.15	7.15
101	.00304	101	AP2	.00304	0	20	20	60	7.01	7.01
102	.00350	101	AP3	.00654	0	20	20	60	8.07	15.09
103	.00320	102*	AP4	.00974	0	20	20	60	7.38	21.73
104	.00254	104	AP5	.00254	0	20	20	60	5.86	5.86
105	.00050	104	AP6	.00304	0	20	20	60	1.17	7.03
106	.00260	100,103*		.01544	0	20	20	60	6.0	33.00
107	.00313	107		.00313	0	20	20	60	4.32	4.32
108	.00313	108	AP7	.00313	0	20	20	60	7.22	7.22
109	.00160	108		.00473	0	20	20	60	3.70	10.92
110	.00326	109*	AP8 AP9	.00799	0	20	20	60	7.52	18.44
111	.00269	110*		.01068	0	20	20	60	6.21	24.03
112	.0022	112	AP11	.0022	0	20	20	60	5.08	5.08
113	.00315	111*,112	AP10	.01603	0	20	20	60	7.27	35.48
114	.00085	114		.00085	0	20	20	60	1.97	1.97
115	.0017	105*,114	AP12	.00559	0	20	20	60	3.93	12.62
116	.00207	115*	AP13	.00766	0	20	20	60	4.78	16.54
117	.00184	116*		.00950	0	20	20	60	4.25	19.81
118	.00220	118	AP15	.00220	0	20	20	60	5.08	5.08
119	.00180	119	AP16	.00180	0	20	20	60	4.16	4.16
120	.00470	118		.00690	0	20	20	60	10.83	14.74
121	.00180	119,120*	AP14 AP17	.01050	0	20	20	60	4.16	22.93
122	.0014	121*	AP18	.01190	0	20	20	60	3.24	26.29
123	.0019	117*,122*	AP21	.02330	0	20	20	60	4.39	50.08

*Cumulative Q of basin

Table 2
Street Flow Depths at Key Locations

Location	Street Width	Curb Type	Slope (ft/ft)	Q100(cfs)	Depth (ft)	EG (ft)
AP20	40	STD	0.02	44.27	0.52	0.84
AP19	40	STD	0.02	40.43	0.50	0.80
AP18	26	STD	0.008	26.29	0.51	0.67
AP17	26	STD	0.0128	22.93	0.45	0.64
AP16	26	MTBL	0.01	4.16	0.27	0.33
AP15	26	STD	0.005	5.08	0.32	0.36
AP14	26	STD	0.03	14.74	0.34	0.59
AP13	26	STD	0.009	16.54	0.43	0.54
AP12	26	STD	0.0166	12.62	0.35	0.51
AP11	26	MTBL	0.011	5.08	0.28	0.35
AP10	26	STD	0.005	35.48	0.63	0.78
AP9	26	STD	0.005	18.44	0.49	0.58
AP8	26	MTBL	0.008	7.52	0.33	0.40
AP7	26	MTBL	0.0106	7.22	0.32	0.40
AP6	26	MTBL	0.007	7.03	0.33	0.37
AP5	26	MTBL	0.0165	5.86	0.28	0.38
AP4	26	STD	0.0141	21.73	0.43	0.62
AP3	26	MTBL	0.03	8.07	0.27	0.48
AP2	26	MTBL	0.03	7.01	0.27	0.45
AP1	26	MTBL	0.02	7.15	0.29	0.42

*FLOWS LISTED ARE TOTAL STREET FLOWS

TABLE 3

DETENTION POND FLOOD ROUTING SUMMARY

DATA / RESULT DESCRIPTION		DETENTION POND(S)			
DETENTION POND ANALYSIS POINT NUMBER		1			
RETURN PERIOD / DURATION	(yr / hr)	100yr-6hr			
DEVELOPMENT CONDITION		Developed			
TOTAL DRAINAGE AREA	(sq mi)	0.0666			
INFLOW TIME TO PEAK	(hrs)	1.533			
INFLOW PEAK DISCHARGE	(cfs)	125.22			
INFLOW TOTAL RUNOFF VOLUME	(ac-ft)	3.4824			
OUTFLOW TIME TO PEAK	(hrs)	2.033			
OUTFLOW PEAK DISCHARGE	(cfs)	16.93			
OUTFLOW MAXIMUM STORAGE VOLUME AT PEAK	(ac-ft)	2.6929			
OUTFLOW TOTAL RUNOFF VOLUME	(ac-ft)	3.4824			
MAXIMUM STORAGE VOLUME AT EMERGENCY SPILLWAY ELEVATION	(ac-ft)	3.86			
DEAD STORAGE VOLUME (Between reservoir invert elev. and principal spillway invert elev.)	(ac-ft)	3.86			
TOTAL RESERVOIR STORAGE TIME	(hrs)	12.17			
RESERVOIR INVERT ELEVATION	(ft)	5081.37			
PRINCIPAL SPILLWAY ELEVATION (a) 18"Φ RCP	(ft)	5074.7			
EMERGENCY SPILLWAY ELEVATION (b) 45' crest lgth, 5' crst width; riprap	(ft)	5080.0			
TOP OF EMBANKMENT ELEVATION	(ft)	5081.0			
MAXIMUM WATER SURFACE ELEVATION	(ft)	5078.73			
MAXIMUM WATER DEPTH	(ft)	4.03			
FREEBOARD TO EMERGENCY SPILLWAY ELEVATION	(ft)	1.27			
FREEBOARD TO TOP OF EMBANKMENT	(ft)	2.27			
EMERGENCY SPILLWAY DESIGN RETURN PERIOD	(yr / hr)	100yr-6hr			
EMERGENCY SPILLWAY DESIGN FLOW	(cfs)	135			
EMERGENCY SPILLWAY DESIGN DEPTH	(ft)	1			

(a) - Provide brief description for example - One 36-inch RCP with "projecting" entrance without an orifice plate.

(b) - Provide brief description for example - Reinforced Concrete - 30 ft. crest length (perpendicular to flow), 10 ft. crest width (parallel with flow), trapezoidal shape to match dam embankment with side slopes of 1V:3H on embankment approach and outfall, and 1V:2H on sides of spillway above the crest.

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ANALYZE SUMP INLETS

@ AP10 $Q = 35.48$ CFS
$d = 0.63$ ft (from Table 2)

Recommended Inlet: Modified 'A' w/Single Grate & Double Throat

Grate Open Area

Gross Area = 2'-1½" × 2'-11⅜" = 2.13 × 2.95 = 6.28

Less Bearing Bars = (0.5) 1/12 × 2.95 × 13 = 1.6
Less Cross Bars = (0.5) 1/12 × 2.13 × 7 = 0.62
Plus Intersection Counted Twice = (0.5) 1/12 × (0.5) 1/12 × 77 = 0.13
4.19 ⊞

Calculate for TC

$H = 0.63$ ft
$A = 4.19/2 = 2.10$ ⊞ (TO ACCOUNT for CLOGGING)

FLOW Thru Grate = $CA\sqrt{2gH}$ = $.67(2.10)\sqrt{64.4(.63)}$ = 8.94 CFS

FLOW Thru Double Throat = $.67(.5)(13.4)\sqrt{64.4(.63)}$ = 28.6 CFS

TOTAL CAPACITY = 28.6 + 8.94 = 37.54 CFS > 35.48 CFS ✓OK

@ AP20 $Q = 45.93$ CFS
$d = 0.53'$

Flow thru Grate = $CA\sqrt{2gH}$ = $.67(2.10)\sqrt{64.4(.53)}$ = 8.22 CFS
Flow Thru Double Throat = $.67(.5)(13.4)\sqrt{64.4(.53)}$ = 26.22 CFS

Total Capacity = 26.22 + 8.22 = 34.44 CFS

USE 2 INLETS = 68.88 CFS > 45.93 CFS ✓OK

@ AP21 $Q = 49.35$ CFS $d = 0.66'$

Flow thru Grate = $.67(2.10)\sqrt{64.4(.66)}$ = 9.17 CFS
Flow thru Double Throat = $.67(.5)(13.4)\sqrt{64.4(.66)}$ = 29.27 CFS
Total Capacity = 38.44 CFS
USE 2 INLETS = 76.88 CFS > 49.35 CFS ✓OK

24" Connection to Black's Diversion Ch.
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	24" to Black's Diversion Channel
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	2.00 feet H20
Elevation at 1	5,103.70 ft
Elevation at 2	5,102.18 ft
Length	127.74 ft
C Coefficient	105.0
Diameter	24.00 in
Discharge	34.60 cfs

Results		
Pressure at 1	3.12	feet H20
Headloss	2.64	ft
Energy Grade at 1	5,108.71	ft
Energy Grade at 2	5,106.06	ft
Hydraulic Grade at 1	5,106.82	ft ← @ Catch Basin
Hydraulic Grade at 2	5,104.18	ft ← HGL @ Black's Diversion Channel
Flow Area	3.14	ft²
Wetted Perimeter	6.28	ft
Velocity	11.01	ft/s
Velocity Head	1.89	ft
Friction Slope	0.020686	ft/ft

Notes:

INV of 24" is 1' above the channel bottom = 5102.18
INV @ CATCH BASIN = 5103.7
ELEVATION @ CATCH BASIN GRATE = 5109.41

EXIST MH (IN ELLISON) TO MH5
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	EXST MH TO MH 5
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	30.00	in
Discharge	34.19	cfs

Results		
Depth	1.74	ft
Flow Area	3.66	ft²
Wetted Perimeter	4.94	ft
Top Width	2.30	ft
Critical Depth	1.99	ft
Percent Full	69.77	
Critical Slope	0.007361	ft/ft
Velocity	9.35	ft/s
Velocity Head	1.36	ft
Specific Energy	3.10	ft
Froude Number	1.31	
Maximum Discharge	44.12	cfs
Full Flow Capacity	41.01	cfs
Full Flow Slope	0.006949	ft/ft
Flow is supercritical.		

Notes:

EXIST INV = 5064.05
INV (E) @ MH5 = 5067.45
LENGTH = 340 FT
HGL @ MH5 = 5069.19
RIM (MH5) = 5073.60

MH5 TO MH4
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	MH5 TO MH4
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	30.00	in
Discharge	34.19	cfs

Results		
Depth	1.74	ft
Flow Area	3.66	ft^2
Wetted Perimeter	4.94	ft
Top Width	2.30	ft
Critical Depth	1.99	ft
Percent Full	69.77	
Critical Slope	0.007361	ft/ft
Velocity	9.35	ft/s
Velocity Head	1.36	ft
Specific Energy	3.10	ft
Froude Number	1.31	
Maximum Discharge	44.12	cfs
Full Flow Capacity	41.01	cfs
Full Flow Slope	0.006949	ft/ft
Flow is supercritical.		

Notes:

INV (N) @ MH5 = 5067.55
INV (S) @ MH4 = 5068.90
LENGTH = 135 FT
HGL ELEV @ MH4 = 5070.64
RIM (MH4) = 5078.00

MH4 TO MH3
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	MH4 TO MH3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	30.00	in
Discharge	34.19	cfs

Results		
Depth	1.74	ft
Flow Area	3.66	ft^2
Wetted Perimeter	4.94	ft
Top Width	2.30	ft
Critical Depth	1.99	ft
Percent Full	69.77	
Critical Slope	0.007361	ft/ft
Velocity	9.35	ft/s
Velocity Head	1.36	ft
Specific Energy	3.10	ft
Froude Number	1.31	
Maximum Discharge	44.12	cfs
Full Flow Capacity	41.01	cfs
Full Flow Slope	0.006949	ft/ft
Flow is supercritical.		

Notes:

INV (E) @ MH3 = 5072.15
INV(W) @ MH4 = 5069.00
LENGTH = 315 FT
HGL @ MH 3 = 5074.65
RIM (MH3) = 5080.00

Bypass Pipe: MH 3 to MH 2
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	MH3 TO MH2
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	7.07 feet H20
Pressure at 2	1.50 feet H20
Elevation at 1	5,078.00 ft
Elevation at 2	5,073.15 ft
Length	450.00 ft
C Coefficient	105.0
Diameter	18.00 in

Results		
Discharge	17.26	cfs
Headloss	10.42	ft
Energy Grade at 1	5,086.55	ft
Energy Grade at 2	5,076.13	ft
Hydraulic Grade at 1	5,085.07	ft ← HGL @ MH 2
Hydraulic Grade at 2	5,074.65	ft ← HGL @ MH 3
Flow Area	1.77	ft^2
Wetted Perimeter	4.71	ft
Velocity	9.76	ft/s
Velocity Head	1.48	ft
Friction Slope	0.023155	ft/ft

Notes:

INV(W) @ MH3 = ELEV 2 = 5073.15
INV(E) @ MH2 = ELEV 1 = 5078.00
RIM (MH2) = 5092.00

MH2 TO POND
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	MH2 TO POND
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Depth	3.00	ft
Diameter	36.00	in

Results		
Discharge	94.32	cfs
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.73e-7	ft
Critical Depth	2.87	ft
Percent Full	100.00	
Critical Slope	0.017383	ft/ft
Velocity	13.34	ft/s
Velocity Head	2.77	ft
Specific Energy	5.77	ft
Froude Number	0.24e-3	
Maximum Discharge	101.46	cfs
Full Flow Capacity	94.32	cfs
Full Flow Slope	0.020000	ft/ft
Flow is subcritical.		

Notes:

INV (N) @ MH 2 = 5082.07
INV @ POND = 5081.37
LENGTH = 35 FT

MH2 TO MH1
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\trespIct.fm2
Worksheet	MH2 to MH1
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	6.97 feet H20
Elevation at 1	5,079.10 ft
Elevation at 2	5,078.10 ft
Length	100.00 ft
C Coefficient	105.0
Diameter	42.00 in
Discharge	92.94 cfs

Results		
Pressure at 1	6.81	feet H20
Headloss	0.84	ft
Energy Grade at 1	5,087.36	ft
Energy Grade at 2	5,086.52	ft
Hydraulic Grade at 1	5,085.91	ft ← HGL @ MH1
Hydraulic Grade at 2	5,085.07	ft ← HGL @ MH2
Flow Area	9.62	ft^2
Wetted Perimeter	11.00	ft
Velocity	9.66	ft/s
Velocity Head	1.45	ft
Friction Slope	0.008447	ft/ft

Notes:

INV(W) @ MH2 = ELEV 2 = 5078.10
INV (E) @ MH1 = ELEV 1 = 5079.10
RIM (MH 1) = 5100.5

MH1 TO AP21
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	MH1 TO AP21
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	6.71 feet H20
Elevation at 1	5,080.70 ft
Elevation at 2	5,079.20 ft
Length	200.00 ft
C Coefficient	105.0
Diameter	48.00 in
Discharge	100.16 cfs

Results		
Pressure at 1	6.22	feet H20
Headloss	1.01	ft
Energy Grade at 1	5,087.91	ft
Energy Grade at 2	5,086.90	ft
Hydraulic Grade at 1	5,086.92	ft ← HGL @ AP21
Hydraulic Grade at 2	5,085.91	ft ← HGL @ MH1
Flow Area	12.57	ft²
Wetted Perimeter	12.57	ft
Velocity	7.97	ft/s
Velocity Head	0.99	ft
Friction Slope	0.005063	ft/ft

Notes:

This pipe is sized for double the flowrate since there is
no emergency outfall available. Q= 50.08 cfs * 2 = 100.16 cfs

INV(W) @ MH 1 = ELEV 2 = 5079.20
INV @ CATCH BASIN = 5080.70
CATCH BASIN GRATE ELEV = 5087.23

MH1 TO AP20
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	MH1 TO AP20
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data	
Pressure at 2	5.81 feet H20
Elevation at 1	5,082.75 ft
Elevation at 2	5,080.10 ft
Length	175.00 ft
C Coefficient	105.0
Diameter	30.00 in
Discharge	44.27 cfs

Results		
Pressure at 1	5.09	feet H20
Headloss	1.93	ft
Energy Grade at 1	5,089.10	ft
Energy Grade at 2	5,087.17	ft
Hydraulic Grade at 1	5,087.84	ft ← HGL @ AP20
Hydraulic Grade at 2	5,085.91	ft ← HGL @ MH 1
Flow Area	4.91	ft²
Wetted Perimeter	7.85	ft
Velocity	9.02	ft/s
Velocity Head	1.26	ft
Friction Slope	0.011013	ft/ft

Notes:

INV (N) @ MH 1 = ELEV 2 = 5080.10
INV @ CATCH BASIN = 5082.75
CATCH BASIN GRATE ELEV = 5090.62

SIDEWALK CULVERT AT PARK SITE
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\tresplct.fm2
Worksheet	SIDEWALK CULVERT FROM PARK SITE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.020000	ft/ft
Water Surface Elevation	1.00	ft

Elevation range: 0.38 ft to 1.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.00	0.00	1.00	0.013
0.01	0.42			
0.50	0.38			
0.98	0.42			
1.00	1.00			

Results		
Wtd. Mannings Coefficient	0.013	
Discharge	4.06	cfs
Flow Area	0.59	ft^2
Wetted Perimeter	2.14	ft
Top Width	1.00	ft
Height	0.62	ft
Critical Depth	1.21	ft
Critical Slope	0.009262	ft/ft
Velocity	6.87	ft/s
Velocity Head	0.73	ft
Specific Energy	1.73	ft
Froude Number	1.57	
Flow is supercritical.		

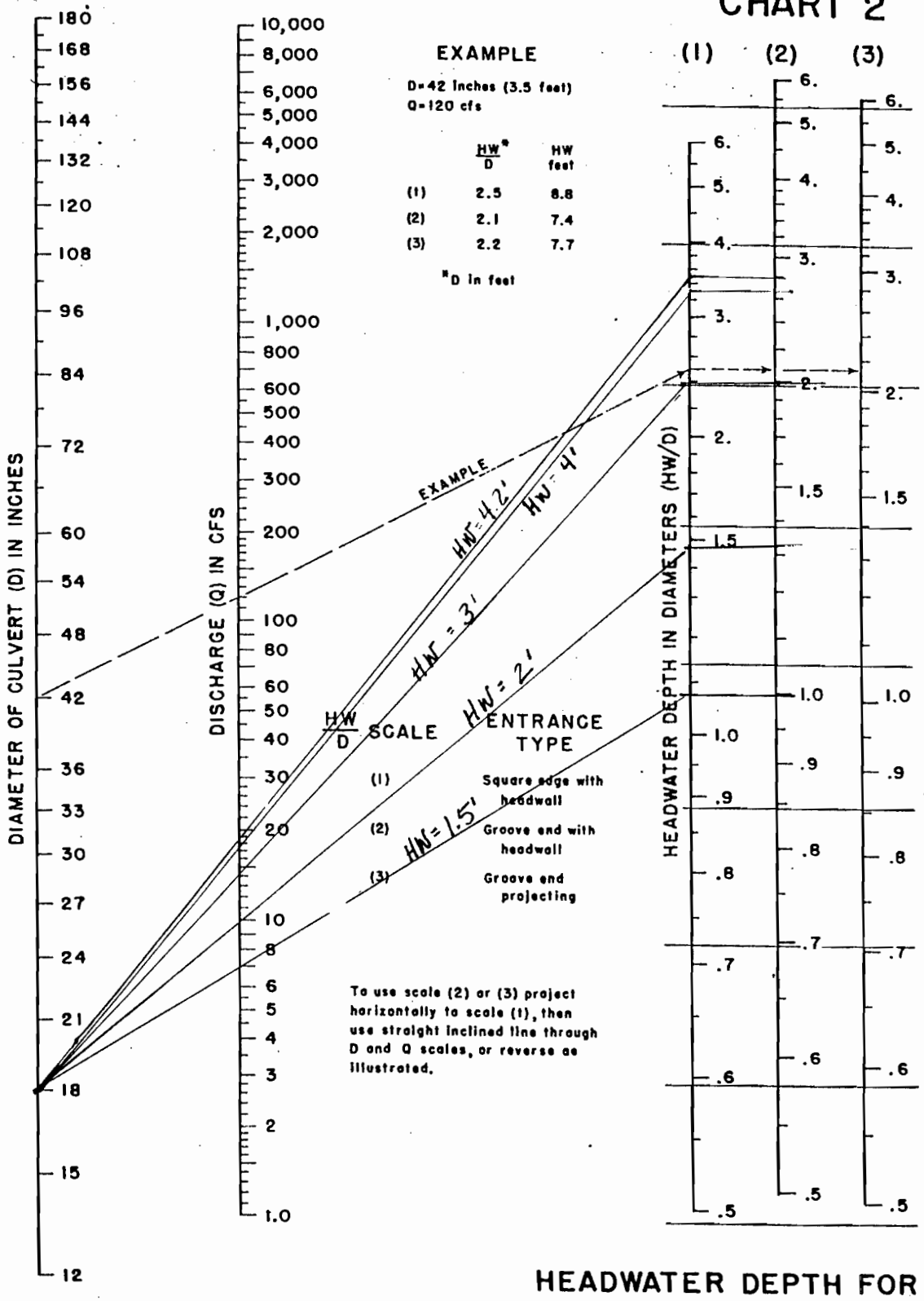
Notes:

CHANNEL SECTION DEFINED IS PER COA STD
DWG # 2236

AN 12 " CHANNEL SECTION IS ASSUMED

DETENTION POND OUTFALL RATES

FLOW RATES FROM AN 18" ϕ OUTFALL PIPE



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

CHANNEL HISTORY

As we understand the situation, the Black's Diversion Channel was designed by the Soil Conservation Service and constructed in 1974 under the sponsorship of the Central Rio Grande Soil and Water Conservation District, the Corrales Watershed District, and the Sandoval Soil and Water Conservation District. The Diversion was designed to pick up flows from the Black Arroyo at a location approximately half way between Golf Course Road and Ellison Road, and convey them southward to the Calabacillas Arroyo. In 1977, the operation and maintenance of the Black's Diversion was assumed by AMAFCA. In 1983, AMAFCA installed the 7-Bar Channel which intercepts some of the eastward flowing drainage from Rio Rancho and carries it to the mouth of Black's Diversion. In 1992, a dam at the confluence of the East and West Branches of Black Arroyo was completed that detains the developed flow in Black Arroyo and releases it so that, together with the flow from 7-Bar Channel, the combined flow in the Black's Diversion Channel is below its capacity. The current sediment ladened capacity of the Black's Diversion Channel using SCS criteria for freeboard and superelevation has been determined to be 3700 cfs.

PROPOSED DEVELOPMENT

Currently Tracts B-9G and B-9H-1A, Seven Bar Ranch (Tres Placitas Subdivision) drain overland to the south along the east side Black's Diversion Channel. The site is undeveloped and most of it is significantly lower than the top of channel at this time. The site is planned to be developed into a 254 lot

subdivision. A portion of the land adjacent to both the Black's Diversion Channel and the SkyView Drainage Channel will be dedicated to AMAFCA with the final plat of the site. Upon development, the northern third of the site will be able to drain to the Black's Diversion Channel via a storm drain. The connection point will be approximately 1225 feet north of the Ellison Drive bridge.

DRAINAGE MANAGEMENT PLAN

The previous area drainage plan, dated August 1992, was the Special Assessment District 223 Drainage Management Plan developed by Easterling and Associates for the City of Albuquerque. In it, the flows from the northern portion of Tract B-9G, Seven Bar (Q=23.1 cfs) are collected by a public storm drain system and conveyed to a connection through the wall of the Black's Diversion Channel approximately one-foot above the channel invert.

TECHNICAL JUSTIFICTION

Attached you will find a hydrograph from the AHYMO analysis for the Black's Diversion that reflects fully developed hydrological conditions with the completion of the Black Arroyo Dam. This hydrograph was submitted by Bohannon Huston in April 1996 for the Ellison Drive Storm Drain Project, and was previously approved by both AMAFCA and the SCS. The total flow at the confluence of Black Arroyo and 7-Bar Channel was routed to the inflow point of the proposed storm drain system from Tres Placitas Subdivision. The contributing basins from Tres Placitas were then modeled and added to the

AHYMO analysis. The result is two detailed hydrographs that illustrate the impact of the addition of this basin on flow in the Black's Diversion Channel.

Hydrograph Blk (ID=1, in the AHYMO output) shows the total flow at the confluence of Black Arroyo and 7-Bar Channel. The hydropgraph is attenuated with the peak of 3310.4 cfs occurring at 2.25 hours. Currently, this amount flows the entire distance of the Black's Diversion Channel and empties into the Calabacillas Arroyo. Hydrograph Blk.1 (ID=3, in the AHYMO output) shows the result of the above flow being routed approximately 727 feet to the proposed inflow point of the Tres Placitas runoff. This hydrograph is similar to Hydrograph Blk with a peak that still occurs approximately at 2.25 hours and a minor increase in peak flow to 3311.1 cfs that resulted from the routing.

Hydrograph number 113.2 (ID=31, in the AHYMO output) shows the routed flows from the basins in Tres Placitas at the point where they are proposed to enter the Black's Diversion Channel. Note that the peak flow of 34.55 cfs occurs at 1.50 hours, this is 0.75 hours (45 minutes) ahead of the peak flow in the Diversion Channel. This is a conservative value for the peak flows in Tres Placitas, because while the basins are small and the routing is over short distances, the minimum basin time to peak for AHYMO was set at 8 minutes. The actual time to peak is probably less than 8 minutes. Accordingly, it is also likely that the time to peak for the storm drain at the Diversion Channel is before 1.50 hours. By referring to the rating curve after hydrograph Blk and before hydrograph Blk.1, the flow in the Diversion Channel at 1.50 hours is 787.9 cfs, which corresponds to a water surface elevation of approximately 2.32 feet above the channel invert. If the proposed storm drain connection is a 24" pipe entering

12" above the channel invert, then the pipe soffit will be 0.68 feet above the channel water surface elevation when the peak flow is in the pipe.

Hydrograph Blk.2 (ID=33, in the AHYMO output) is the resultant hydrograph from the addition of hydrographs Blk.1 and 113.2. As can be seen, the peak flow for the Diversion Channel is 3313.9 cfs, which is a negligible increase over the unrouted flow at the beginning of the Diversion Channel (hydrograph Blk), and it still occurs at 2.25 hours. At the time of the Diversion Channel peak, only residual flows (2.8 cfs) are remaining in the Tres Placitas storm drain system.

CONCLUSION

In conclusion, the flow from a proposed storm drain system in Tres Placitas does not appreciably impact the peak flow in the Black's Diversion Channel. This conclusion can be reached primarily because the flow in the proposed public storm drain system peaks and subsides significantly in advance of the peak flow in the Diversion Channel.