Eagle Pointe Subdivision
Calabacillas Arroyo

January 1995

EAGLE POINTE SUBDIVISION
CALABACILLAS ARROYO

Prepared for:

Sandia Properties, Ltd.
#10 Tramway Loop NE
Albuquerque, NM 87122

Prepared by:

BOHANNAN-HUSTON INC.
ENGINEERS ARCHITECTS PHOTOGRAMMETRISTS SURVEYORS

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Kurt rec'd 2-8-95

January 31, 1995

Larry Blair, P.E.
Executive Director
AMAFCA
2600 Prospect NE
Albuquerque, NM 87107

Recd AMAFCA 2/2/95

Re: Eagle Pointe Subdivision/Calabacillas Arroyo Report

Dear Mr. Blair:

Enclosed is a copy of the revised report on the Calabacillas Arroyo modifications prepared for Sandia Properties Ltd. The original copy dated December 22, 1994 with AMAFCA's comments (Kurt's) is also enclosed.

All of your comments in the original report have been incorporated excluding the following:

1. The equilibrium slope of 0.01132 foot/foot used was from the 1983 Simons and Li report. You suggested that this may have changed. A new slope of 0.01290 foot/foot was calculated using DPM methods. The S & L slope was chosen in order to be more conservative (i.e. the bottom of the soil cement walls are at a slightly lower elevation).

2. You also suggested the top elevation of the soil cement walls might need to increase due to possible aggradation. The three feet of freeboard used is FEMA criteria for berm construction. For bank protection (that is not berm as in this case) the three feet should be sufficient extra height for possible aggradation. The soil cement berm drop structure is not at risk due to overtopping. A study of the potential aggradation impacts would require a comprehensive study.

3. Lastly, you suggested that because the HEC-2 run is critical at several cross sections sequent depth might be used. Studying four separate cross sections for sequent depth showed that the maximum difference between critical and sequent depth was only 0.12 feet. Therefore, the HEC-2 100-year (critical) elevations are sufficient for determining the top of the soil cement walls.

Thank you for your input. If you have any questions, please feel free to call.

Sincerely,

Howard C. Stone

Howard C. Stone, P.E.
Vice President & Group Manager
Water Resources Group

Status of floodplain on S. side?

BF:HCS/rkl
Enclosure

cc: Cleve Matthews

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TABLE OF CONTENTS

APPENDICES

I. INTRODUCTION

The Eagle Pointe Subdivision Units 1 and 2 (Eagle Ranch tracts 3A and 2A) are proposed to be built on the south and north sides, respectively, of the Calabacillas Arroyo, just east of Golf Course Road on Albuquerque's West Mesa (see Figure 1, Location Map). AMAFCA required an erosion envelope analysis and a 100-year flood study to determine options for protecting the banks of the Calabacillas Arroyo.

The portion of the arroyo to be studied ends at AMAFCA drop structure #4, about 1200 feet downstream from a bridge and drop structure at Golf Course Road. A new prudent line needs to be determined due to several changes in the arroyo, 100-year flows and analytical procedures since the Simons and Li (S & L) line was established. The S & L line is outlined in the 1983 "Erosion Study to Determine Boundaries for Adjacent Development - Calabacillas Arroyo." This line is shown on Figure 2. Also a new 100-year flood elevation is determined because these changes occurred after the FEMA floodplains were established (1983).

II. PURPOSE

The purpose of this report is to establish a new prudent line, determine a new 100-year water surface, propose arroyo improvements, estimate the cost of these improvements, and make a recommendation for construction.

Information on the existing drop structures was taken from the AMAFCA as-built drawings of the Calabacillas grade control structures (1991). A recent Bohannan-Huston Inc. site survey contour map was used for conceptual design (see Appendix A: Contour Maps). Other details were taken from FEMA FIRM panel 2 and the 1973 AMAFCA Orthophoto Topographic maps A-12 and B-12.

III. PROCEDURES

A. Hydrology

All analyses were done using a 100-year flow rate of 13,300 CFS, as directed by AMAFCA. This flow rate was determined from a report by Wilson on the Swinborne Dam. This flow resulted in a dominant discharge (20% of 100-year flow) of 2660 CFS.

The Calabacillas Arroyo thalweg has changed significantly since the last FEMA floodplain study. This was found by comparing Bohannan-Huston Inc. contour map and the AMAFCA Orthophoto Topographic maps (see Appendix A). For example, the elevation just downstream of Golf Course Road has lowered from 5139 to 5133 feet. In discussions with AMAFCA, the reason for this was due to grading by AMAFCA personnel to straighten the arroyo in this reach and to construction associated with the Golf Course Road bridge.

B. Hydraulics

Because of the changes in the arroyo bed bank, a HEC-2 analysis was done in order to determine a more current 100-year water surface. This new floodplain is shown on Figure 2. As per FEMA guidelines, the water surface was based on critical depth since the runoff is in the supercritical flow regime (see Appendix B: HEC-2 Output).

C. Prudent Line

There are three prudent lines in this study. The first is the existing S & L line. The second was calculated using existing conditions. The third was calculated assuming arroyo improvements will be made (i.e. intermediate drop structure). The prudent lines were determined using the methods outlined in the "Sediment and

Erosion Design Guide prepared for AMAFCA" by RCE. The new prudent line (without improvements) is shown on Figure 2. The calculations for the new erosion envelopes can be found in Appendix C: Prudent Line Calculations.

D. Bank Improvements

In order to protect the subdivision, two options were examined. The first is a short-term or interim option that includes soil cement walls at specific reaches of the arroyo where the existing bank is close to the property. This would include a 370 foot long northwest wall, a 200 foot long northeast wall, and a 175 foot long south wall. The long-term or permanent solution would include a soil cement berm drop structure between Golf Course Road and Drop Structure #4. The construction of the drop structure would narrow the erosion envelope and negate the need for the south wall. The long-term solution also includes a northeast soil cement wall and a northwest soil cement wall. The short-term and long-term proposed structures are shown on Figure 2.

For soil cement design purposes, an equilibrium slope must be used. In this report a 2-year, long-term slope of 0.01132 foot per foot was used. This value was taken from the 1983 Simons and Li Erosion Study.

The design criteria for the soil cement structures is as follows: (1) The bottom of all soil cement is at the equilibrium slope elevation minus ten feet for scour (see Appendix D), (2) the top of all soil cement walls are at the new 100-year water surface plus three feet of freeboard, (3) all walls will be placed in ten foot wide layers and at a 1:1 slope underground. critical depth

A summary of all structure's dimensions and costs can be found in Appendix E: Cost Work Sheet.

IV. RESULTS AND DISCUSSION

A. New Prudent Line

Using the steps outlined in the "Erosion Design Guide" for estimating the maximum lateral erosion distance, a centerline setback (CSB) was calculated to be 431 feet. This method is assuming sinusoidal meander bends. Because the two drop structures act as control points, the bends start at each structure (see Figure 2). These lines extend far beyond the S & L line and the proposed development.

B. New Prudent Line (With Proposed Improvements)

In order to narrow this new erosion envelope some improvements must be done. In order for development to occur bank protection walls are necessary. However, this is only an interim or short-term solution. For a permanent or long-term solution an intermediate drop structure must be built in order to shorten the distance between control points thereby narrowing the erosion envelope. This prudent line (assuming construction of the new drop structure) was determined using the same steps as in the previous line. However, extra steps were taken because the calculated wavelength divided by two is larger than the distance between the existing and proposed control structures. Basically, the CSB is governed by fitting the sinusoidal bend between the structures.

V. CONCLUSION

In order for the proposed development to occur, improvements to the Calabacillas Arroyo must be made. Two possible scenarios were examined. The first is the short-term bank protection (see Figure 2). The second scenario, long-term protection, includes the soil cement berm drop structure, the northeast soil cement wall and the northwest soil cement wall. A summary of the estimated costs of each structure and scenario is shown in Table 1.

Table 1: Construction Cost Estimates

Scenario	Structures Included	Total Structure Cost	Total Scenario Cost
Option 1: Short-Term/ Interim	Northwest Wall Northeast Wall South Wall	$245,496 $124,500 $112,376	$482,372
Option 2: Long-Term/ Permanent	Northwest Wall Northeast Wall Drop Structure	$127,698 $124,500 $267,890	$520,088

The costs include construction, contingencies and engineering design, staking, inspection and testing. A summary of the dimensions and costs can be found in Appendix E.

A. Short-Term/Interim Solution

In order for the developer to protect his property for the short-term, soil cement walls must be built at all places where the arroyo bank is threatening the property. This will result in three separate walls to be built: a 370 foot long northwest wall, a 200 foot long northeast wall, and a 175 foot long south wall. These proposed walls are shown on Figure 2. The total construction cost for this solution is estimated at $482,372.

B. Long-Term/Permanent Solution

The long-term solution proposes one additional drop structure halfway between Golf Course Road and Drop Structure #4. The construction of the drop structure decreases the prudent line width so that it is inside the drainage easement line. This eliminates the need for the south wall. Although the northwest wall is also far outside the erosion envelope, the 100-year water surface is at the base and could potentially cause erosion. The need for this wall is not eliminated; however, the design criteria changes. The equilibrium slope is no longer used. The erosion envelope is narrowed by the construction of the drop structure. The northeast wall is outside of this new prudent line, therefore any scour is local and due to the 100-year storm velocities, not long-term scour or degradation. Because of this scour along a floodwall was calculated from procedures in the Sediment and Erosion Design Guide to the bottom elevation of the soil cement (see Appendix D: Scour Calculation). Therefore, the long-term solution includes a new drop structure, a 200 foot northeast soil cement wall and a 370 foot northwest soil cement wall. The estimated cost of this option is $520,088.

VI. RECOMMENDATIONS

Bohannan-Huston Inc. recommends the long-term, permanent solution. This will avoid any structures later becoming unnecessary (when a long-term solution is implemented). The recommendation includes the new drop structure, the 200 foot northeast wall and the 370 foot northwest wall (see Figure 2). The total cost of this option is $520,088. A proposed cost share for this option is as follows:

Table 2: Proposed Cost Share Arrangement

TRACT 3A OFF-SITE DEVELOPMENT (Unit 1)

	Sandia Properties, Ltd.	AMAFCA
Drop Structure (Construction)	$112,323	$112,323
Drop Structure (Design)	$16,287 →	16
Drop Structure (Staking, Inspection & Testing)		$26,958
Subtotal	$128,610	$139,281

TRACT 2A OFF-SITE DEVELOPMENT (Unit 2)

	Sandia Properties, Ltd.	AMAFCA
Northwest Wall (Construction)	50 000	~~$107,084~~
Northwest Wall (Design)	$7,764	
Northwest Wall (Staking, Inspection Testing)		$12,850
Northeast Wall (Construction, Design, Staking, Inspection & Testing)	$124,500	
Subtotal	$132,264	$119,934
TOTAL	**$260,874**	**$259,215**
	310 294	252 276

This will result in the developer (Sandia Properties, Ltd.) paying for half of the design of the drop structure, half of the drop structure construction cost, the design of the northwest wall and the total cost of the northeast wall. AMAFCA is proposed to pay for half of the drop structure construction cost, the inspection and testing of the drop structure and the construction, testing and inspection of the northwest wall.

The off-site modifications to tract 3A (Unit 1) are proposed to be built first, followed by tract 2A (Unit 2). With this cost share Sandia Properties, Ltd. pays 50.2% of the total modification cost and AMAFCA would pay 49.8%.

EXISTING ARROYO

(METHODS FROM "DESIGN SPECS FOR ARROYOS")

$Q_{100} = 3300$ cfs

$Q_D = 0.6\,Q_{100} = 0.6(3300\text{ cfs}) = 2000$ cfs (eq 3.7?)

$W_D = 4.0\,Q_D^{0.4} = 4.0(2000)^{0.4} = 108$ LF (eq 3.73)

$\frac{\lambda}{W_D} = 14 \rightarrow \lambda = 14(108) = 1120'$ (3.74c)

$\Delta_{max} = 10.1\,Q_D^{0.4} = 10.1(2000)^{0.4} = 377'$ (3.81c)

$\frac{\lambda}{2} = \frac{1120}{2} = 755$ < distance between structures (1500)'

$CSB = \frac{W_D}{2} + \Delta_{max} = \frac{108}{2} + 377 = \boxed{431'}$

MODIFIED ARROYO (PROPOSED NEW DROP STRUCTURES)

W/ THE NEW STRUCTURES THE DISTANCE BETWEEN CONTROL POINTS ≅ 475'

X-AXIS ON FIGURE 3.24 $= \frac{\text{SPACING}}{\lambda/2} \quad \frac{475}{755} = 0.63$

Y AXIS $= 0.38 = \frac{\Delta_{max}}{\Delta_{max\,unconstrained}} \rightarrow \Delta_{max} = 0.38(377) = 143$

$CSB = \frac{W_D}{2} + \Delta_{max} = \frac{108}{2} + 143 = \boxed{197'}$

HYDRO:[H9325720.HEC2]SCOUR.WK3

VALUES FROM HEC2 OUTPUT
SCOUR CALCULATION

SECNO	SSTA	STCHL	QLOB	VLOB
200	176.36	221.80	132.53	4.17
250	152.68	226.10	899.25	7.02
300	137.77	224.00	900.00	7.42
350	152.19	199.60	900.00	13.55
400	145.17	277.90	900.00	9.88
450	116.61	305.80	5437.30	14.12
500	131.73	289.90	3671.99	13.73

FROM SEDIMENT AND EROSION DESIGN GUIDE
SCOUR=YH((0.73+0.14*PI*FR^2)*COS(t)+4*FR^0.33*SIN(t)) eq 3.90

SECNO	TOPWID	TALOB	YH=A/T	FRLOB	ANGLE	SCOUR
200	45.44	31.78	0.70	0.88	74	2.66
250	73.42	128.10	1.74	0.94	74	6.79
300	86.23	121.29	1.41	1.10	74	5.82
350	47.41	66.42	1.40	1.30	74	6.19
400	132.73	91.09	0.69	1.90	74	3.58
450	189.19	385.08	2.04	1.60	74	9.81
500	158.17	267.44	1.69	1.80	74	8.59