

DRAINAGE REPORT

For

**DESERT GARDEN ESTATES
SUBDIVISION
Albuquerque, New Mexico**

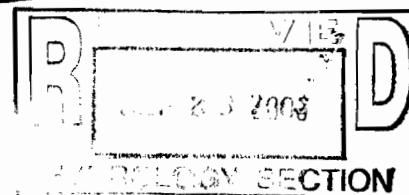
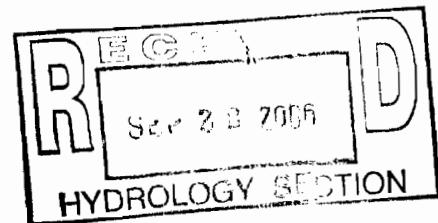
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September 2006



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PURPOSE

The purpose of this report is to provide the Drainage Management Plan for the development of the Desert Gardens Subdivision. This plan will be utilized for the development of the subject property as a 29-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 12.00-acre parcel of land (including Right-of-Way) and located on the north side of Irving Boulevard NW between Ventana Ridge Road and Rainbow Boulevard. The site is located in the North West Mesa area of Albuquerque. The legal description of this site is the unplatted lands of Amalgamated Partners. As shown on FIRM map 35001C0103E, the site is bisected by a branch of the Calabacillas arroyo. The remaining property is located within Flood Zone X. The site is currently undeveloped.

The site is located within the boundary of the Drainage basin of the west branch of the Calabacillas. An analysis of this reach was performed for AMAFCA. Based upon the analysis we are to maintain the natural characteristic of the channel. The design intent is to stay out of the mapped flood plan and the prudent line.

EXISTING CONDITIONS

The site is currently undeveloped. The site is covered with native grasses; there are no signs of previous impact from human activities. The site slopes from west to east at a typical 4% slope. The site is bisected by the west branch of the Callabacillas arroyo. The entire site drains to the existing arroyo. This site currently generates 18.14 cfs during the 100-year, 6-hour storm event. The ultimate flow rate for this reach of the west branch of the Callabacillas is 4460 cfs.

PROPOSED CONDITIONS

The proposed improvements consist of a 29-lot single family residential lot subdivision with approximately 800 lineal feet of 26' wide public roads. The onsite lot grading shall consist of a building pad and rear and side yard swales with typical grades of 1%. Each lot will drain directly to the adjacent roadway. The proposed roadway will consist of a 2% crowned roadway section with mountable and standard curb and gutters. As shown in Appendix A the site contains 12.00 acres. The developed storm water discharge rates were calculated using the simplified procedure for 40 acre and smaller basins as shown in chapter 23-part A of the Development Process Manual. As shown in Appendix A, the total on-site developed flow leaving the developed portion of the site is predicted to be 15.46 cfs. The streets storm water conveyance capacity was calculated using the Manning's Equation and an Excel spreadsheet. As shown in appendix B, the 100-year peak discharge rate will stay within the roadway, and the energy grade line will be contained within the right of way. As shown on the grading plan the mountable curb transitions to standard at the east hammer head prior to the capacity of the mountable curb being exceeded.

The 2-year, 6-hour storm volume is being retained based upon AMAFCA request. The pond will discharge when full and be conveyed to the Calabacillas via an rip rap swale. A turn key agreement was executed between the property owners an AMFCA allowing the improvements. The entire lot area within the prudent line is being dedicated to AMAFCA as right

of way. A copy of this agreement is located within appendix C.

SUMMARY AND RECOMMENDATIONS

This site is an undeveloped portion of land located within the boundaries of the West Branch of the Callabacillas Arroyo. As regulated by this plan the site is allowed to free discharge to the existing arroyo. AMAFCA has required a retention of the 2-year, 6-hour volume. The proposed development will occur only outside of the prudent line of the arroyo. The onsite developed storm water discharge will be conveyed via surface flow by each individual lot to the adjacent Roadway. The public street has capacity to convey the predicted flow.

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

Basin	Area (sf)	Area (acres)	100-Year			
			Treatment A %	Treatment A (acres)	Treatment B %	Treatment B (acres)
ONSITE	522720.00	12.000	79%	9.48	5%	0.600
Total	522720.00	12.000		9.48		0.600

Proposed Developed Basins

Basin	Area (sf)	Area (acres)	100-Year, 6-hr.				10-day		2-year, 6-hr	
			Treatment A %	Treatment A (acres)	Treatment B %	Treatment B (acres)	Treatment C %	Treatment C (acres)	Weighted E (ac-ft)	Volume (ac-ft)
BASIN A	179353.94	4.117	0%	0	16%	0.659	16%	0.65878	1.605	0.510
OFFSITE A	33240.64	0.763	0%	0	7%	0.053	8%	0.06105	1.801	0.201
Total	212594.58	4.881	0%	0	17%	0.712	15%	0.71983	1.636	1.125

6.175

Equations:

$$\text{Weighted E} = E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d / (\text{Total Area})$$

$$\text{Volume} = \text{Weighted E} \cdot \text{Total Area}$$

$$\text{Flow} = Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$$

Where for 100-year, 6-hour storm

$$\begin{aligned} Q_a &= 1.29 \\ Q_b &= 2.03 \\ Q_c &= 2.87 \\ Q_d &= 4.37 \end{aligned}$$

for 2-year, 6-hour storm

$$\begin{aligned} E_a &= 0 \\ E_b &= 0.01 \\ E_c &= 0.12 \\ E_d &= 0.72 \end{aligned}$$

Street Capacity Calculations

DESERT SENNA

26' F-F Street Section with 4" curb

Slope= 0.012

Q=15.46*.89=13.76CFS

For water depths less than 0.0625 feet

Y= Water depth
Area = $16 \cdot Y^2$
P= $\text{SQRT}(1025 \cdot Y^2) + Y$
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	0.27	0.00	0.48	0.00347
0.02	0.0064	0.66	0.01	0.00	0.01	0.44	0.01	0.54	0.00831
0.025	0.01	0.83	0.01	0.01	0.01	0.51	0.01	0.56	0.011
0.035	0.0196	1.16	0.02	0.01	0.02	0.63	0.02	0.60	0.01678
0.045	0.0324	1.49	0.02	0.02	0.05	0.75	0.03	0.62	0.02297
0.052	0.043264	1.72	0.03	0.04	0.07	0.82	0.04	0.64	0.02752
0.06	0.0576	1.98	0.03	0.05	0.10	0.91	0.05	0.65	0.03289
0.0625	0.0625	2.06	0.03	0.06	0.12	0.93	0.06	0.66	0.03461

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

Y1= Y-0.0625
A2= $A1 + 2 \cdot Y1 + 25 \cdot Y1^2$
P2= $P1 + \text{SQRT}(2501 \cdot Y1^2) + Y1$

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	0.06	0.12	0.93	0.06	0.65	0.03481
0.1	0.172656	3.98	0.04	0.20	0.41	1.18	0.12	0.66	0.05579
0.13	0.311406	5.51	0.06	0.44	0.88	1.41	0.18	0.69	0.07746
0.16	0.495156	7.04	0.07	0.81	1.62	1.63	0.26	0.72	0.1013
0.2	0.810156	9.08	0.09	1.55	3.10	1.91	0.38	0.75	0.13543
0.207	0.873506	9.43	0.09	1.71	3.42	1.96	0.41	0.76	0.14163
0.2612	1.446942	12.20	0.12	3.34	6.69	2.31	0.60	0.80	0.1915
0.3025	1.9825	14.31	0.14	5.08	10.17	2.56	0.78	0.82	0.2314

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

Y2= Y - 0.3025
A3= $A2 + Y2^2 \cdot 14$
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	5.11	10.23	2.57	0.78	0.82	0.23227
0.3039	2.0021	14.31	0.14	5.17	10.33	2.58	0.78	0.83	0.23383
0.3062	2.0343	14.31	0.14	5.31	10.61	2.61	0.80	0.83	0.23783
0.31	2.0875	14.31	0.15	5.54	11.08	2.65	0.82	0.84	0.24444
0.3125	2.1225	14.32	0.15	5.69	11.39	2.68	0.84	0.85	0.2488
0.32	2.2275	14.32	0.16	6.17	12.34	2.77	0.89	0.86	0.26191
0.3317	2.3913	14.34	0.17	6.94	13.88	2.90	0.96	0.89	0.28245
0.333	2.4095	14.34	0.17	7.03	14.05	2.92	0.97	0.89	0.28474

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

Y3= Y - 0.333
A4= $A3 + 14 \cdot Y3 + 25 \cdot Y3^2$
P4= $P3 + \text{SQRT}(2501 \cdot Y3^2)$

Depth (ft)	Area (ft ²)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.335	2.4376	14.44	0.17	7.13	14.26	2.93	0.98	0.89	0.28649
0.3601	2.80726	15.69	0.18	8.53	17.07	3.04	1.09	0.89	0.30898
0.38	3.122725	16.69	0.19	9.78	19.57	3.13	1.19	0.90	0.32744
0.4196	3.809389	18.67	0.20	12.64	25.29	3.32	1.39	0.90	0.36563
0.4603	4.596832	20.70	0.22	16.14	32.28	3.51	1.62	0.91	0.40659
0.504	5.534525	22.89	0.24	20.57	41.14	3.72	1.87	0.92	0.45221
0.513	5.7395	23.34	0.25	21.57	43.15	3.76	1.93	0.92	0.46179

Channel Capacity

	Top Width (ft)	Bottom Width (ft)	Depth (ft)	Area (ft^2)	WP (ft)	R	Slope (%)	Q Provided (cfs)	Q Required (cfs)	Velocity (ft/s)
ROCK CHANNEL	10	10	1	10.00	12.00	0.8333333	8.9	#DIV/0!	15.46	1.55
ASPHALT	10	10	0.67	6.70	11.34	0.5908289	8.9	123.35	15.46	2.31

Manning's Equation:

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

A = Area

R = D/4

S = Slope

n = 0.017

ASPHALT

0.04 RIPRAP

DEVELOPED CONDITIONS SUMMARY RESULTS (NAVD '27)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	27	PF1	5100	5467.75	5473.46	5473.46	5475.21	0.013379	10.74	507.89	161.58	0.95
Reach-1	26	PF1	5100	5467.49	5472.71	5473.04	5474.73	0.019944	11.41	449.79	164	1.12
Reach-1	25	PF1	5100	5466.9	5471.76	5472.13	5473.84	0.021079	11.56	442.25	155.4	1.15
Reach-1	24	PF1	5100	5465.32	5471.81	5471.45	5473.06	0.012041	8.96	570.13	184.03	0.87
Reach-1	23	PF1	5100	5465.54	5471	5471	5472.51	0.013341	9.96	550.6	223.21	0.93
Reach-1	22	PF1	5100	5464.56	5470	5470.38	5471.89	0.016878	11.3	515.3	213.59	1.05
Reach-1	21	PF1	5100	5463.84	5470.09	5469.6	5471.13	0.007419	8.64	723.62	242.22	0.72
Reach-1	20	PF1	5100	5463.32	5469.25	5469.25	5470.75	0.010872	10.31	612.51	232.55	0.87
Reach-1	19	PF1	5100	5462.21	5468.13	5468.55	5470.18	0.015731	11.62	482.14	196.71	1.03
Reach-1	18	PF1	5100	5461.47	5468	5467.94	5469.53	0.010955	10.35	586.43	191.31	0.87
Reach-1	17	PF1	5100	5461.96	5467.75	5467.36	5469.07	0.009435	9.53	603.6	175.79	0.81
Reach-1	16	PF1	5100	5461.43	5466.5	5466.5	5468.25	0.015752	10.6	481.21	139.8	1.01
Reach-1	15	PF1	5100	5459.88	5466.15	5465.55	5467.32	0.009487	8.72	590.68	178.39	0.79
Reach-1	14	PF1	5100	5460.01	5465	5465	5466.66	0.012807	10.66	545.93	185.3	0.93
Reach-1	13	PF1	5100	5458.46	5463.72	5464.1	5465.84	0.016522	12.04	491.61	180.6	1.06
Reach-1	12	PF1	5100	5457.85	5463.19	5463.38	5464.93	0.015291	10.83	527.44	194.52	1
Reach-1	11	PF1	5100	5457.63	5463.07	5462.19	5463.88	0.007079	7.22	709.41	215.67	0.68
Reach-1	10	PF1	5100	5457.49	5462.5		5463.45	0.010067	7.84	650.54	213.63	0.79
Reach-1	9	PF1	5100	5455.65	5461.42	5461.42	5462.84	0.016623	9.59	532.11	188.41	1
Reach-1	8	PF1	5100	5455.85	5460.59	5460.7	5462.19	0.018567	10.16	502.43	180.39	1.06
Reach-1	7	PF1	5100	5455.34	5459.64	5459.94	5461.4	0.017714	10.79	517.22	237.9	1.06
Reach-1	6	PF1	5100	5454.35	5458.27	5458.89	5460.42	0.028238	12.54	509.9	270.24	1.31
Reach-1	5	PF1	5100	5453.38	5458	5458.15	5459.35	0.015382	10.32	660.75	295.2	0.99
Reach-1	4	PF1	5100	5452.04	5456.58	5457.09	5458.45	0.029153	12.12	550.87	297.58	1.31
Reach-1	3	PF1	5100	5450.96	5455.99	5456.19	5457.42	0.017726	11.08	655.31	295.55	1.06
Reach-1	2	PF1	5100	5450.24	5454.79	5455.21	5456.58	0.021424	12.54	591.61	264.38	1.18
Reach-1	1	PF1	5100	5448.46	5452.4	5453.19	5455.1	0.042677	13.57	412.68	205.77	1.56

Conversion factor of -2.85 ft added to all Table 3 elevs

EXISTING CONDITIONS SUMMARY RESULTS (NAD '27)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	27	PF1	1342	5467.75	5470.83	5470.65	5471.64	0.014541	7.22	185.8	90.37	0.89
Reach-1	26	PF1	1342	5467.49	5470.35	5470.25	5471.2	0.01619	7.4	181.29	92.11	0.93
Reach-1	25	PF1	1342	5466.9	5469.53	5469.53	5470.44	0.019149	7.67	175.02	95.68	1
Reach-1	24	PF1	1342	5465.32	5469.15	5468.52	5469.7	0.008187	5.95	225.46	95.25	0.68
Reach-1	23	PF1	1342	5465.54	5468.24	5468.23	5469.17	0.01919	7.73	173.68	94.13	1
Reach-1	22	PF1	1342	5464.56	5467.62		5468.46	0.014778	7.39	181.68	86.5	0.9
Reach-1	21	PF1	1342	5463.84	5467.25	5466.8	5467.91	0.01047	6.5	206.54	91.95	0.76
Reach-1	20	PF1	1342	5463.32	5466.26	5466.26	5467.32	0.018434	8.28	162.1	76.67	1
Reach-1	19	PF1	1342	5462.21	5465.88	5465.34	5466.53	0.009284	6.44	208.34	85.84	0.73
Reach-1	18	PF1	1342	5461.47	5465.45		5466.13	0.009874	6.6	203.18	84.38	0.75
Reach-1	17	PF1	1342	5461.96	5465.09		5465.71	0.009961	6.35	211.46	94.01	0.75
Reach-1	16	PF1	1342	5461.43	5464.02	5463.97	5464.86	0.018152	7.34	182.89	102.77	0.97
Reach-1	15	PF1	1342	5459.88	5463.49		5464.02	0.008297	5.87	228.49	99.49	0.68
Reach-1	14	PF1	1342	5460.01	5462.42	5462.38	5463.31	0.018184	7.57	177.18	94.96	0.98
Reach-1	13	PF1	1342	5458.46	5461.96		5462.52	0.008973	6.04	224.26	112.41	0.71
Reach-1	12	PF1	1342	5457.85	5461.2		5461.83	0.01211	6.34	211.82	109.18	0.8
Reach-1	11	PF1	1342	5457.63	5460.86		5461.18	0.006292	4.52	297.13	156.1	0.58
Reach-1	10	PF1	1342	5457.49	5460.18		5460.71	0.014285	5.84	229.62	151.71	0.84
Reach-1	9	PF1	1342	5455.65	5459.08	5459.08	5459.95	0.019548	7.48	179.37	103.42	1
Reach-1	8	PF1	1342	5455.85	5458.2	5458.32	5459.14	0.025376	7.78	172.42	114.1	1.12
Reach-1	7	PF1	1342	5455.34	5457.72	5457.6	5458.42	0.016168	6.74	199.24	116.77	0.91
Reach-1	6	PF1	1342	5454.35	5457.13	5456.97	5457.73	0.013556	6.26	229.82	206.25	0.83
Reach-1	5	PF1	1342	5453.38	5456.17	5456.17	5457	0.018089	7.34	187.12	133.15	0.97
Reach-1	4	PF1	1342	5452.04	5455.01	5455.28	5456.06	0.022126	8.27	172.76	148.31	1.07
Reach-1	3	PF1	1342	5450.96	5454.5	5454.54	5455.19	0.013114	6.91	240.46	246.32	0.84
Reach-1	2	PF1	1342	5450.24	5452.99	5453.39	5454.25	0.029015	9.29	172.15	164.91	1.23
Reach-1	1	PF1	1342	5448.46	5450.92	5451.32	5452.29	0.055011	9.39	143.82	137.8	1.56

Conversion factor of -2.85 ft added to all Table 2 elevs

DEV. CONDITIONS W/ ENCROACHMENT SUMMARY RESULTS
(NAD '27)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	27	PF1	5100	5467.75	5473.46	5473.46	5475.21	0.013379	10.74	507.89	161.58	0.95
Reach-1	26	PF1	5100	5467.49	5472.71	5473.04	5474.73	0.019944	11.41	449.79	164	1.12
Reach-1	25	PF1	5100	5466.9	5471.76	5472.13	5473.84	0.021079	11.56	442.25	155.4	1.15
Reach-1	24	PF1	5100	5465.32	5471.81	5471.45	5473.06	0.012041	8.96	570.13	184.03	0.87
Reach-1	23	PF1	5100	5465.54	5471	5471	5472.51	0.013341	9.96	550.6	223.21	0.93
Reach-1	22	PF1	5100	5464.56	5470	5470.38	5471.89	0.016878	11.3	515.3	213.59	1.05
Reach-1	21	PF1	5100	5463.84	5470.09	5469.6	5471.13	0.007419	8.64	723.62	242.22	0.72
Reach-1	20	PF1	5100	5463.32	5469.25	5469.25	5470.75	0.010872	10.31	612.51	232.55	0.87
Reach-1	19	PF1	5100	5462.21	5468.13	5468.55	5470.18	0.015731	11.62	482.14	196.71	1.03
Reach-1	18	PF1	5100	5461.47	5467.95	5467.94	5469.52	0.011411	10.51	576.83	190.43	0.89
Reach-1	17	PF1	5100	5461.96	5467.67	5467.36	5469.05	0.01001	9.73	590.41	174.83	0.83
Reach-1	16	PF1	5100	5461.43	5467.15	5466.48	5468.37	0.00943	8.89	581.35	195.43	0.79
Reach-1	15	PF1	5100	5459.88	5466.02	5465.64	5467.68	0.011388	10.34	493.26	116.07	0.88
Reach-1	14	PF1	5100	5460.01	5464.95	5464.95	5466.92	0.014689	11.34	462.46	120.27	1
Reach-1	13	PF1	5100	5458.46	5463.73	5464.04	5466.01	0.017292	12.34	444.93	130.09	1.08
Reach-1	12	PF1	5100	5457.85	5463.09	5463.33	5465.09	0.017756	11.48	465.4	146.1	1.07
Reach-1	11	PF1	5100	5457.63	5463.06	5462.18	5464	0.007288	7.79	655.01	168.1	0.7
Reach-1	10	PF1	5100	5457.49	5462.33		5463.54	0.011145	8.83	577.54	169.89	0.84
Reach-1	9	PF1	5100	5455.65	5461.35	5461.35	5462.92	0.016156	10.03	508.52	163.32	1
Reach-1	8	PF1	5100	5455.85	5460.44	5460.69	5462.23	0.021881	10.71	476.15	174.61	1.14
Reach-1	7	PF1	5100	5455.34	5459.72	5459.94	5461.38	0.016338	10.51	534.82	245.95	1.02
Reach-1	6	PF1	5100	5454.35	5458.26	5458.89	5460.43	0.028588	12.6	507.52	270.02	1.31
Reach-1	5	PF1	5100	5453.38	5458	5458.15	5459.35	0.015382	10.32	660.75	295.2	0.99
Reach-1	4	PF1	5100	5452.04	5456.58	5457.09	5458.45	0.029153	12.12	550.87	297.58	1.31
Reach-1	3	PF1	5100	5450.96	5455.99	5456.19	5457.42	0.017726	11.08	655.31	295.55	1.06
Reach-1	2	PF1	5100	5450.24	5454.79	5455.21	5456.58	0.021424	12.54	591.61	264.38	1.18
Reach-1	1	PF1	5100	5448.46	5452.4	5453.19	5455.1	0.042677	13.57	412.68	205.77	1.56

Conversion factor of -2.85 ft added to all Table 4 elevs

TABLE 4A