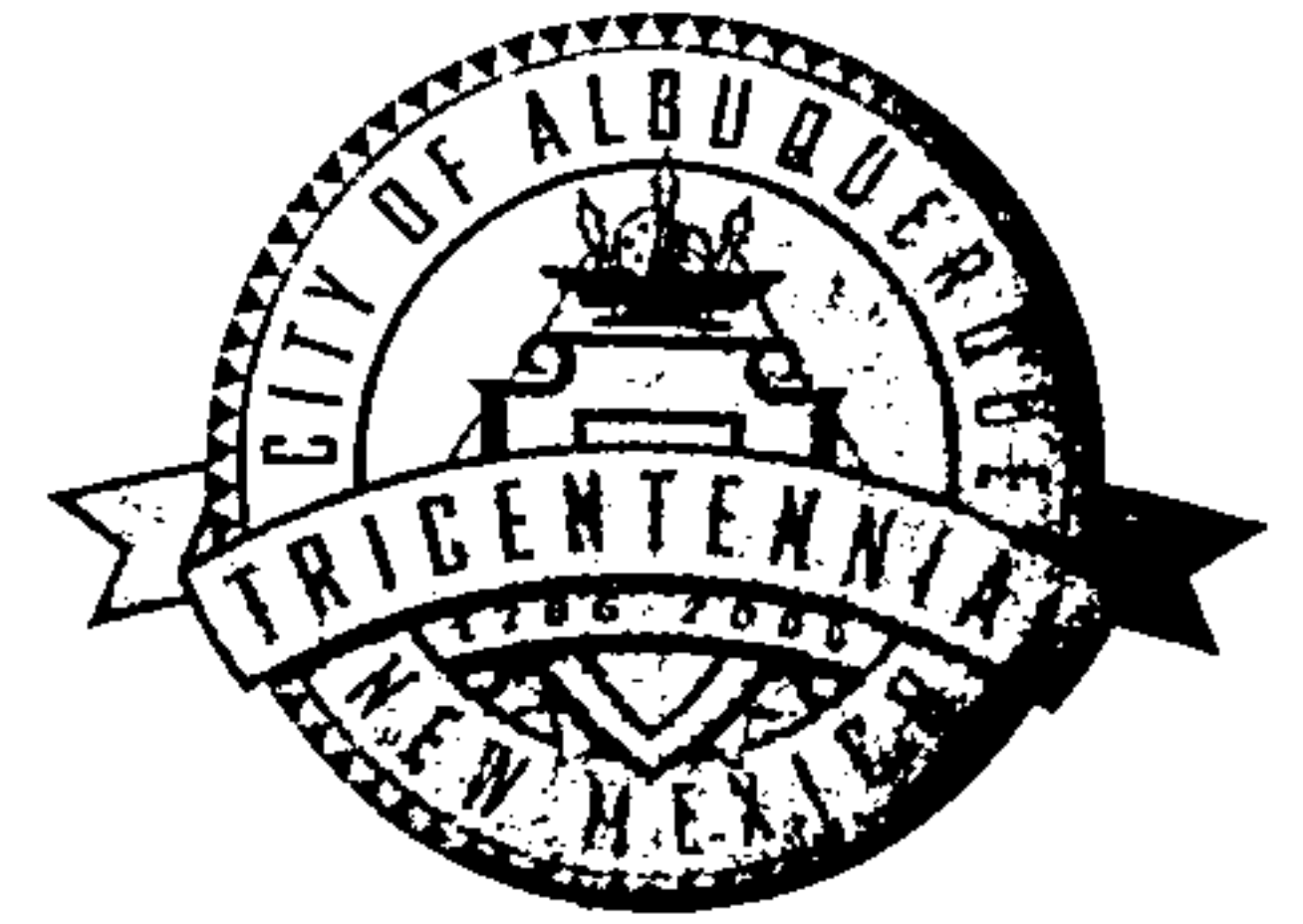


CITY OF ALBUQUERQUE



March 1, 2007

Ronald R. Bohannon, P.E.
Tierra West, LLC.
5571 Midway Park Place NE
Albuquerque, NM 87103

Re: Fraternal Order of Police Development
Engineer's Stamp dated 2-1-07

(E17/D11)

Dear Mr. Bohannon,

Based upon the information provided in your submittal received February 1, 2007, the above referenced plan is approved for DRB action on the proposed Site Plan for Subdivision and Site Plan for Building Permit. Once the plan has been approved by the DRB, please submit a mylar copy to me in order to obtain rough grading approval.

This project will also require a National Pollutant Discharge Elimination System (NPDES) permit. Inquiries regarding this permit should be directed to Sertil Kanbar at 768-3645. If you have any questions or need additional information, feel free to contact me at 924-3990.

If you have any questions, you may contact me at 924-3990.

Sincerely,

Jeremy Hoover, P.E.
Senior Engineer
Hydrology Section
Development and Building Services

cc: file E17/D11
Lynn Mazur, P.E., CFM, AMAFCA

P.O. Box 1293

Albuquerque

New Mexico 87103

www.cabq.gov

Tim Eichenberg - Chair
 Danny Hernandez - Vice Chair
 Daniel F. Lyon - Secretary - Treasurer
 Ronald D. Brown - Assistant Secretary - Treasurer
 Janel Sifers - Director

John P. Kelly, P.E.
 Executive Engineer



**Albuquerque
 Metropolitan
 Arroyo
 Flood
 Control
 Authority**

2400 Prospan N.E., Albuquerque, NM 87107
 Phone: (505) 884-2215 Fax: (505) 884-0214

Post-it® Fax Note 7671		Date 12-29	# of pages 1
To Brad Bingham		From Lynn Mazur	
Co./Dept. Hydrology		Co. AMAFCA	
Phone #		Phone #	
Fax #		Fax #	

E17/D11

December 29, 2006

Mr. Ronald Bohannon, P.E.
 Tierra West, LLC
 5571 Midway Park Place NE
 Albuquerque, NM 87109

Re: Drainage Report for Fraternal Order of Police next to Bear Canyon Arroyo,
 Engineer's Stamp Dated December 12, 2006, ZAP B-12

Dear Mr. Bohannon:

AMAFCA approves the grading and drainage plan presented in the referenced report. Please provide design details of the storm drain connection to the Bear Canyon Arroyo when they are available.

AMAFCA will sign-off on Certificate of Occupancy and any platting action. If you have any questions, please call me at 884-2215.

Sincerely,
 AMAFCA

Lynn M. Mazur, P.E., C.F.M.
 Development Review Engineer

Cc: Brad Bingham, City Hydrology

DRAINAGE REPORT

for

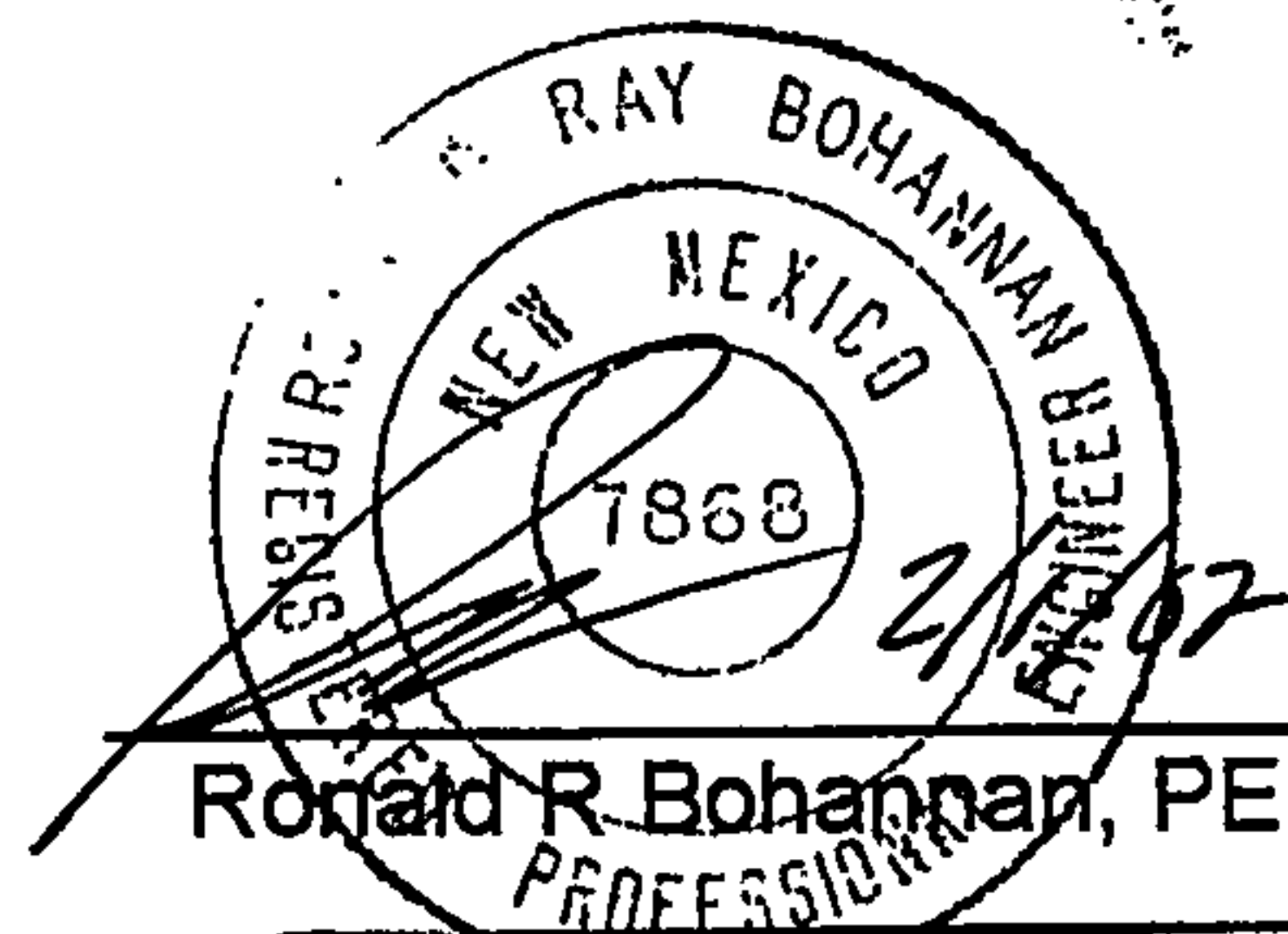
**Fraternal Order of Police Development
@ Northeastern Corner of Jefferson Street
and the Bear Canyon Arroyo**

Prepared by:

Tierra West, LLC
5571 Midway Park Place NE
Albuquerque, New Mexico 87109

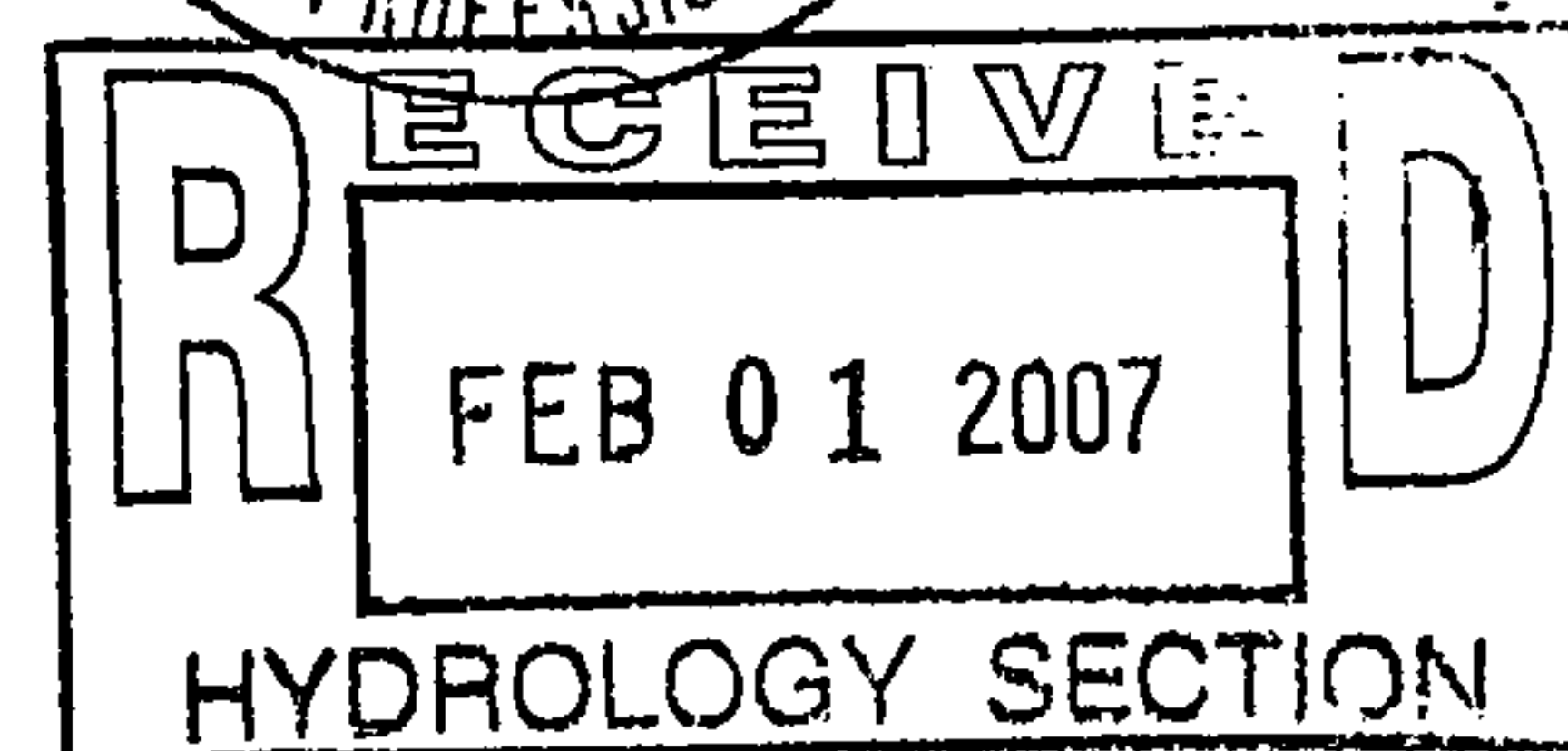
January 29, 2007

I certify that this report was prepared under my supervision, and I am a registered professional engineer in the State of New Mexico in good standing.



Ronald R. Bohannon, PE

Job No. 25016



PURPOSE

The purpose of this report is to provide the drainage management plan for the development of the Fraternal Order of Police on the east side of Jefferson and North of the Bear Canyon Drainage Easement. This plan will be used for the development of the subject 9.67 acre property. This plan is in accordance with the DPM, Chapter 22, Hydrology Section. The purpose of this report is to provide the drainage analysis and management plan for the new site.

INTRODUCTION

The subject of this report, as shown on the Exhibit A vicinity map, pages 4 and 5, is a 9.67 acre parcel of land located north of the Bear Canyon Arroyo and on the east side of Jefferson Street, zone atlas page E-17-Z. The site is in Albuquerque, New Mexico and is currently the location of the Fraternal Order of Police. The legal description of the property is Lots 1 and 2 of the Fraternal Order of Police Addition and is shown on FIRM maps #35001C0138E and #35001C0139E. According to the FIRM maps, pages 6 and 7, the site is not within the 100-year flood zone.

City of Albuquerque
350002

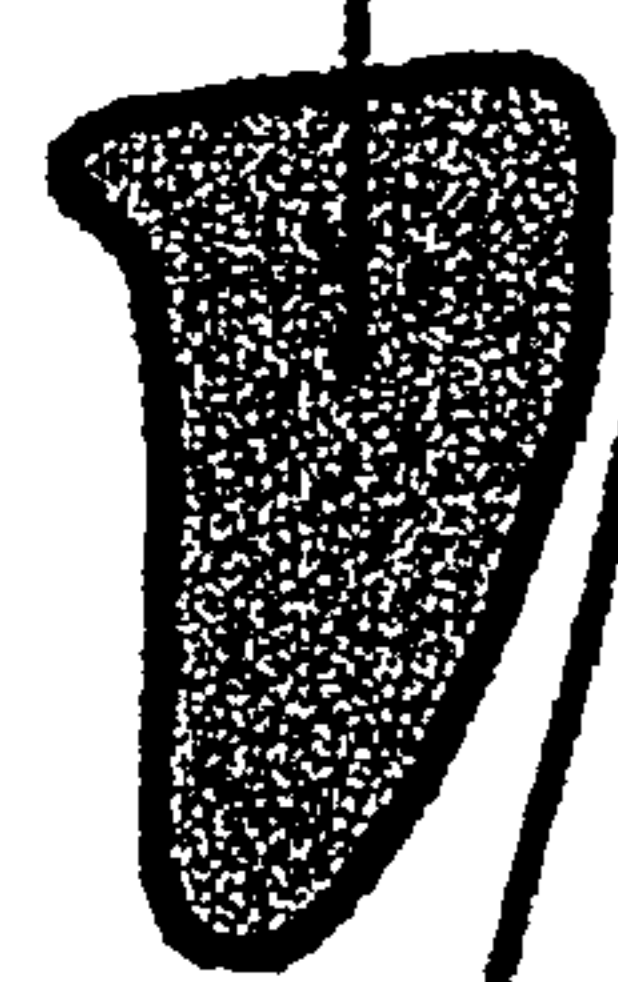


ZONE A

ZONE A

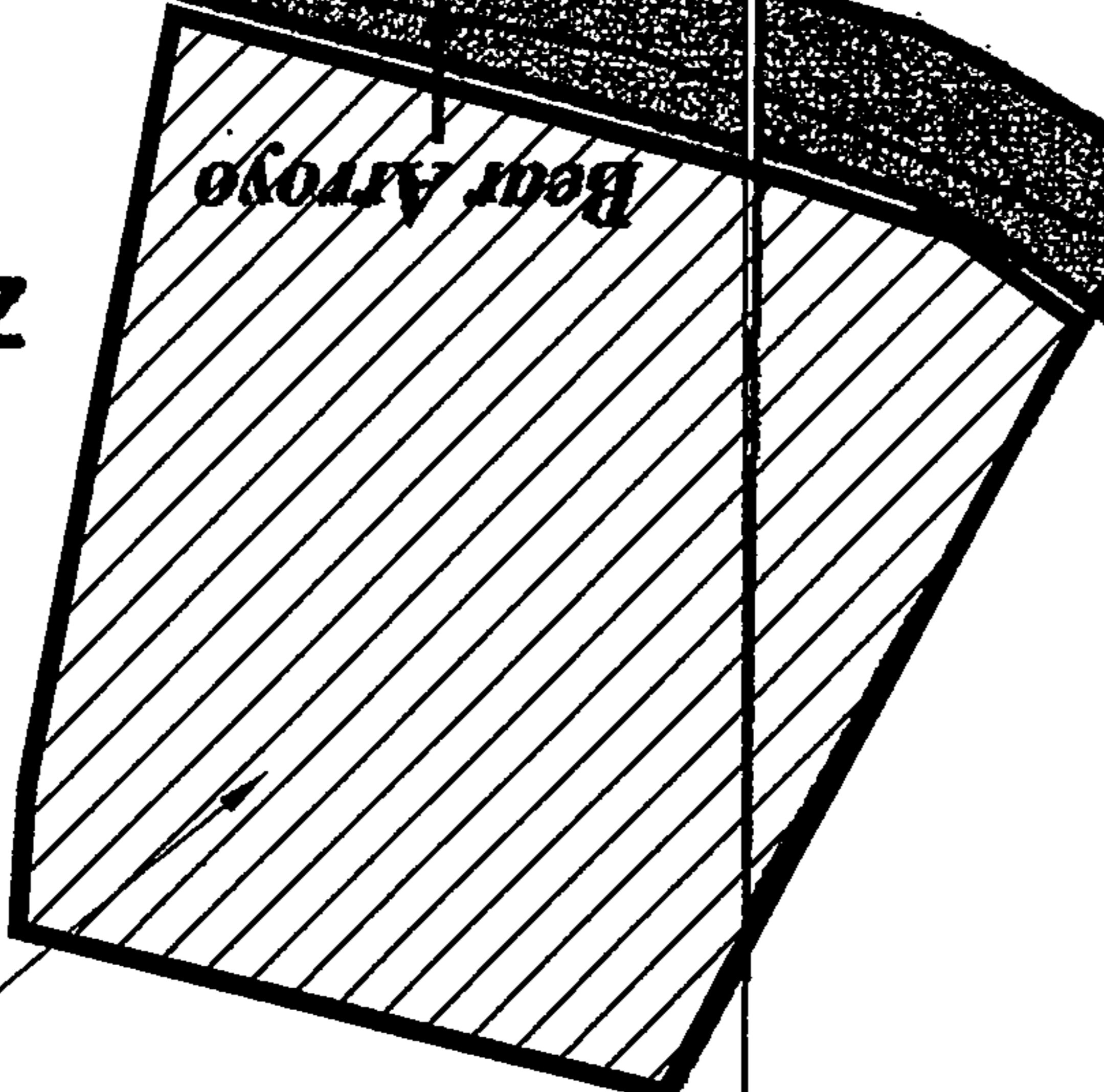
ZONE X

ZONE AH
(EL 5189)



SITE

+



Bear Arroyo

Bear Arroyo

1% ANNUAL CHANGE
FLOOD DISCHARGE
CONTAINED IN CHANNEL

JEFFERSON PLAZA NE

BALLOON PARK RD NE

N ST NE

ST NE

PAN AMERICAN FRWY N



EXISTING CONDITIONS

Currently, the site is partly developed with the existing parking lot and buildings located on the northeast quadrant of the property. The 9.67 acre site is bounded on the west by Jefferson Street, on the north by Border Machinery, on the east by an industrial park, and on the south by the Bear Canyon Arroyo. The property currently drains west to Jefferson and southwards towards the Bear Canyon Arroyo. No offsite flows currently enter the property. The east property uses parking lot ponding near the northeast boundary of this property and a water block on the main access road to keep water offsite. The property to the north, Border Machinery, is sloped to Jefferson and no water enters this property. The existing onsite runoff is calculated to be 28.37 cfs using the weighted E method for a 100-year storm with a land treatment of 73% Type B and 27% Type D.

PROPOSED CONDITIONS

The proposed commercial development will consist of four tracts. The total runoff from the site will increase after the site is developed. The building sizes given on the grading plan are only estimated at this time. The site will be divided into three basins with a total onsite runoff calculated to be 42.52 cfs from a 100-year storm. One of the basins, with an area of approximately 2.96 acres will drain to Jefferson Street; the rest of the site will drain to the Bear Canyon Arroyo south of the site. An exhibit showing the direction of surface flow and location of basins is shown on the Proposed Basin Map, in map pocket B. The Albuquerque Metropolitan Flood Control Authority (AMAFCA), which owns and maintains the Bear Canyon Arroyo, has granted free discharge by a Private License Agreement, dated November 27, 2006, attached in Appendix B.

Basin 1 consists of most of the north-northwestern portion of the site as well as the buffer area next to Jefferson Street on the western boundary, with an area of 2.96

acres. The basin will drain 12.84 cfs to Jefferson Street with most of the runoff flowing through the north entrance of the site. Jefferson slopes to the north at this point. A land treatment of 77% D and 23% C was used.

Basin 2 encompasses the majority of the site. The basin has an area of approximately 6.22 acres. The total runoff from this basin will be 27.48 cfs and will drain to a Double Type 'C' curb inlet located at the southwest corner near the south entrance. The flow will continue through a 24" storm drain pipe to a water quality manhole that will keep debris from entering the arroyo. A land treatment of 82% D and 18% C was used. As shown in the Calculations Section, the capacity of the inlet is calculated to be 28.56 cfs using a 50% clogging factor. If the inlet should become clogged, the runoff will overtop the 8" curb at this spot and drain into the Bear Canyon Arroyo.

Basin 3 includes a small portion of lots 1-B and 2-B, with an area of 0.49 acres, and is surrounded by Basin 2. This basin will drain to a curb inlet located approximately 220' east of the Basin 2 inlet. The total runoff from this basin will be 2.20 cfs that will enter a Single Type 'C' inlet and continue through a 12" HDPE pipe to the Basin 2 inlet. As shown in the Calculations Section, the capacity of the inlet is calculated to be 15.45 cfs using a 50% clogging factor. A land treatment of 13% C and 87% D was used. If the inlet should become clogged the runoff will overtop the 8" curb into the Bear Canyon Arroyo.

The Bear Canyon Arroyo, where runoff from Basins 2 and 3 will drain, is owned and maintained by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), which has approved the discharge through a Private License Agreement. The discharge point will be located through the existing concrete lining on the arroyo side slope, east of the Jefferson Street bridge. This will mitigate the effects of scouring. A Ring Chamber Energy Dissipater is not needed to reduce the velocity at the outfall since the velocity, calculated to be 9.5 ft/s, is significantly below the threshold of 18 ft/s

used in AMAFCA's design manual. The total outflow from the site into the arroyo will be

29.68 cfs.

SUMMARY AND RECOMMENDATIONS

The site is currently the home of the Fraternal Order of Police and is partially developed. The site will be completely redeveloped and graded to include three basins. The total runoff will increase by approximately 14.15 cfs to a total of 42.52 cfs. The basin at the north end will drain offsite onto Jefferson Street. The remaining area will drain through storm drain pipe to an outfall at the bottom of the Bear Canyon Arroyo, with a total flow of 29.68 cfs. A Single Type 'C' inlet will collect runoff within Basin 3, and convey it through a 12" diameter pipe and the Double Type 'C' inlet within Basin 2. From this the flow will be conveyed through 24" RCP then through a water quality manhole, and outfall into the arroyo.

Undeveloped On-Site Basins - Zone 2

Weighted E Method

Fraternal Order of Police
TW Job #25016

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year			10-Year		
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs
1	421,302	9.67	0%	0.00	73%	7.06	0%	0	27%	2.61	1.142	0.920	28.37	0.566	0.456	14.91
Total		9.67										0.92	28.37		0.46	14.91

Equations:

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

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

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

After Development On-Site Basins - Zone 2

Weighted E Method

Fraternal Order of Police
TW Job #25016

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year			10-Year		
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E Inches	Volume ac-ft	Flow cfs	Weighted E Inches	Volume ac-ft	Flow cfs
			1	128,832	2.96	0%	0	0%	0.00	23%	0.68	77%	2.28	1.892	0.466	12.84
2	270,845	6.22	0%	0	0%	0.00	18%	1.12	82%	5.10	1.942	1.006	27.48	1.192	0.618	17.92
3	21,321	0.49	0%	0	0%	0.00	13%	0.06	87%	0.43	1.991	0.081	2.20	1.233	0.050	1.45
Total		9.66		0.00		0.00		1.86		7.80		1.55	42.52		0.95	27.68

Equations:

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

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

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

Ring Chamber Energy Dissipator*

Find the Outlet Velocity

Manning's Equation

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

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

where,

$R = \text{Hydraulic Radius} = \text{Area} / \text{Wetted Perimeter}$

Pipe Diameter =	2.000 ft
Area =	3.142 sq ft
Wetted Perimeter =	6.278 ft
Hydraulic Radius =	0.500 ft
Slope =	1.73%
Velocity =	9.50 ft/s

Velocity < 18 ft/s,

Ring Chamber is not needed

*Ring Chamber Energy Dissipator Design Manual, AMAFCA, 2001

Basin 2 Inlet Capacity

DOUBLE 'C' STORM DROP INLET

Capacity of the grate:

$$\begin{aligned} L &= 88.75'' - 2(6'' \text{ ends}) - 6'' \text{ center piece} - 14(\frac{1}{2}'' \text{ middle bars}) \\ &= 63.75'' \\ &= 5.3125' \end{aligned}$$

$$\begin{aligned} W &= 25.5'' - 13(\frac{1}{2}'' \text{ middle bars}) \\ &= 19'' \\ &= 1.583' \end{aligned}$$

$$\begin{aligned} \text{Area} &= 1.583' \times 5.3125' \\ &= 8.41 \text{ ft}^2 \end{aligned}$$

$$\begin{aligned} \text{Effective Area} &= 8.41 - 8.41 (0.5 \text{ clogging factor}) \\ &= 4.21 \text{ ft}^2 \text{ at the grate} \end{aligned}$$

Orifice Equation

$$Q = CA \sqrt{2gH}$$

$$Q = 0.6 \times 4.21 \times \sqrt{2 \times 32.2 \times 0.67}$$

$$Q = 16.59 \text{ cfs}$$

Capacity of the throat:

$$\begin{aligned} L &= 88 - \frac{3}{4}'' \\ &= 7.3958' \end{aligned}$$

Weir Equation

$$Q = CLH^{3/2}$$

$$Q = 2.95 \times 7.3958 \times 0.67^{3/2}$$

$$Q = 11.97 \text{ cfs}$$

Total Capacity:

$$Q = 16.59_{\text{grate}} + 11.97_{\text{throat}}$$

$$Q = 28.56 \text{ cfs}$$

Basin 3 Inlet Capacity

SINGLE 'C' STORM DROP INLET

Capacity of the grate:

$$\begin{aligned} L &= 47.375'' - 2(6'' \text{ ends}) - 14(1/2'' \text{ middle bars}) \\ &= 28.375'' \\ &= 2.365' \end{aligned}$$

$$\begin{aligned} W &= 30'' - 13(1/2'' \text{ middle bars}) \\ &= 23.5'' \\ &= 1.958' \end{aligned}$$

$$\begin{aligned} \text{Area} &= 2.365' \times 1.958' \\ &= 4.63 \text{ ft}^2 \end{aligned}$$

$$\begin{aligned} \text{Effective Area} &= 4.63 - 4.63 (0.5 \text{ clogging factor}) \\ &= 2.3 \text{ ft}^2 \text{ at the grate} \end{aligned}$$

Orifice Equation

$$Q = CA \sqrt{2gH}$$

$$Q = 0.6 \times 2.3 \times \sqrt{2 \times 32.2 \times 0.67}$$

$$Q = 9.06 \text{ cfs}$$

Capacity of the throat:

$$\begin{aligned} L &= 47 - 3/8'' \\ &= 3.948' \end{aligned}$$

Weir Equation

$$Q = CLH^{3/2}$$

$$Q = 2.95 \times 3.948 \times 0.67^{3/2}$$

$$Q = 6.39 \text{ cfs}$$

Total Capacity:

$$Q = 9.06_{\text{grate}} + 6.39_{\text{throat}}$$

$$Q = 15.45 \text{ cfs}$$