DRAINAGE REPORT

For

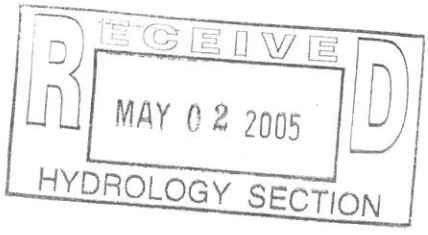
ESTRADA COURT OAKLAND SUBDIVISION
Albuquerque, New Mexico

Prepared by

Rio Grande Engineering
1606 Central SE
Albuquerque, New Mexico 87106

April 2005

David Soule P.E. No. 14522



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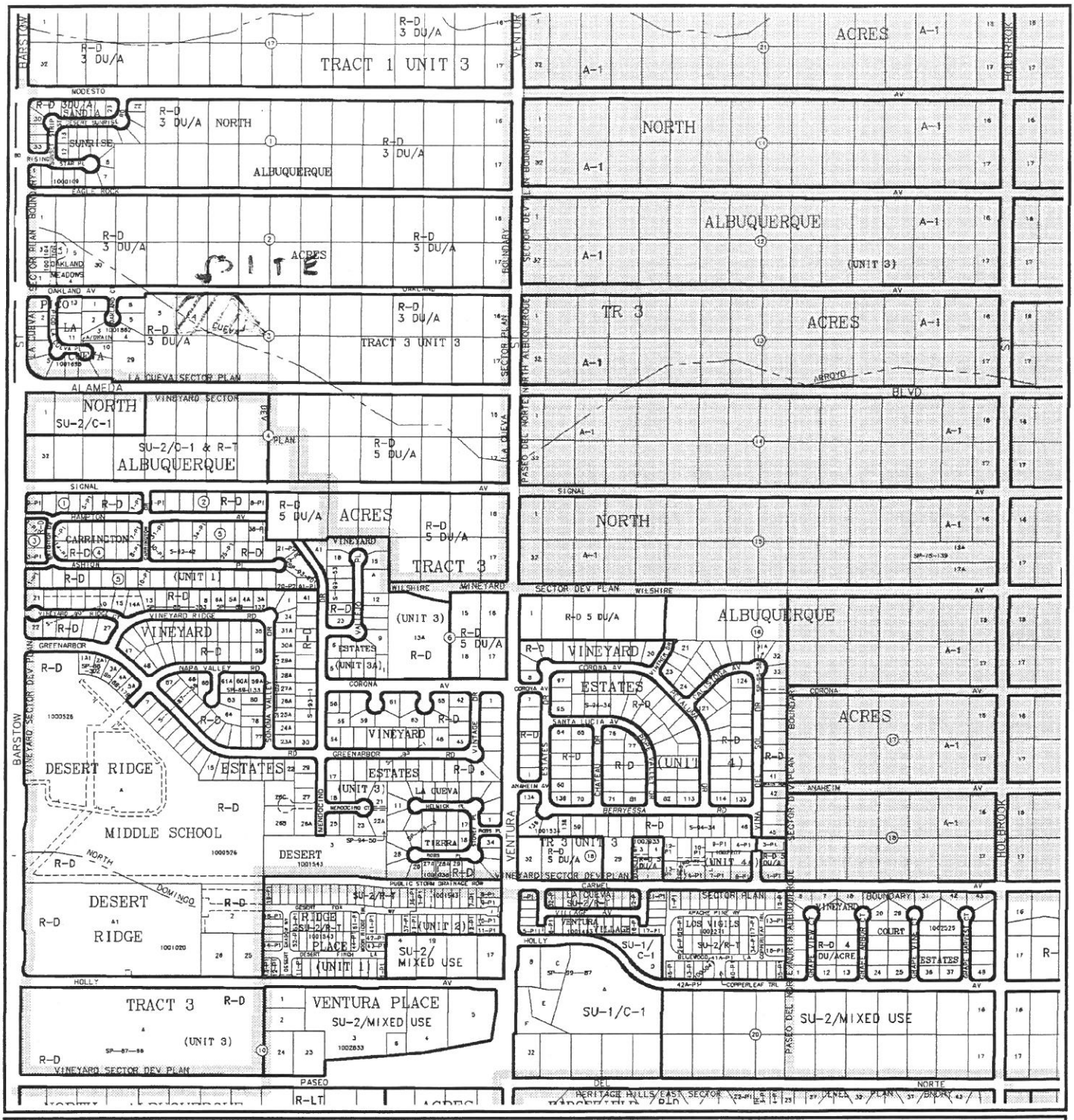
PURPOSE

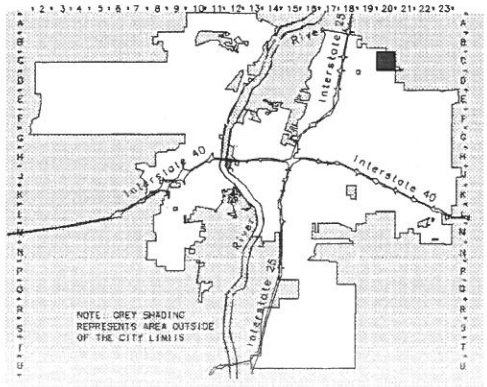
The purpose of this report is to provide the Drainage Management Plan for the development of the Estrada Court Subdivision. This plan will be utilized for the development of the subject property as a 5-lot single family residential subdivision. This plan was prepared in accordance with the City of Albuquerque's Development Process Manual. This report will demonstrate that the proposed improvements do not adversely affect the surrounding properties, nor the upstream or downstream facilities.

INTRODUCTION

The subject of this report, as shown on the Exhibit A, is a 2-acre parcel of land located on the south side of Oakland Boulevard between Barstow Boulevard and Ventura Boulevard. The site is located in the Far Northeast area of Albuquerque. The legal description of this site is Lots 6, 7 of Block 3, Tract 3, Unit 3 North Albuquerque Acres. As shown on FIRM map 35001C141F, only a very small portion of the site lies within flood zone X, with the majority of the site lying within flood zone AO (2'). The site is currently undeveloped.

The site is located within basin 111.1 as described in the North Albuquerque Acres Master Drainage Plan (NAAMDP) and as shown on Appendix C. Currently a bifurcation of the La Cueva Arroyo crosses this site. In the existing condition approximately 3000 cfs can pass through the site within this major arroyo. The site currently drains from the southeast to the northwest, discharging directly into the La Cueva Arroyo located within the adjacent lot 5. The La Cueva Arroyo becomes channelized approximately 1500' downstream. The development of this site relies on the construction of the Oakland Branch of the La Cueva. The construction of this channel will remove the major upland flow and eliminate the floodplain on the site. The development of this site must be in conformance to the governing North Albuquerque Acres Master Drainage Plan.





GRAPHIC SCALE IN FEET

250 0 750 1000

Zone Atlas Page

C-20-Z

Map Amended through February 03, 2004

Albuquerque Geographic Information System
PLANNING DEPARTMENT

EXISTING CONDITIONS

The site is currently undeveloped. The site is covered with native grasses; there are signs of minor impact from human activities due to recent construction in the immediate area. The site slopes from southeast to northwest at a typical 4% slope. Major flow flows enter the site from the southern boundary. As shown on the North Albuquerque Acres Master Drainage Plan existing condition basin map, the majority of the project lies within the La Cueva Arroyo. As described within the NAAMDP and shown on in Appendix C, the fully developed flows for this reach of the La Cueva Arroyo are predicted to be 3094 cfs. As shown in Appendix A, the site currently discharges 4.15 cfs directly to the La Cueva arroyo. This flow is conveyed within the floodway which is channelized approximately 1500' downstream at Barstow Boulevard. This concrete 'Nor Este' channel was designed for ultimate conditions of the upstream basin, which includes this site.

PROPOSED CONDITIONS

This site is located within the boundaries of the North Albuquerque Acres Master Drainage Plan (NAAMDP). The development of this site will be in conformance to this Plan. As shown in the NAAMDP, this site is located within Basin 111.1 and basin 111.3. Based upon the alignment of the La Cueva Channel, this site is removed from basin 111.1 and included entirely within basin 111.3. As shown in Appendix C, this site is allowed to free discharge based upon the land treatments listed in Table A-1. Based upon the developed conditions assumptions this site is allowed to discharge 5.98 cfs. This site must accept the upland flows and pass them through the site. The development of this site can not be accomplished without the prior or concurrent construction the La Cueva channel- Oakland Reach.

The development of this site shall include the construction of a single Cul-de-sac and 5 individual single-family residential lots. The lots will be graded to free discharge to Estrada Court

which will drain directly to Oakland Avenue. Once the flows enter Oakland they are conveyed west to a set of inlets near Barstow. These inlets drain to an existing storm drain within Barstow that discharges via a 36" pipe to the La Cueva Channel. The inlets and downstream drainage infrastructure were designed for this flow as prescribed within the North Albuquerque Acres Master Drainage Plan. As shown in Appendix A, the site is predicted to discharge 5.86 cfs.

This site must accept and pass through the future condition fully developed flow that will enter the site along its southern boundary. As shown on the grading plan this is accomplished by the construction of a 10' wide concrete channel that runs along the southern property line and within the property discharging directly to Estrada Court. As shown in Appendix B, this channel was designed to convey the entire 9 cfs that will enter the site at future complete build out.

The proposed improvements for the proposed channel are being designed by this office and will be approved independent of this plan. The proposed channel dimension and flow line elevations adjacent to the site were taken from the channel plans proposed by this office. The proposed channel improvements will be bonded with this development.

SUMMARY AND RECOMMENDATIONS

This site is an undeveloped portion of land located directly adjacent and within the La Cueva Arroyo. The development of this project will consist of 5 single family residential lots. This site is located within the boundaries of the North Albuquerque Acres Master Drainage Plan. The proposed discharge resulting from this development is 5.86 cfs. The allowable discharge for fully developed onsite conditions is 5.98 cfs. The ultimate channel section for the adjacent La Cueva Arroyo will be financially guaranteed. The portion of the site located within the floodplain will be reclaimed by the issuance of a Letter of Map Revision from FEMA. The permanent channel will be submitted and approved by AMAFCA and the city of Albuquerque. A Turn-key agreement has been executed between the City of Albuquerque, AMAFCA, and the developer.

The proposed site development does not adversely affect the upstream or downstream facilities. The site was designed in conformance to City of Albuquerque Drainage Policy. Therefore, we request approval of the site-grading plan. Since public improvements will be constructed a work order and Subdivision Improvement Agreement will be required. Since this site encompasses more than 1 acre, a NPDES permit will be required prior to any construction activity.

APPENDIX A

SITE HYDROLOGY

Weighted E Method

Existing Basins

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year		
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs
onsite	77220.00	1.773	80%	1.4181818	0%	0.000	10%	0.17727	10%	0.177	0.893	0.132	4.15

Proposed Developed Basins

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year, 6-hr.			10-day
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
Upstream A	116305.20	2.670	20%	0.534	20%	0.534	34%	0.9078	26%	0.694	1.368	0.304	9.00	0.397
Proposed	77220.00	1.773	20%	0.3545455	30%	0.532	23%	0.40773	27%	0.479	1.342	0.198	5.86	0.262
Allowable	77220.00	1.773	20%	0.3545455	20%	0.355	34%	0.60273	26%	0.461	1.368	0.202	5.98	0.264

Equations:

Weighted E = Ea*Aa + Eb*Ab + Ec*Ac + Ed*Ad / (Total Area)

Volume = Weighted D * Total Area

Flow = Qa * Aa + Qb * Ab + Qc * Ac + Qd * Ad

Where for 100-year, 6-hour storm

Ea= 0.66
Eb= 0.92
Ec= 1.29
Ed= 2.36

Qa= 1.87
Qb= 2.6
Qc= 3.45
Qd= 5.02

APPENDIX B

HYDRAULIC CALCULATIONS

Channel Capacity

	Top Width	Bottom Width	Depth	Area	WP	R	Slope	Q Provided	Q Required	Velocity
	(ft)	(ft)	(ft)	(ft^2)	(ft)		(%)	(cfs)	(cfs)	(ft/s)
north south	10	10	1	10.00	12.00	0.8333333	0.6	60.12	9.00	0.90
east west	10	10	1	10.00	12.00	0.8333333	0.4	49.09	9.00	0.90

Manning's Equation:

Q = 1.49/n * A * R^(2/3) * S^(1/2)

A = Area

R = D/4

S = Slope

n = 0.017

Street Capacity Calculations

Unnamed street

24' F-F Street Section with 4" curb

Slope= 0.016

For water depths less than 0.0625 feet

Y=	Water depth
Area =	16*Y^2
P=	SQRT(1025*Y^2) + Y
n=	0.017

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.01	0.0016	0.33	0.00	0.00	0.00	0.32	0.00	0.56	0.00434
0.02	0.0064	0.66	0.01	0.00	0.01	0.50	0.01	0.63	0.01034
0.025	0.01	0.83	0.01	0.01	0.01	0.58	0.01	0.65	0.01366
0.035	0.0196	1.16	0.02	0.01	0.03	0.73	0.03	0.69	0.02077
0.045	0.0324	1.49	0.02	0.03	0.06	0.86	0.04	0.72	0.02837
0.052	0.043264	1.72	0.03	0.04	0.08	0.95	0.05	0.73	0.03394
0.06	0.0576	1.98	0.03	0.06	0.12	1.05	0.06	0.75	0.04052
0.0625	0.0625	2.06	0.03	0.07	0.13	1.07	0.07	0.76	0.04262

For water depths greater than 0.0625 ft but less than 0.3025 ft

Y1=	Y-0.0625
A2=	A1 + 2*Y1 + 25*Y1^2
P2=	P1 + SQRT(2501*Y1^2)+Y1

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.063	0.063506	2.09	0.03	0.07	0.14	1.08	0.07	0.76	0.04287
0.1	0.172656	3.98	0.04	0.24	0.47	1.37	0.14	0.76	0.0687
0.13	0.311406	5.51	0.06	0.51	1.01	1.63	0.21	0.80	0.09516
0.16	0.495156	7.04	0.07	0.93	1.87	1.88	0.30	0.83	0.12419
0.2	0.810156	9.08	0.09	1.79	3.58	2.21	0.44	0.87	0.16566
0.207	0.873506	9.43	0.09	1.98	3.95	2.26	0.47	0.88	0.17318
0.2612	1.446942	12.20	0.12	3.86	7.72	2.67	0.70	0.92	0.2336
0.3025	1.9825	14.31	0.14	5.87	11.74	2.96	0.90	0.95	0.28188

For water depths greater than 0.3025 ft but less than 0.333 ft

Y2=	Y - 0.3025
A3=	A2 + Y2*14
P3=	P2 + Y2

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.303	1.9895	14.31	0.14	5.90	11.81	2.97	0.90	0.95	0.28292
0.3039	2.0021	14.31	0.14	5.97	11.93	2.98	0.91	0.95	0.28479
0.3062	2.0343	14.31	0.14	6.13	12.25	3.01	0.92	0.96	0.28957
0.31	2.0875	14.31	0.15	6.40	12.79	3.06	0.95	0.97	0.29747
0.3125	2.1225	14.32	0.15	6.57	13.15	3.10	0.97	0.98	0.30268
0.32	2.2275	14.32	0.16	7.12	14.24	3.20	1.02	1.00	0.31834
0.3317	**2.3913**	**14.34**	**0.17**	**8.01**	**16.02**	**3.35**	**1.11**	**1.03**	**0.34287**
0.333	2.4095	14.34	0.17	8.11	16.23	3.37	1.12	1.03	0.3456

For water depths greater than 0.333 ft but less than 0.513 ft

Y3=	Y - 0.333
A4=	A3 + 13 * Y3 + 25 * Y3^2
P4=	P3 + SQRT(2501 * Y3^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.335	2.4356	14.44	0.17	8.22	16.44	3.38	1.13	1.03	0.34747
0.3601	2.78016	15.69	0.18	9.70	19.39	3.49	1.26	1.02	0.37178
0.38	3.075725	16.69	0.18	11.01	22.03	3.58	1.36	1.02	0.39205
0.38946	3.223173	17.16	0.19	11.69	23.38	3.63	1.41	1.02	0.40196
0.4603	4.469532	20.70	0.22	17.78	35.57	3.98	1.83	1.03	0.48094
0.504	5.363525	22.89	0.23	22.54	45.08	4.20	2.12	1.04	0.53312
0.513	5.5595	23.34	0.24	23.62	47.24	4.25	2.18	1.05	0.54414

Street Capacity Calculations

Oakland Aveneu

28' F-F Street Section with 8" curb

Slope= 0.02

For water depths less than 0.125 feet

Y= Water depth

Area = 8*Y^2

P= SQRT(257*Y^2) + Y

n= 0.017

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.01	0.00	0.17	0.00	0.00	0.00	0.35	0.00	0.61	0.0049834
0.02	0.00	0.34	0.01	0.00	0.00	0.55	0.01	0.69	0.0118244
0.04	0.01	0.68	0.02	0.01	0.02	0.87	0.03	0.77	0.0279214
0.06	0.03	1.02	0.03	0.03	0.07	1.14	0.07	0.82	0.0460561
0.08	0.05	1.36	0.04	0.07	0.14	1.39	0.11	0.86	0.0656293
0.1	0.08	1.70	0.05	0.13	0.26	1.61	0.16	0.90	0.0863334
0.12	0.12	2.04	0.06	0.21	0.42	1.82	0.22	0.92	0.1079776
0.125	0.13	2.13	0.06	0.23	0.47	1.87	0.23	0.93	0.1135192

For water depths greater than 0.125 ft but less than 0.365 ft

Y1= Y-0.125

A2= A1 + 2*Y1 + 25*Y1^2

P2= P1 + SQRT(2501*Y1^2)+Y1

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.13	0.14	2.38	0.06	0.25	0.50	1.83	0.24	0.89	0.1117024
0.16	0.23	3.91	0.06	0.42	0.83	1.84	0.30	0.81	0.1205379
0.2	0.42	5.95	0.07	0.87	1.74	2.10	0.42	0.83	0.1540767
0.24	0.69	8.00	0.09	1.65	3.30	2.40	0.58	0.86	0.1970921
0.2846	1.08	10.27	0.11	2.98	5.96	2.76	0.78	0.91	0.2507645
0.32	1.47	12.08	0.12	4.44	8.88	3.03	0.97	0.94	0.2961972
0.3551	1.91	13.87	0.14	6.29	12.58	3.30	1.17	0.97	0.3431224
0.365	2.05	14.37	0.14	6.89	13.78	3.37	1.23	0.98	0.3566486

For water depths greater than 0.365 ft but less than 0.667 ft

Y2= Y - 0.365

A3= A2 + Y2*14

P3= P2 + Y2

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.37	2.12	14.38	0.15	7.29	14.57	3.45	1.27	1.00	0.3690524
0.4556	**3.31**	**14.46**	**0.23**	**15.34**	**30.67**	**4.63**	**2.11**	**1.21**	**0.5834662**
0.4848	3.72	14.49	0.26	18.59	37.19	5.00	2.42	1.26	0.6576553
0.5	3.94	14.51	0.27	20.38	40.77	5.18	2.59	1.29	0.6964974
0.54	4.50	14.55	0.31	25.40	50.80	5.65	3.05	1.36	0.7994377
0.5584	4.75	14.56	0.33	27.85	55.69	5.86	3.27	1.38	0.8471365
0.63	5.76	14.64	0.39	38.18	76.37	6.63	4.18	1.47	1.0347284
0.667	6.27	14.67	0.43	44.01	88.01	7.02	4.68	1.51	1.1328354

For water depths greater than 0.667 ft but less than 0.847 ft

Y3= Y - 0.667

A4= A3 + 14 * Y3 + 25 * Y3^2

P4= P3 + SQRT(2501 * Y3^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.7	6.76	16.32	0.41	46.45	92.91	6.87	4.81	1.45	1.1245572
0.72	7.09	17.32	0.41	48.26	96.52	6.81	4.90	1.41	1.1246896
0.74	7.43	18.32	0.41	50.30	100.59	6.77	5.01	1.39	1.1280675
0.76	7.79	19.32	0.40	52.56	105.13	6.75	5.13	1.36	1.1342763
0.78	8.17	20.32	0.40	55.06	110.12	6.74	5.25	1.34	1.1429734
0.8	8.58	21.32	0.40	57.78	115.55	6.74	5.39	1.33	1.1538728
0.847	9.60	23.68	0.41	65.05	130.10	6.77	5.74	1.30	1.1868488

APPENDIX C

EXCERPTS FROM

NORTH ALBUQUERQUE ACRES

MASTER DRAINAGE PLAN

FINAL
NORTH ALBUQUERQUE ACRES
MASTER DRAINAGE PLAN

Prepared For:

City of Albuquerque

Prepared By:

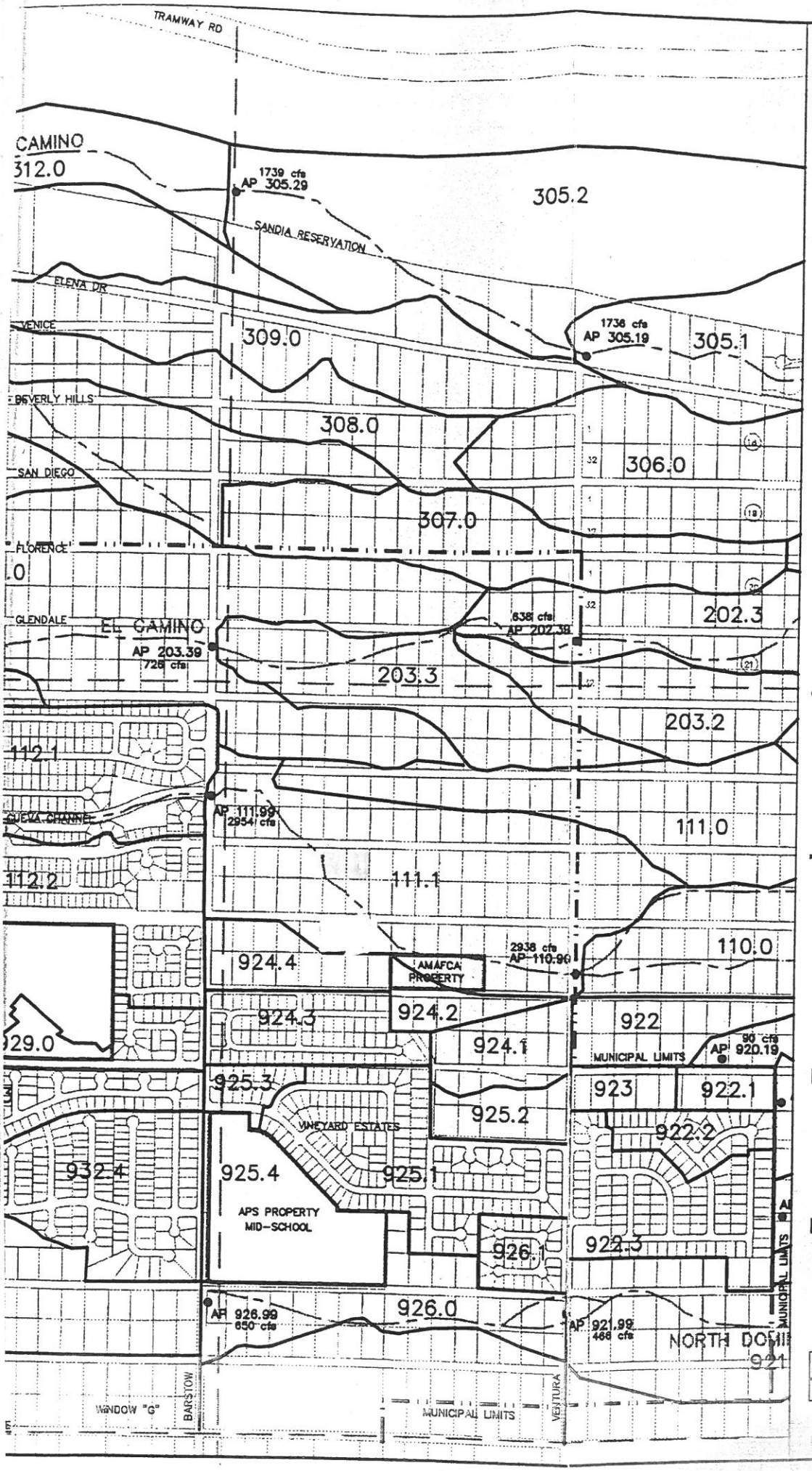
Resource Technology, Inc.

ENGINEERS AND ENVIRONMENTAL SCIENTISTS
1720-B Randolph Road SE, Albuquerque, NM 87106
Telephone (505) 243-7300
Fax (505) 243-7400
rti@nmia.com

DONALD S. DIXON
NEW MEXICO
11043
REGISTERED PROFESSIONAL

10/28/98

October 1998



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1000 0 500 1000

(IN FEET)

LEGEND

107.1 SUBBASIN DESIGNATION

SUBBASIN BOUNDARY

EXISTING PLATTING

EXISTING ARROYO FLOW PATH

AP 107.29 ● 2756 cfs ANALYSIS POINT AND EXISTING CONDITION FLOW RATE

* FLOW RATE NOT BULKED FOR SEDIMENT

2 POTENTIAL AVULSION LOCATION

MUNICIPAL LIMITS

NORTH ALBUQUERQUE ACRES
MASTER DRAINAGE PLAN

EXISTING CONDITION

FIGURE 3A

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

CITY OF Albuquerque

Resource Technology, Inc.
Civil Engineering
Environmental Sciences
Water Resources
Landscape Architecture
Planning
1720 – B Carlisle Road SE
Albuquerque, New Mexico 87106
Email: rti@rtinm.com
Telephone: (505) 243-7700
Facsimile: (505) 243-7400

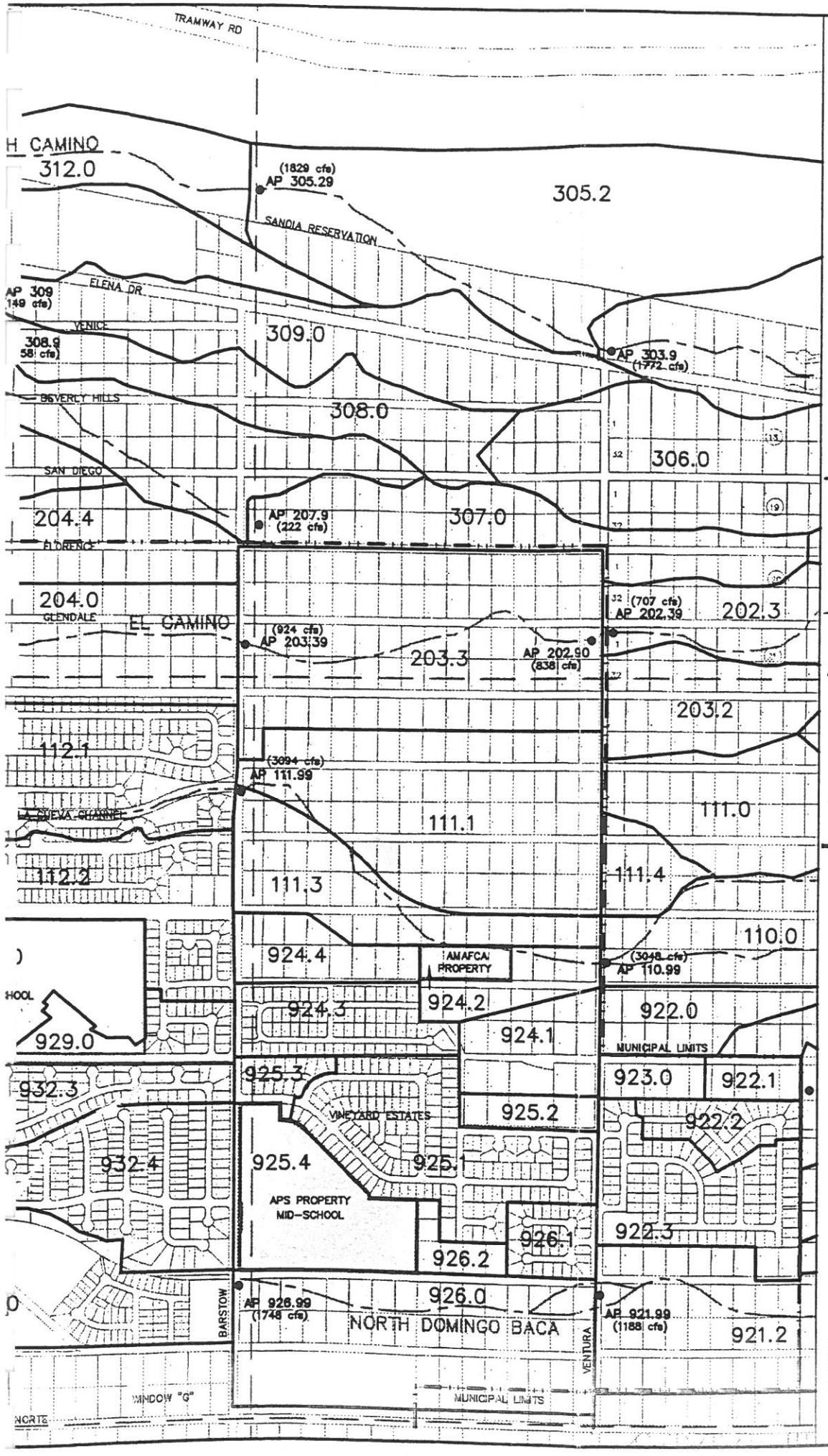
TABLE A-8 LA CUEVA ARROYO EXISTING CONDITIONS					
Sub-basin	**Area (sq. mi.)**	**10-yr Vol (ac-ft)**	**10-yr Qp (cfs)**	**100-yr Vol (ac-ft)**	**100-yr Qp (cfs)**
110	.1634	3.502	79.91	8.385	202.35
111.0	.0674	1.044	31.33	2.940	88.80
111.1	.1194	2.453	73.86	5.962	184.36
112.1	.0894	5.152	129.98	8.942	219.11
112.2	.0826	4.342	110.08	7.690	191.10
113.0	.1136	1.793	58.65	4.875	160.25
115.0	.1337	1.981	64.79	5.503	183.65
116.0	.1309	2.783	77.34	6.460	193.62
117.2	.1391	3.624	69.79	7.778	160.02
117.21	.0234	1.305	33.81	2.263	56.92
117.3	.0863	2.044	58.74	4.588	136.26
117.4	.0750	1.292	37.59	3.335	102.09
117.5	.0550	3.907	95.92	6.417	151.76
117.31	.250	1.394	36.12	2.418	60.81
117.32	.0090	0.502	13.01	.871	21.90

TABLE A-2

LA CUEVA ARROYO SUB-BASIN CHARACTERISTICS

Basin ID	Hydrologic Condition	Basin Area (mi^2)	Land Treatment (%)				TP (hrs)
			A	B	C	D	
100	Existing	1.2140	0	0	100	0	.475
	Future	1.2140	0	0	100	0	.475
101	Existing	.6070	0	0	100	0	.267
	Future	.6070	0	0	100	0	.267
102	Existing	.8750	20	40	40	0	.320
	Future	.8750	20	40	40	0	.320
102.1	Existing	.0930	82	0	18	0	.133
	Future	.0930	80	0	20	0	.133
106	Existing	.0436	78	0	5	17	.133
	Future	.0436	22	23	38	17	.133
106.1	Existing	.1116	75	0	15	10	.14
	Future	.1116	22	23	38	17	.14
107.1	Existing	.1808	92	0	3	5	.14
	Future	.1808	22	23	38	17	.14
107.2	Existing	.1720	86	0	5	9	.18
	Future	.1720	22	23	38	17	.18
108	Existing	.2055	80	0	10	10	.16
	Future	.2055	22	23	38	17	.16
109	Existing	.1006	80	0	10	10	.133
	Future	.1006	22	23	38	17	.133
110	Existing	.1634	80	0	10	10	.19
	Future	.1634	22	23	38	17	.19
111	Existing	.0674	90	0	5	5	.14
	Future	.0533	16	26	33	25	.14
111.1*	Existing	.1194	80	0	10	10	.133
	Future	.0969	20	20	34	26	.133
111.3*	Future	.0420	0	34	16	50	.133
111.4*	Future	.0141	22	23	38	17	.133
112.1*	Existing	.0894	0	34	16	50	.140
	Future	.0894	0	34	16	50	.140
112.2*	Existing	.0826	11	29	15	45	.140
	Future	.0826	0	34	16	50	.140

*Modified for COA NAA MDP 9/97



LEGEND

107.1 SUBBASIN DESIGNATION

SUBBASIN BOUNDARY

EXISTING PLATTING

EXISTING ARROYO FLOW PATH

AP 107.29 (8956 cfs) ANALYSIS POINT AND FUTURE CONDITION FLOW RATE

* FLOW RATE NOT BULKED FOR SEDIMENT

2 POTENTIAL AVULSION LOCATION

MUNICIPAL LIMITS

NORTH ALBUQUERQUE ACRES MASTER DRAINAGE PLAN

FUTURE CONDITION

FIGURE 4A

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

CITY OF Albuquerque

Resource Technology, Inc.
Civil Engineering
Environmental Sciences
Water Resources
Landscape Architecture
Planning
1720 - B Randolph Road SE
Albuquerque, New Mexico 87106
E-mail: rti@rtinc.com
Telephone: (505) 843-7200
Facsimile: (505) 843-7201

TABLE A-9

LA CUEVA ARROYO FUTURE CONDITIONS

Sub-basin	Area (sq. mi.)	10-yr Vol (ac-ft)	10-yr Qp (cfs)	100-yr Vol (ac-ft)	100-yr Qp (cfs)
110.0	.1634	5.774	138.24	11.738	275.61
111.0	.0533	1.823	57.02	3.739	108.83
111.1	.0500	2.054	57.41	7.699	195.97
111.3	.0420	2.498	64.56	4.348	107.90
111.4	.0141	0.482	15.09	0.989	28.80
112.1	.0894	5.152	129.98	8.942	219.11
112.2	.0826	4.760	120.22	8.262	202.31
113.0	.1000	6.393	159.65	10.797	262.65
115.0	.1202	7.581	189.15	12.750	312.21
116.1	.1028	6.570	164.05	11.100	270.05
116.2	.0719	4.529	113.32	7.629	185.54
116.21	.0344	1.682	45.58	3.024	79.13
117.2	.0500	2.788	72.23	4.836	121.61
117.22	.0156	1.108	27.22	1.820	43.06
117.3	.1172	6.536	167.85	11.336	286.33
117.4	.0512	3.225	80.83	5.432	132.07
117.5	.0550	3.907	95.92	6.417	151.76

APPENDIX D

Upland Basin Map