DRAINAGE REPORT

For

SOUTH OAKLAND SUBDIVISION
Albuquerque, New Mexico

Prepared by

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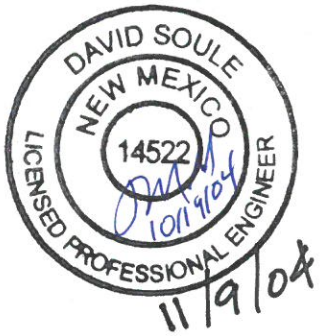
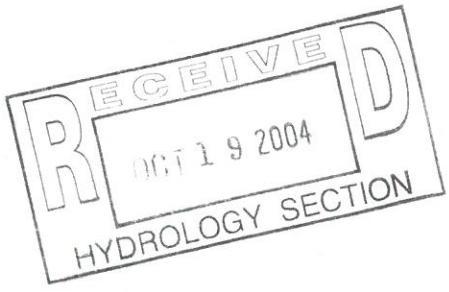


October 2004



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PURPOSE

The purpose of this report is to provide the Drainage Management Plan for the development of the East Oakland Heights Subdivision. This plan will be utilized for the development of the subject property as a 6-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 3-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 7, 8, 9 of Block 3, Tract 3, Unit 3 North Albuquerque Acres. As shown on FIRM map 35001C141F, a portion of the site lies within flood zone X, with a portion of Lots 7 and 8 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. Minor upstream flows enter the site along the eastern boundary. Significant flows pass through Oakland right-of-way along the north side of the property. The southwest corner of the subject property is crossed by the La Cueva Arroyo, which is a major unimproved floodway. The site currently drains from the east to the west, 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 must be in conformance to the governing North Albuquerque Acres Master Drainage Plan.

EXISTING CONDITIONS

The site is currently undeveloped. The site is covered with native grasses; there are signs of minor impact from human activities. The site slopes from east to west at a typical 4% slope. Minor flows enter the site from the eastern boundary. As shown on the Basin map located in Appendix A and as calculated in Appendix A, the predicted offsite flows entering the site along the projects eastern boundary amounts to 3.37 cfs. The southwest quadrant of this 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 3.25 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. 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 5.02 cfs. This site is required to build its portion of the La Cueva channel and construct a 48" RCP conduit within Oakland Avenue from the Channel to the projects east property line. The inlet and drainage conduit is required to capture and convey the upstream flow generated in its fully developed condition. The predicted flows as shown within the NAAMDP and as shown in Appendix C is 143 cfs.

The development of this site shall include the construction of a single Cul-de-sac and 6 individual single-family residential lots. The lots will be graded to free discharge to Black Oak

Court which will drain to the west where the flows are captured by a double-grated type-A inlet. As shown in appendix B, the inlet, storm drain and Cul-de-sac were designed to accommodate the entire flow. The flows will be temporarily retained onsite until the adjacent reach of the La Cueva Arroyo is construction. As shown in Appendix A, the site is predicted to discharge 4.89 cfs. 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.

This project will serve as an entry point for the Oakland reach of the La Cueva Channel. The southern wall will serve and an entry control for the east entrance to the channel. Therefore the project will include a scour/flood wall. This wall will tie-in to the permanent channel and must extend past the erosion set back. As shown in appendix D, the bank erosion set back limit for this reach of floodplain is 180'. As shown in appendix D, the total predicted scour for this wall (including local and anti-dune) is 4.87'. Therefore the bottom of the scour wall was established at 5' below the adjacent La Cueva Arroyo thalweg.

SUMMARY AND RECOMMENDATIONS

This site is an undeveloped portion of land located directly adjacent to the La Cueva Arroyo. The development of this project will consist of 6 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 4.89 cfs. The allowable discharge for fully developed onsite conditions is 5.02 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 is

currently being negotiated with AMAFCA. .

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.

Weighted E Method

Existing Basins

											100-Year		
Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs
			%	(acres)	%	(acres)	%	(acres)	%	(acres)			
onsite	64895.69	1.490	80%	1.19184	10%	0.149	5%	0.07449	5%	0.074	0.803	0.100	3.25

Proposed Developed Basins

											100-Year, 6-hr.			10-day
Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
			%	(acres)	%	(acres)	%	(acres)	%	(acres)				
Upstream A	48625.00	1.116	40%	0.4465106	15%	0.167	24%	0.26791	21%	0.234	1.207	0.112	3.37	0.144
Proposed	64895.69	1.490	20%	0.29796	29%	0.432	26%	0.38735	25%	0.372	1.324	0.164	4.89	0.214
Allowable	64895.69	1.490	20%	0.29796	20%	0.298	34%	0.50653	26%	0.387	1.368	0.170	5.02	0.222

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	Qa= 1.87
Eb= 0.92	Qb= 2.6
Ec= 1.29	Qc= 3.45
Ed= 2.36	Qd= 5.02

Street Capacity Calculations

Unnamed street

24' F-F Street Section with 4" curb

Slope= 0.08

or water depths less than 0.0625 feet

Water depth

a = 16*Y^2

= SQRT(1025*Y^2) + Y

= 0.017

epth (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	0.71	0.01	1.25	0.01334
0.02	0.0064	0.66	0.01	0.01	0.01	1.12	0.02	1.40	0.03086
0.025	0.01	0.83	0.01	0.01	0.03	1.30	0.03	1.45	0.04039
0.035	0.0196	1.16	0.02	0.03	0.06	1.63	0.06	1.54	0.06059
0.045	0.0324	1.49	0.02	0.06	0.13	1.93	0.09	1.60	0.08198
0.052	0.043264	1.72	0.03	0.09	0.18	2.13	0.11	1.64	0.09754
0.06	0.0576	1.98	0.03	0.13	0.27	2.34	0.14	1.68	0.11584
0.0625	0.0625	2.06	0.03	0.15	0.30	2.40	0.15	1.69	0.12166

water depths greater than 0.0625 ft but less than 0.3025 ft

1= Y-0.0625

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

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

epth (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	0.15	0.31	2.41	0.15	1.69	0.1224
0.1	0.172656	3.98	0.04	0.53	1.05	3.05	0.31	1.70	0.19585
.13	0.311406	5.51	0.06	1.13	2.27	3.64	0.47	1.78	0.26871
0.16	0.495156	7.04	0.07	2.09	4.17	4.21	0.67	1.86	0.34763
0.2	**0.810156**	**9.08**	**0.09**	**4.00**	**8.00**	**4.94**	**0.99**	**1.95**	**0.45934**
207	0.873506	9.43	0.09	4.42	8.84	5.06	1.05	1.96	0.47951
2612	1.446942	12.20	0.12	8.64	17.27	5.97	1.56	2.06	0.64075
0.3025	1.9825	14.31	0.14	13.13	26.25	6.62	2.00	2.12	0.7688

water depths greater than 0.3025 ft but less than 0.333 ft

2= Y - 0.3025

3= A2 + Y2*14

P2 + Y2

epth (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	13.20	26.41	6.64	2.01	2.12	0.77142
.3039	2.0021	14.31	0.14	13.34	26.68	6.66	2.03	2.13	0.77613
.3062	2.0343	14.31	0.14	13.70	27.40	6.73	2.06	2.14	0.78818
0.31	2.0875	14.31	0.15	14.30	28.60	6.85	2.12	2.17	0.8081
0.3125	2.1225	14.32	0.15	14.70	29.40	6.93	2.16	2.18	0.82121
0.32	2.2275	14.32	0.16	15.93	31.85	7.15	2.29	2.23	0.86061
.3317	2.3913	14.34	0.17	17.92	35.83	7.49	2.49	2.29	0.92225
0.333	2.4095	14.34	0.17	18.14	36.29	7.53	2.51	2.30	0.92911

water depths greater than 0.333 ft but less than 0.513 ft

3= Y - 0.333

A3 + 13 * Y3 + 25 * Y3^2

P3 + SQRT(2501 * Y3^2)

epth (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	18.39	36.77	7.55	2.53	2.30	0.93421
.3601	2.78016	15.69	0.18	21.68	43.37	7.80	2.81	2.29	1.00017
0.38	3.075725	16.69	0.18	24.63	49.26	8.01	3.04	2.29	1.05479
0.38946	3.223173	17.16	0.19	26.14	52.27	8.11	3.16	2.29	1.0814
.4603	4.469532	20.70	0.22	39.77	79.54	8.90	4.10	2.31	1.29181
0.504	5.363525	22.89	0.23	50.40	100.81	9.40	4.74	2.33	1.42968
0.513	5.5595	23.34	0.24	52.82	105.64	9.50	4.87	2.34	1.45871

Pipe Capacity

Pipe	D	Slope	Area	R	Q Provided	Q Required	Velocity
	(in)	(%)	(ft^2)		(cfs)	(cfs)	(ft/s)
A	48	3.8	12.57	1	280.77	10.79	0.86
A	48	1	12.57	1	144.03	10.79	0.86

Manning's Equation:

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

A = Area
R = D/4
S = Slope
n = 0.013

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


95 cfs
143 cfs
48"
SD-28
sb-25
Q_{100}= 3048 cfs
C-4
CHANNEL
LA CUEVA CHANNEL
PROPOSED ALAMEDA
AMAFCA
PROPERTY
DIKE
SD-30
64 cfs
42"
SD-27
POND
12" W
VINEYARD ESTATES
ALMADEN
VALLEY
SD-29
34 cfs
30"
SD-31 42 cfs
POND 64 cfs
91 cfs
36"
30"
79 cfs
VINTNER
179 cfs
48"
PROPERTY
54"
MID-SCHOOL
SD-26
POND
201 cfs
12" W
48"
293 cfs
54"
POND
POND
C-6
CHANNEL
(CHANNEL)
SD-32
Q_{100}= 1188 cfs
Q_{100}= 700 cfs
NORTH DOMINGO BACA
ARROYO
VENTURA
MUNICIPAL LIMITS
42" W

Assumptions:
1. Channel to be designed by Clark engr.
2. Design analysis subject to site approval ∴ Use
3. No work performed within floodplain

* Erosion Set back

Q_{100} = 3094 CFS Per NAAMD (AP 11.99)

$Q_D = .2(Q_{100})$ = 619 CFS

$W_D = 4.6\, Q_D^{(.4)}$ = 60.2'

$L_V = \lambda = W_D(1.8 + 4\log Q_D)$ = 720.4'

Bank Setback = $\lambda/4$ = 180'

Since there are two distinct flow paths and work has been done on Southern tributary. assume Bank Setback governs.

* Scour

based upon Approved analysis by Clark 4/20/08

Y_1 = 2.2' Fr = 1.6

local Scour = $.73Y_1 + .14\pi(Y_1)Fr^2$

$1.606 + 2.477$

= 4.083'

Anti Dune Scour

$= \frac{1}{2} h_a = \frac{(.07)(2\pi)V^2}{g} = \frac{.28\pi Y_1 Fr^2}{2}$

= 1.79'

Total Scour = Local Scour + Anti Dune Scour

= 4.083 + 7.9

= 9.871 below channel floor