CITY OF
Albuquerque

September 29, 1998

Fred Arfman, P.E.
Isaacson & Arfman, P.A.
128 Monroe Street NE
Albuquerque, NM 87108

RE: LAS MARCADAS PARK II (C12-D2C). DRAINAGE PLAN FOR GRADING PERMIT AND WORK ORDER APPROVALS. ENGINEER'S STAMP DATED SEPTEMBER 15, 1998.

Dear Mr. Arfman:

Based on the information provided on your September 28, 1998 (originally 9/17/98) submittal, the above referenced project is approved for Grading Permit and Work Order.

If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,

John P. Murray, P.E.
Hydrology

c: Andrew Garcia
File

CITY OF
Albuquerque

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John P. Murray, P.E.
Hydrology

c: Andrew Garcia
File

CITY OF
Albuquerque

January 17, 1997

Martin J. Chávez, Mayor

Kent M. Whitman, P.E.
Community Sciences Corp.
P.O. Box 1328
Corrales, NM 87048

RE: RE: LAS MARCADAS 11 SUBDIVISION (C12-D2C). ENGINEER'S GRADING CERTIFICATION FOR FINANCIAL GUARANTEE RELEASE. ENGINEER'S CERTIFICATION DATED 6-21-95. CITY PROJECT NUMBER 4773.91.

Dear Mr. Whitman:

Based on the above submittal, City Hydrology accepts the Engineer's Certification of grading & drainage. Contact Terri Martin to obtain the Financial Guaranty Release for City Project number 4773.91

If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Terri Martin
Andrew Garcia
File

City of Albuquerque

P. O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103
PUBLIC WORKS DEPARTMENT

March 19, 1997

CERTIFICATE OF WORK ORDER COMPLETION

The Strosnider Company
6121 Indian School Rd.
Albuquerque, NM 87110

RE: LAS MARCADAS SUBDIVISION UNIT 2 PROJECT NO. 4773.91 MAP NO. C-12

Dear Sir:

This is to certify that the City of Albuquerque accepts Project No. 4773.91 as being completed according to approved plans and construction specifications. Please be advised this certificate of completion and acceptance shall only become effective upon final plat approval and filing in the office of the Bernalillo County Clerk's Office.

The project is described as follows:

- Curb and gutter, paving and storm drainage were constructed. Water and sanitary sewer were also installed and will be maintained by NMUI.
- A six foot sidewalk on the west side of Golf Course Road was built.
- A four foot sidewalk on the north side of Shelly Rose Road was also built.

The contractor's correction period began the date of this letter and is effective for a period of one (1) year.

Sincerely,

Russell B. Givler

Russell B. Givler, P.E.
Chief, Construction Engineer
Public Works Department

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

January 16, 1996

Brian Garrison
Community Sciences Corp.
P.O. Box 1328
Corrales, NM 87048

RE: LAS MARCADAS 11 SUBDIVISION (C12-D2C). ENGINEER'S GRADING CERTIFICATION FOR FINANCIAL GUARANTEE RELEASE. ENGINEER'S CERTIFICATION DATED 6-21-95.

Dear Brian:

The Engineer's Certification submitted 11-16-95 satisfies the Grading and Drainage line item condition, established by the infrastructure list dated 10-11-94.

The City will hold back $43,778.25 (per Community Sciences estimate received 12-26-95) of the bond money for the incomplete and or inadequate construction listed below:

1. Removal of the 6 foot wide channel.
2. Construction of a new 10' wide channel, including trash rack
3. Safety fencing along channel perimeter.
4. Installation of two additional inlets on Ryan Patrick.

Prior to further release of bond money, the City requests the following items be addressed:

1. Redesign and reconstruct the inlet at the end of the 6 foot wide concrete channel.
2. Safety fencing/barrier for the 2 foot nominal drop off into the concrete channel.
3. Installation of a trash rack at the end of the 6 foot wide concrete channel.

It would assist in a more timely review if the issues described above are submitted together.

I have received your inlet capacity calculations for the two inlets on Patrick Ryan street. This item will be reviewed with your channel redesign submittal, mentioned above.

If I can be of further assistance, please feel free to contact me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Dan Hogan
Russell Givler
Fred Aguirre
Billy Goolsby
Tom Kennerly
Theresa Lucero
Andrew Garcia
Lloyd Strosnider - Owner
Kent M. Whitman - Community Sciences
File

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

July 25, 1995

John J. Dipollino
Community Sciences Corp.
P.O. Box 1328
Corrales, NM 87048

RE: ENGINEER'S CERTIFICATION FOR LAS MARCADAS 11 SUBDIVISION (C12/D2C) RECEIVED JUNE 23, 1995 FOR BOND RELEASE. ENGINEER'S STAMP DATED 6-21-95.

Dear Mr. Dipollino:

Based upon your June 23, 1995 submittal, the above referenced project is not approved for Bond Release.

Prior to obtaining Bond Release, please address the following comment:

Enclosed is a copy of an Albuquerque Subdivision Regulation which requires no more than an 18" grade deviation between the preliminary-plat grading plan and the final grading plan within 50 feet of the subdivision boundary.

There are a number of grades built 18" or more above the grades approved on the preliminary-plat grading plan. How are the grade changes (see plan mark-up for specific spots elevations) absorbed? Most of these grade deviations are adjacent to the Piedras Marcadas Arroyo.

If you need further assistance, please call me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Associate

c: Jack Cloud - Chairman DRB
Andrew Garcia - COA
Kurt Browning - AMAFCA
File

PWHYD/lam

LAS MARCADAS II PARK
HYDROLOGY NOTES

EXISTING CONDITIONS:

The site is currently undeveloped and undisturbed with native soils and vegetation typical of the north west valley. Water sheet flows across the property from north to south. A portion of the site flows west into the Piedras Maracadas Arroyo and the remaining area flows east into Tia Christina Dr NW. There are no offsite flows which cross the site.

EXISTING HYDROLOGY:

Area : 1.70 Acres

Precipitation Zone: 1

Design Storm: 100 yr-6 hr, D = 2.2 in

Land Treatment: 80 % A
20 % C

Excess Precipitation = ((.99)(.34) + (.44)(1.36))/1.70 = .55 in

Discharge

Q (to Tia Christina) = 1.29(.68) + 2.87(.17) = 1.37 cfs
Q (to Piedras Marcadas) = 1.29(.68) + 2.87(.17) = 1.37 cfs

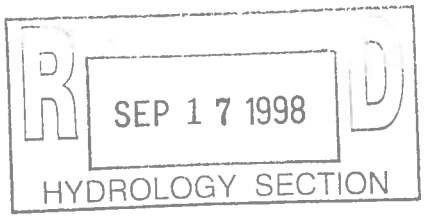
PROPOSED CONDITIONS:

The site will be developed with a parking area, landscaping and trails. A large portion of the site will be left in its native state. Some re-seeding with natural vegetation will be done to increase the ground cover in these areas. Developed runoff will follow the existing drainage patterns. Flows which will enter Tia Christina (Basin A) will be detained by first a depressed planter and then a small ponding area. Runoff flowing to the west (Basin B) will be allowed free discharge across the AMAFCA right of way and into the Peidras Marcadas Arroyo

PROPOSED HYDROLOGY:

Area: Basin A: 0 .63 Ac
Basin B: 1.09 Ac

Land Treatment:
Basin A: 60% D



15% B
25% C

Basin B: 15% D
20% B
30 % C
35% A

Excess Precipitation:

Basin A: ((.38)(1.97) + (.10)(.67) + (.15)(.99))/ .63 = 1.53 in
Basin B: ((.16)(1.97) + (.33)(.99) + (.22)(.67) + (.38)(.44))/1.09 = .88 in

Discharge

Basin A: 4.37(.38) + 2.87(.15) + 2.03(.10) = 2.29 cfs
Basin B: 4.37(.16) + 2.87(.33) +2.03(.22) + 1.29(.38) = 2.58 cfs

community sciences corporation

DRAINAGE REPORT

FOR

LAS MARCADAS II SUBDIVISION (MAP #C-12)

PREPARED FOR

The Strosnider Company

PREPARED BY

COMMUNITY SCIENCES CORPORATION
P. O. BOX 1328
CORRALES, NEW MEXICO 87048

September, 1994

Stephen L. Crawford, P.E.

STEPHEN L. CRAWFORD NEW MEXICO 10274 REGISTERED PROFESSIONAL ENGINEER

9-6-94

csc#20-02-036/20-02af.rep

P.O. Box 1328
Corrales, New Mexico 87048
Tel (505) 897-0000 Fax (505) 898-5195

SURVEYING
LAND PLANNING
CIVIL ENGINEERING
DEVELOPMENT CONSULTANTS

TABLE OF CONTENTS

I. PURPOSE AND SCOPE

The Strosnider Company is currently planning for the development of Las Marcadas II. The proposed development consists of approximately 19.5 acres and is to be subdivided into 76 single family units.

This report presents an overall Drainage Management and Conceptual Grading Plan for approval by the City of Albuquerque in order that subsequent subdivision and development may commence.

II. SITE DESCRIPTION AND HISTORY

Las Marcadas II is a replat of a portion of Paradise Valley Tract 1-A, and Eagle Ranch Tract 22A-2. It is located northwest of the intersection of Golf Course Road and Paseo Del Norte (see Vicinity Map on Preliminary Grading and Drainage Plan, Pocket #1).

The site has one main drainage divide which produces two main flows. One slopes to the Piedras Marcadas Arroyo at an average slope of 4%, the other slopes towards Golf Course Road at an average slope of 2.5%. There is an existing flood plain along the Piedras Marcadas Arroyo and the proposed Las Marcadas II project does not encroach on it. The soil is classified by the Soil Conservation Service as "Bluepoint, loamy, fine sand," and is classified in the "Type A" hydraulic soils group by the SCS.

Ongoing studies are being conducted for the Golf Course Road Storm Drain System for AMAFCA by Leedshill-Herkenhoff.

An erosion setback study along the Piedras Marcadas Arroyo has been established by Smith Engineering Company for Las Marcadas II, and the project's platting will avoid encroaching on the prudent line.

III. DESIGN CRITERIA

A. Flood Control Regulations

The drainage plan presented in this report has been designed to comply with AMAFCA resolution 80-15, which requires that proposed land development projects be designed such that no flooding of private properties will occur during any storm up to and including the 100-year frequency event. Additionally, this drainage plan has been designed to comply with current "City of Albuquerque Drainage Ordinance" and Chapter 22 of the Development Process Manual (DPM), and subsequently adopted general policies of the City of Albuquerque.

1. 100-year storm

   a. Stormwater flow depth not to exceed the top of curb in any street.

   b. Jump depth to be contained within right-of-way.

2. 10-year storm:

   a. Local street - velocity times depth less than 6.5

   b. Arterial streets:

i. Flow not to exceed a depth of 0.50
ii. Velocity times depth less than 6.5
iii. One driving lane in each direction free of stormwater

B. Engineering Parameters

In accordance with AMAFCA criteria, all hydrological analysis is based on the 100-year frequency, 6-hour duration storm, as represented in Section 22.2, Hydrology, of the "Development Process Manual, Volume 2, Design Criteria for the City of Albuquerque, New Mexico, January 1993".

Ten-year, 6-hour values were also used for subcatchments, in accordance with City drainage policies regarding street flow.

The four rainfalls pertinent to the study are as follows:

	10-Year	100-Year
One-Hour	1.26"	1.90"
Six-Hour	1.48"	2.23"

IV. COMPUTATIONAL PROCEDURES

The analysis approach follows standard engineering practice. Key points of confluence were selected and the associated individual and aggregate contributing basins were subsequently defined.

Hydrological computations were accomplished by means of the September 1993 version of AHYMO Computer Program as developed by AMAFCA. The input parameters and resulting flows for the basins are summarized on Table 1. Summary and detailed AHYMO printouts are contained in Appendix A.

Times of concentration were estimated using the Upland Method and then converted to times to peak (Lg), in accordance with the above referenced Section 22.2 which also establishes the minimum time of concentration as 12 minutes.

Flow characteristics for conveyance swales, channels, and streets were analyzed based on the Manning equation for uniform flow. Streets are assumed to have a 2% cross slope from lip of gutter to crown and a curb and gutter per City of Albuquerque Standard details. Finished grade at the right-of-way is 0.33' above top of curb.

V. OFF-SITE DRAINAGE

There is one small offsite drainage basin which contributes minimal flow to the site from Eagle Ranch Tract 22A-1. This flow will be redirected via a drainage swale along the southern property line to an existing storm drain inlet in the parking lot of the West Mesa Christian Church, located on Eagle Ranch Tract 22A-1 (see Drainage Plan in map pocket). This proposed change in flow pattern on Tract 22A-1 has been coordinated with the owner's of the property.

VI. ON-SITE DRAINAGE

Proposed drainage basins 202.1 and 202.2 will drain down Tia Christina to a rundown channel which will then enter a drop manhole into a low velocity, flat slope storm system that will release it into the Piedras Marcadas Arroyo.

Basins 201.1, 201.2 and 201.3 will drain to a sump condition, with a series of inlets in Ryan Patrick Drive, which will drain to the existing 42" RCP lateral in Golf Course Road. The Golf Course Road Storm Drain System which is currently under design by Leedshill-Herkenhoff for AMAFCA will serve this 42" lateral. A 10' rundown channel will serve as an emergency overflow into Golf Course Road.

Along the Piedras Marcadas Arroyo the prudent limit for erosion control, established by Smith Engineering Company, is not encroached upon in any case. The prudent limit study by Smith Engineering Company is under separate cover. Small on-site basins 204, 205, 206 which are presently producing sheet flows will remain undisturbed by this project.

VII. EROSION CONTROL

Control of excessive soil erosion into City streets and drainage improvements during construction will be accomplished by use of temporary lot line, water-trap berms. These will be windrowed into place following mass grading operations and left in place until each home is constructed and sold. The Preliminary Grading and Drainage Plan in Pocket #1 illustrates the dimensions of these berms, and they will be located along those boundaries of each lot which are common to City rights-of-way or public easements.

TABLE I

EXISTING DEVELOPMENT CONDITIONS

					LAND TREATMENT				INCREMENTAL		FUTURE TOTAL	
Basin I.D.	Area (Sq.Mi.)	Contr. Basin	Sum Area (Sq.Mi.)	T_c (Min.)	A	B	C	D	Q_{100} (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_{10} (cfs)
101	.0186	---	---	12	100	0	0	0	16.36	3.15	---	---
102	.0104	---	---	12	100	0	0	0	9.15	1.76	---	---
103	.0053	---	---	12	100	0	0	0	4.67	.90	---	---
104	.0021	---	---	12	100	0	0	0	1.85	.36	---	---
105	.0017	---	---	12	100	0	0	0	1.50	.29	--	---
106	.0050	---	---	12	100	0	0	0	4.40	.85	---	---
107	.0017	---	---	12	100	0	0	0	1.50	.29	---	---

FUTURE DEVELOPMENT CONDITIONS

					LAND TREATMENT				INCREMENTAL		FUTURE TOTAL	
Basin I.D.	Area (Sq.Mi.)	Contr. Basin	Sum Area (Sq.Mi.)	T_c (Min.)	A	B	C	D	Q_{100} (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_{10} (cfs)
201.1	.0063	---	---	12	0	29.5	29.5	41	13.31	7.46	---	---
201.2	.0077	---	---	12	0	29.5	29.5	41	16.26	9.12	29.57	16.58
201.3	.0041	---	---	12	0	29.5	29.5	41	8.67	4.86	8.67	4.86
201.5	---	201.4,201.3	.01810	12	0	29.5	29.5	41	38.23	21.43	38.23	21.43
202.1	.0065	---	---	12	0	29.5	29.5	41	13.73	7.70	---	---
202.2	.0068	---	---	12	0	29.5	29.5	41	14.36	8.05	28.09	15.75
202.3	---	202.1,202.2	.01330	12	0	29.5	29.5	41	28.09	19.75	28.09	15.75
204	.0021	---	---	12	0	29.5	29.5	41	1.82	.35	---	---
205	.0017	---	---	12	0	29.5	29.5	41	1.48	.28	---	---
206	.0060	---	---	12	0	29.5	29.5	41	5.20	1.00	---	---
207	.0016	---	---	12	0	29.5	29.5	41	1.48	.28	---	--

TABLE 2

FLOW CHARACTERISTICS AT KEY LOCATIONS

STREET	LOCATION	ST. WIDTH	% SLOPE	Q100	Dn	Dc	Vn	Vc	AREA	TOP WIDTH	EG	F	*POOL DEPTH
TIA CHRISTINA	6+70	26 STAND	0.80	13.73	0.41	0.41	2.63	2.63	5.23	26.21	0.51	1.04	0.54
TIA CHRISTINA	2+00	26 STAND	4.00	28.09	0.40	0.53	5.67	3.28	4.95	26.20	0.90	2.30	0.74
SHERRY ANN	1+50	27 MOUNT	2.56	13.31	0.29	0.35	3.63	2.51	3.66	27.89	0.50	1.77	0.47
RYAN PATRICK	8+00	28 STAND	2.56	29.57	0.43	0.54	4.94	3.26	5.98	28.22	0.81	1.89	0.75
SHELLY ROSE	6+10	28 STAND	4.00	8.67	0.29	0.36	3.92	2.20	2.21	20.25	0.52	2.09	0.45

* POOL DEPTH = Dc + (1.25Vc^2)/(2g)

EROSION SETBACK STUDY

PIEDRAS MARCADAS ARROYO ABOVE PASEO DEL NORTE

Report Prepared for

Community Sciences Corporation
Corrales, New Mexico

Project:

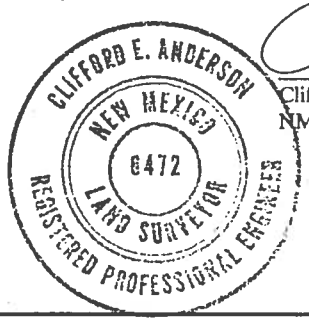
Las Marcadas II
for the Strosnider Company

Prepared by:

Smith Engineering Company
6400 Uptown Blvd. NE, Suite 500E
Albuquerque, New Mexico 87110
Tel: 505/884-0700

SEC #94-77-01

This report was prepared by me, Clifford E. Anderson, NM PE & PS No. 6472. On Friday, July 29, 1994, I conducted an on-site review of this study area, and had in my possession the topographic map that is included in this report. It appears that no grading or filling has occurred on the site since the preparation of the topographic map, and by visual observation, the topographic map appears to reflect the conditions 1 observed.



8/9/94

Clifford E. Anderson — Date
NM PE & PS No. 6472

EROSION SETBACK STUDY
PIEDRAS MARCADAS ARROYO
ABOVE PASEO DEL NORTE

INTRODUCTION

Community Sciences Corporation (CSS) has authorized Smith Engineering Company (SEC) to prepare an erosion setback study for the Piedras Marcadas Arroyo above the future alignment of Paseo del Norte. A future subdivision, Las Marcadas II, is proposed to be platted and constructed on the easterly side of the arroyo. The purpose of this study is to determine the extent to the area to be set aside for drainage, if the arroyo is allowed to remain in a natural condition and the new residential lots will be placed outside of the anticipated erosion setback area. The study reach of the arroyo is approximately 2,400 feet long. A vicinity map is included as Figure 1 of this report.

It is anticipated that drainage from the new development can discharge at the downstream end of the subdivision in a manner that does not cause upstream instability due to head cutting. Additional stabilization of the arroyo bank adjacent to the subdivision could be constructed with the subdivision to reduce the land area required for erosion protection. While this report may be of assistance for engineers designing such bank stabilization, this report does not include specifics required to design such stabilization. No bank stabilization construction is currently known to be under consideration.

The westerly side of the Piedras Marcadas Arroyo is currently owned by the City of Albuquerque as Open Space/Piedras Marcadas National Monument. No development of this property is currently anticipated. This erosion setback study included both sides of the arroyo in order to determine if some feature on the westerly bank would impact the erosion of the easterly bank. The primary purpose of this study is to establish the erosion setback at the easterly bank.

Hydrology

Flow rates for the middle branch of the Piedras Marcadas Arroyo have been established by Molzen-Corbin and Associates with the "Piedras Marcadas Drainage Management Plan Revision" (draft, May, 1993). This report is not yet completed and has not been distributed for agency or public review. The report includes hydrology for existing conditions and 9 alternatives. No alternative has been selected, but it appears that alternatives number 1 through 4 will not be further considered because of downstream flow constraints. Of the remaining alternatives, number 9 (Model No. WCUPDN2.DAT) represents the most critical proposed flow condition in this reach of the Piedras Marcadas Arroyo. The flow near, within, and immediately downstream of sub-basin 303 represents the study area. A basin boundary map showing the Piedras Marcadas watershed is included as Figure 2 of this

report. These are represented in the AHYMO computer output files from the Molzen-Corbin draft study by Hydrographs 104.11 (@ 4,400' upstream of Paseo del Norte) and 103.10 (@ Paseo del Norte). The Molzen-Corbin study also contains an existing conditions model of the watershed (Model No. EX100.DAT). Because the proposed alternatives 5 through 9 include the diversion of existing flows out of the watershed, the existing condition represents the critical flow condition for this watershed. If future upstream diversions were funded and constructed, the erosion setback distances would be subject to reevaluation.

The Molzen Corbin study might receive further hydrologic modifications to incorporate a 3-minute incremental time with a 24-hour rainfall distribution, as currently recommended in the City Development Process Manual (DPM). Also, recent studies in the Rio Rancho area have indicated that the channel routing function in the AHYMO program, as used by Molzen-Corbin, may not accurately represent the actual routing conditions of the steep sand bottom arroyos common to the Albuquerque area. A new routing function, the Muskingum-Cunge procedure, has recently been added to the AHYMO program to correct this problem. Updated input files using Muskingum-Cunge routings were obtained from AMAFCA. The results of the revised AHYMO analysis in the Piedras Marcadas Arroyo adjacent to Las Marcadas II are summarized as follows:

	Q_{100}@ Paseo del Norte Alignment (HYD No. = 103.10)	Q_{100}@ 4,400' Upstream Paseo del Norte (HYD No. = 104.11)
Existing Condition (PMEX100M)	740.27	728.87
Alternative No. 9 (WCUPD2PM)	650.85	657.51

Summary printouts from the AHYMO program modeling are included with this report.

The upper end of Las Marcadas II is approximately 2,400 feet upstream of Paseo del Norte, so the critical flow at the upper end of the project is 735 cfs. The flow rate at the Paseo del Norte alignment, with Q_{100}=740 cfs, is the recommended value for further erosion setback analysis. If the future option 9 is constructed, the revised flow rates would result in a 5 percent reduction in the erosion setbacks obtained using existing condition flow rates.

Computation of Erosion Setback

The procedures in Section 3.4.5 of AMAFCA's Sediment and Erosion Design Guide (March 1994) were used to obtain the maximum erosion distance. Specifically, the procedures to obtain the "Approximate Maximum Erosion Distance based on Optimal Bend Shape" were

used. The procedures for estimating migration rate using the sediment transport and bend shear procedures and the CURVECALL program are not required for this site. As described in page 3-80 of the Sediment and Erosion Design Guide, if the total migration rate computations are used and "the maximum distance is reached, the computations can be stopped and the erosion buffer estimated based on the maximum erosion envelope." For this report, the "maximum erosion envelope" procedures will be used.

The computation of the maximum erosion envelope proceeded as follows:

Compute dominant discharge from Q_{100}:

$Q_d = 0.2Q_{100} = 0.2*740 \text{ cfs} = 148 \text{ cfs}$

(ref: equation 3.77)

Determine if arroyo section is supercritical or subcritical:

$S_c = 0.037Q_d^{-0.133} = 0.019^{ft/ft}$

(ref: equation 3.80)

Actual ground slope = (5169'-5117')/2,360' = $0.022^{ft/ft}$

Since $0.022 > S_c$ then slope is critical or supercritical

Compute channel width for dominant discharge:

$W_D = 4.6Q_D^{0.4} = 4.6(148)^{0.4} = 33.95$ feet

use $W_D = 34$ feet

(ref: equation 3.78)

Compute the meander wavelength:

$\lambda/W_D = 10$ for $Q_D \leq 200$ cfs

(ref: equation 3.74a)

$\lambda = 10*W_D = 10*34 = 340$ feet

The half meander wavelength ($\lambda/2$) represents the approximate location where the meandered channel crosses the average down-valley direction.

Determination of the average down-valley direction requires the following steps:

- determine the centerline of flow from the existing topography
- determine the location where the $\lambda/2$ distances intersect the centerline of flow. Distances are adjusted so that existing meanders are centered on the $\lambda/2$ distances.

- plot a smooth line between the points of intersection to obtain the average down-valley direction.

The maximum channel offset (Δmax) is computed by:

$\Delta max = 2.5W_d = 2.5*34 = 85^{feet}$
for $Q_D \leq 200$ cfs
(ref: equation 3.75a)

The centerline setback (CSB) is computed as:

$CSB = \Delta max + W_D/2 = 85 + 34/2 = 102$ feet
(ref: page 3-74)

The centerline setback is then plotted parallel with and 102 feet from the average down-valley direction.

The existing topographic mapping did not clearly indicate a location for the channel bank, and further location of this feature was based on field observation. In many cases, a definite bank could not be observed. Where it was observed that the bank of a wide arroyo section could impact the erosion setback, this feature was noted on the topographic map.

The bankline setback was then established at Δmax from the bank. For this study reach, the bankline setback was critical only at 2 locations (Station 5+00 to 7+00) with both locations on the west bank and not impacting Las Marcadas II on the east side.

Field investigation and topographic mapping also indicated a large sharp meander near Station 7+00 to 9+00 that impacted the east bank of the arroyo. It appears that this meander was created by a large low sand dune on the west bank of the arroyo. Based on the vegetation on the dune, this feature does not appear to be currently active. Nevertheless, this feature appears to be of sufficient significance that the erosion envelope could be impacted. The low flow channel of the arroyo is immediately adjacent to the west bank in this area, and the erosion setback was adjusted so that the centerline setback was established from the existing low flow channel. None of the other local meanders appear to result in a need for similar adjustment.

The erosion envelope, or estimated maximum erosion distance, was based on the critical condition for the centerline setback and bankline setbacks.

The 100-year flood zone from the existing FEMA Flood Insurance Rate Map (Community Panel No. 350002-00080) was overlaid onto the existing topographic mapping to determine if the flood zone would represent a critical condition. Figure 3 of this report contains an enlarged copy of a portion of this map. Within Las Marcadas II, the computed erosion envelope is always outside of the mapped flood zone. Erosion setback distances from the

100-year flood zone are between 40 and 80 feet. At one location immediately south of Las Marcadas II, the flood zone is outside of the centerline setback. This condition appears to have been created by filling that occurred after the creation of the FEMA maps.

The erosion envelope obtained using the procedures outlined herein, is shown on the enclosed Drawing No. 1.

Conclusions

The Piedras Marcadas Arroyo in this study reach appears to be very stable and well vegetated. There is no evidence of headcutting or rapid bed degradation, but there is also no evidence of aggradation. There is only limited evidence of recent bank instability. However, the soils in this area consist of very fine sands and are highly erosive. A major flow event could cause rapid changes to the arroyo with little chance to take corrective action. If this arroyo is to remain unlined or Las Marcadas II will not be constructing arroyo bank stabilization, the erosion envelope established in this report should provide equivalent protection to adjacent property for storms up to a 100-year flood event.