

ACCEPTED  
J. DeGrood  
2/12/88

Hydrologic/Hydraulic Report  
for the Erosion Setback Limits  
of Lots 151-171 of  
Ventana Canyon Estates

**OSBORN, PETERSON, WALBERT & ASSOCIATES**  
Engineering, Surveying & Planning, Inc.

P.O. Box 31330  
6383 East Grant Road  
Tucson, Arizona 85751-1330  
Phone: (602) 296-8544



Hydrologic/Hydraulic Report  
for the Erosion Setback Limits  
of Lots 151-171 of  
Ventana Canyon Estates

Section 8, Township 13 South, Range 15 East  
OPW Job 82019-203



Osborn, Petterson, Walbert  
and Associates  
P.O. Box 31330  
6383 East Grant Road  
Tucson, Arizona 85751-1330

(VCE.HYD JS)

February 4, 1988

INDEX

	<u>PAGE</u>
Introduction	1-2
Location Plan	3
1986 Aerial Photograph	4
1967 Aerial Photograph	5
Hydrology Plan	6
Soil Investigation Letter	7-10
Hydrologic Data Sheets	11-20
Culvert Data Sheet	21
Cross-Section Hydraulics	22-25
Hydraulic Summary Table	26
References	27



## INTRODUCTION

This report is being submitted to the Pima County Permits and Compliance Section for the purpose of reducing the erosion setback limits for Lots 151-171 of Ventana Canyon Estates, **Lots 149-178 (Book 41, Page 48)**. The information contained herein supports the claim that a safe reduction in the setback distance can occur.

Included herein is hydrologic and hydraulic data specific to the project site. Hydrologic data sheets are excerpts from the approved Hydrologic/Hydraulic Report for Ventana Canyon Estates, Lots 110-183. Some of the hydraulic calculations were done specifically for this project while others (cross-sections 1-8) were part of a previously approved report for the Esperero Canyon Wash. The latter report addresses golf course improvements which are now existing; included herein is a copy of the hydraulic Summary Table from the report.

The entire project site can be seen on the Hydrology Plan contained herein. That plan also shows the 100-year flood prone areas located within or adjacent to lots 151-171. The western floodplain normally requires a 50 foot erosion setback while the Esperero Canyon Wash usually necessitates a 100 foot erosion setback.

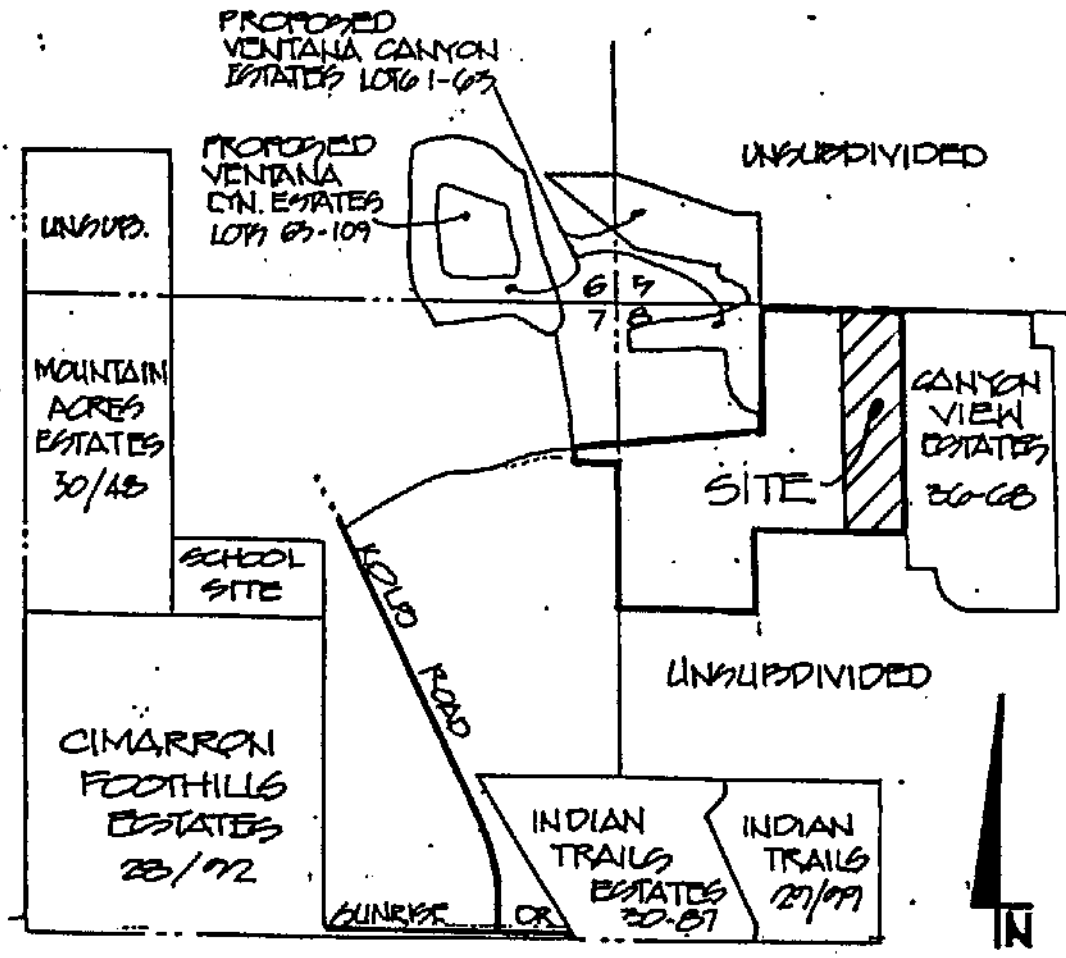
In conjunction with the compilation of this report, a field visit was done. Participating in that visit was Jim Degrood (Manager of Pima County Permits and Compliance Section) and Jim Evanoff (representative of Western Technologies, Inc.) as well as

Jeff Stanley of Osborn, Petterson, Walbert and Associates. It was generally agreed that soil conditions support a reduced erosion setback distance. Outlined on the Hydrology Plan is a golf course easement line which is for golf course use only; a lot owner cannot build beyond that line. That line is typically outside the flood prone area, however, it is within the normal erosion setback area. After considering hydraulics and soil conditions of the wash, it was agreed, by all three persons, that the golf course easement line could also be the erosion setback limit. The only exception was made at Lot 158 where a new line was agreed upon (see Hydrology Plan).

It should be noted that there is not a golf course easement line on lots 168-171. It was agreed in the field that the erosion setback limit could coincide with the top of bank. That line is shown on the Hydrology Plan.

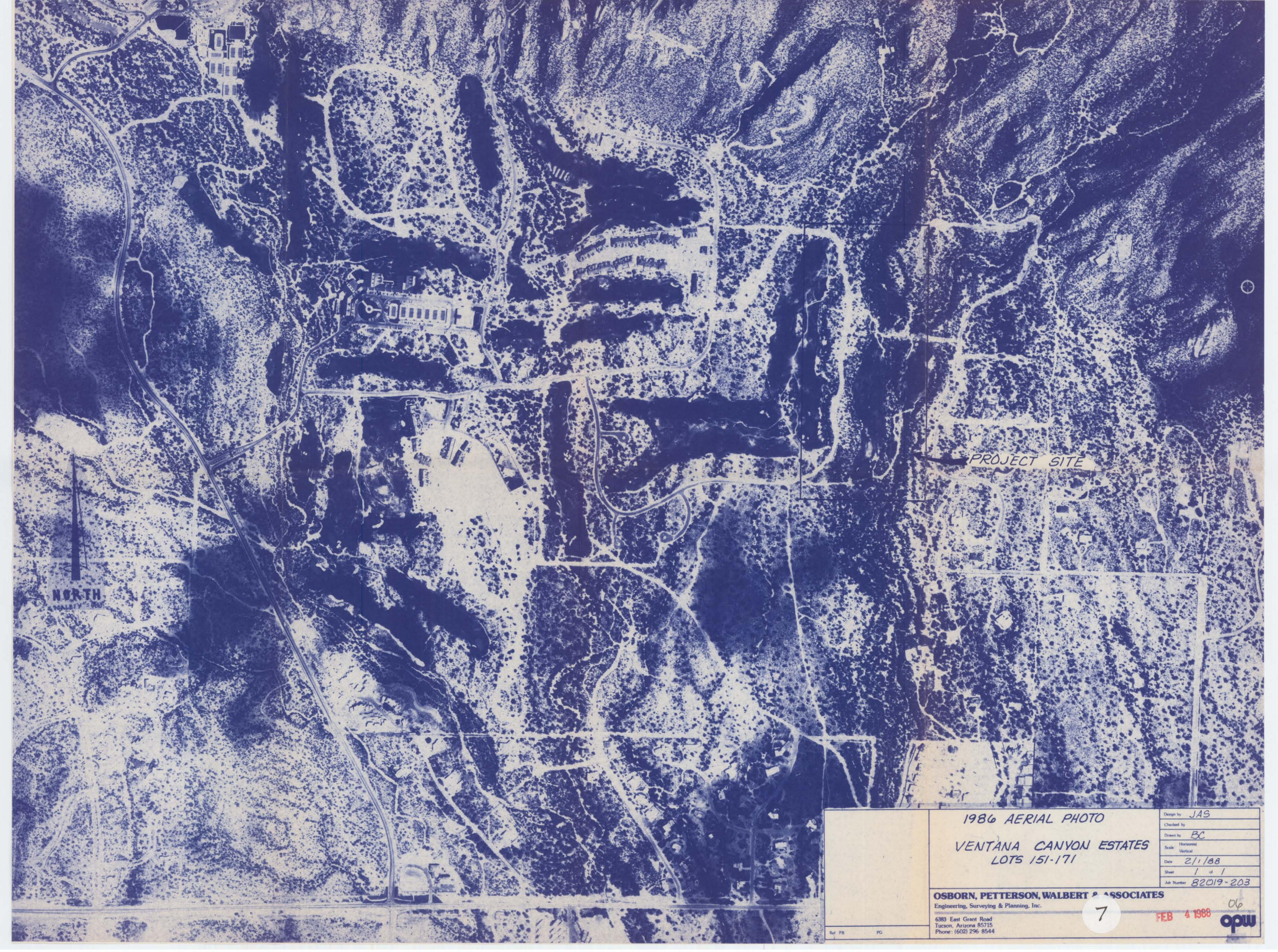
Included herein is a letter from Western Technologies, Inc. regarding soil conditions.

To further substantiate the reduced setback distance, a photographic comparison of existing conditions as well as conditions during 1967 was performed. Both photographs are contained herein. Results indicate that wash conditions are basically the same. There are no visible signs that erosion occurred during the last 20 years. Consequently, the erosion setback line has been safely located.



# LOCATION PLAN

A PORTION OF SECTION 8 - T 135 N, R 10E, Q 4S, R. 12 & M.  
 PIMA COUNTY, ARIZONA  
 SCALE: 3" = 1 MILE



NORTH  
SCALE 1" = 200'

PROJECT SITE

1986 AERIAL PHOTO  
VENTANA CANYON ESTATES  
LOTS 151-171

Design by JAS  
Checked by  
Drawn by BC  
Scale: Horizontal  
Vertical  
Date 2/1/88  
Sheet 1 of 1  
Job Number 82019-203

OSBORN, PETERSON, WALBERT & ASSOCIATES  
Engineering, Surveying & Planning, Inc.

6383 East Grant Road  
Tucson, Arizona 85715  
Phone: (602) 296-8544

7

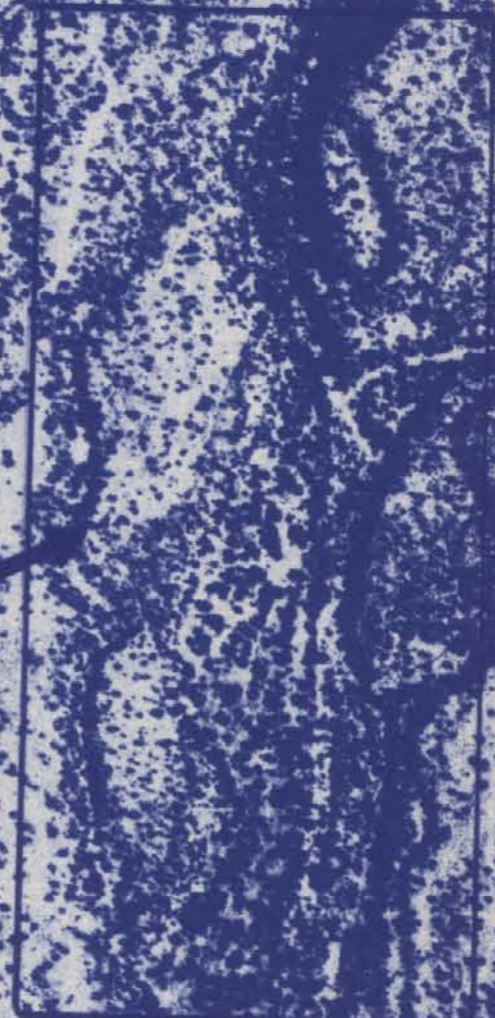
FEB 4 1988

opw

Ref. FB PG



PROJECT SITE



	<b>1967 AERIAL PHOTO</b>	Design by <i>JAS</i>
	<b>VENTANA CANYON ESTATES LOTS 151-171</b>	Checked by
		Drawn by <i>BC</i>
		Scale Horizontal
		Vertical
		Date <i>2/1/88</i>
Sheet <i>1</i> of <i>1</i>		
Job Number <i>82019-203</i>		
<b>OSBORN, PETERSON, WALBERT &amp; ASSOCIATES</b> Engineering, Surveying & Planning, Inc.		
6383 East Grant Road Tucson, Arizona 85715 Phone: (602) 296-8544		
Ref PB PG	FEB 4 1988 opw ka	



LEGEND  
 ○ CONCENTRATION POINT  
 □ CROSS SECTION LOCATION  
 — 10 YEAR FLOODLINE  
 — GOLF COURSE ESMT LINE  
 — EROSION SETBACK LIMIT

**EROSION SETBACK MAP**  
 VENTANA CANYON ESTATES  
 LOTS 152 - 172

OSBORN, PETERSON, WALBERT & ASSOCIATES  
 Engineering, Surveying & Planning, Inc.  
 480 East Green Road  
 Denver, Colorado 80202  
 Phone: (303) 756-8424





**WESTERN  
TECHNOLOGIES  
INC.**

3480 South Dodge Boulevard  
Tucson, Arizona 85713  
(602) 748-2262

Osborn, Petterson, Walbert  
& Associates  
6383 East Grant Road  
Tucson, Arizona 85715

February 2, 1988

Attention: Mr. Jeffrey Stanley, P.E.

Re: Lots 152 to 171 at Ventana  
Canyon Estates  
Desert Loop Moon Drive  
Pima County, Arizona

Inv. No. 29280026

As you requested, we performed a visual review of the referenced lots to determine the erosional potential of the surface soils along existing washes bordering the properties. This report presents our opinions and recommendations based on this review. Also present during the on-site review was Jeff Stanley with Osborn, Petterson, Walbert & Associates and Jim DeGroot with the Pima County Department of Transportation and Flood Control.

The lots are undeveloped parcels of desert land that will eventually support detached residential dwellings. A 20 to 50 foot wide wash draining southerly and roughly paralleling the Esperero Canyon Wash to the east travels along the rear portions of lots 158, 160, 162, 164, and 166. The golf course easement, which crosses through the lots, contains most of the wash in these areas. The wash crosses the eastern portions of lots 152 and 154 and the western portion of lot 153. The wash coalesces with the Esperero Canyon Wash southeast of lot 152. Located along the east, or rear portions of lots 153, 155, 156,

157, 159, 161, 163, 165, 167, and 168 to 171 is the Esperero Canyon Wash. South of about lot 163 the main channel of the wash is about 200 to 250 feet to the east. A grassed fairway of the existing golf course exists between the channel and the lots. A steep slope, with heights of 15 to 30 feet, separates the rear of the lots and the golf course or wash. The golf course easement boundary is generally well above the toe of the slope and the anticipated 100 year flood line.

Based on our visual review and knowledge of the general soil conditions in the area, the surface soils consist of cobbles and boulders in a matrix of gravelly sand with small amounts of silt and/or clay. The ground surface and the banks of the washes contain a large percentage of boulders. We understand the 100 year flood line is along areas of exposed boulders along the wash banks and/or the steep slopes of the Esperero Canyon Wash. The concentrated presence of cobbles and boulders along the channel and slope banks affords good natural protection against lateral bank migration. This is evidenced by little observable erosional features beyond the banks or along the slope. Soils of the types observed at the site, subjected to the anticipated flow quantities and velocities, have low susceptibility to erosion.

I MADE NO RECOMMENDATIONS  
AS TO LOCATION - I ASKED FOR A  
PROPOSAL JRD 2/12/88

Based on the observed conditions and anticipated development, we concur with the recommendations made by Mr. Jim DeGroot with Pima County Department of Transportation and Flood Control while on the site review. These recommendations were generally as follows. For lots 155 to 157 and lots 159 to 167 the erosion setback should be the existing golf course easement line. The erosion setback line should be a minimum of 10 feet from the 100 year flood line for lots 152 to 154. The erosion setback line for lot 158 should be about as shown on the attached site plan.

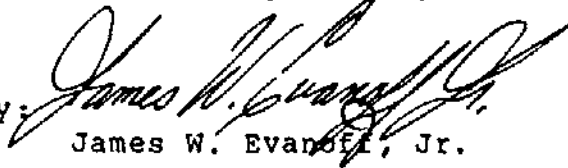


We have appreciated providing your geotechnical consulting services and can review your plans and specifications for consistency with the recommendations. If there are any additional questions, or if we may be of further service, please call us.

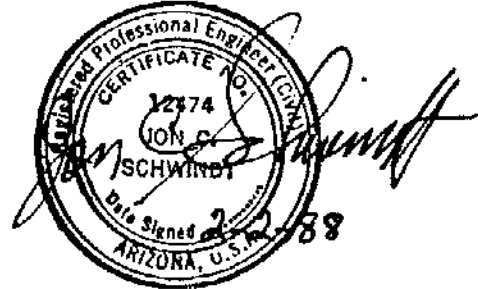
Sincerely,

WESTERN TECHNOLOGIES INC.  
Geotechnical Engineering Services

By:

  
James W. Evanoff, Jr.

/jwe



and:

Jon C. Schwindt, P.E.



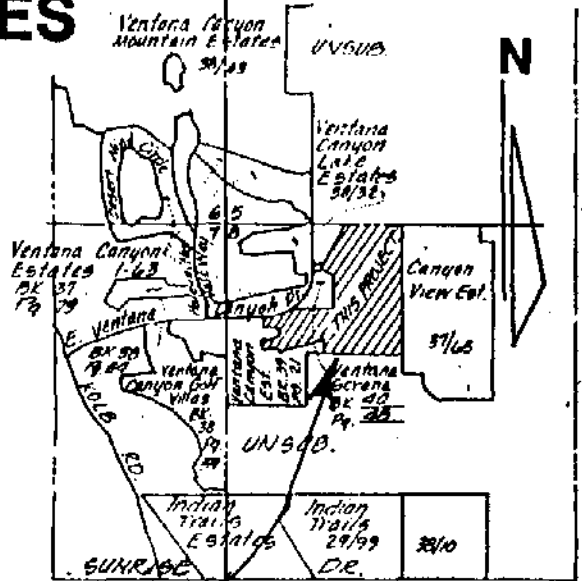
# VENTANA CANYON ESTATES

## LOTS 152 TO 171

SITE PLAN REFERENCE:

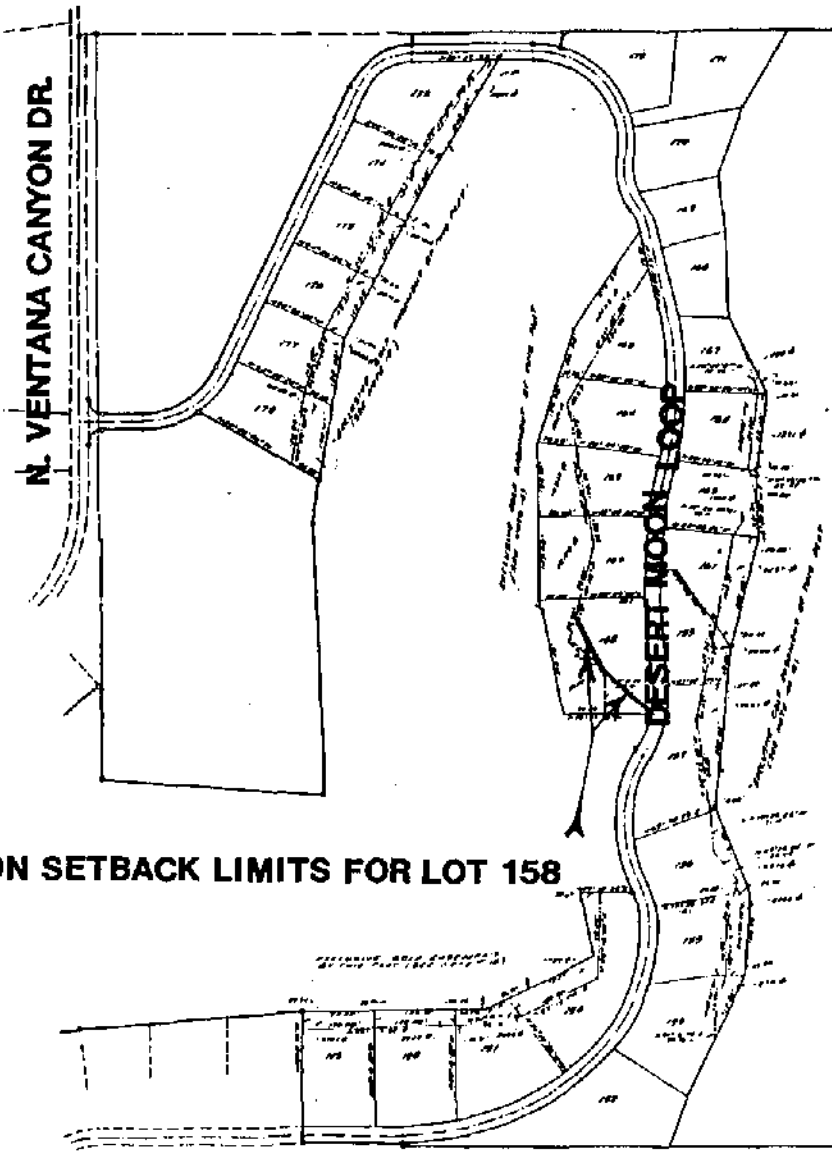
### OSBORN, PETTERSON, WALBERT

### and ASSOCIATES



THIS PROJECT

VICINITY MAP



PROPOSED EROSION SETBACK LIMITS FOR LOT 158

SITE PLAN REDUCED

Date 2-2-88

Checked By

Date 2-2-88

Date

Prepared By

CA



HYDROLOGIC DATA SHEET

Project Name and Location: BRANDT

Drainage Concentration Point: 1 (C/29 OFF)

Watershed Area (A): 6.8 acres/square miles.

Length of Watercourse ( $L_c$ ): 1280 ft. Length to Center of Gravity ( $L_{ca}$ ): 640 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ )-ft.

840  
440

57  
2945 - 2917 = 28

Mean Slope ( $S_c$ ): .066 ft./ft. Watershed Type(s): SUB FOOTHILLS (future)

Basin Factor ( $n_b$ ): .032 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 100% B Cover Type (s): DESERT BRUSH

Cover Density (pervious areas): 40% Impervious Cover: 20% (future)

CN(s): 81.99 (pervious & impervious areas) CN\*(s): 86.16, 99  
(curve number) (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .552 (pervious areas) .955 (impervious areas)

Runoff Supply Rate (q): .633 l in./hr. (function of i)

Time of Concentration ( $T_c$ ): 8.13  $i^{-.4}$  hrs./mins. (function of i)

Iterative Solution of  $T_c$ : 5 hrs./mins.

Rainfall Intensity (i) at  $T_c$ : 10.23 in./hr. Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 6.48 in./hr.  $T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50 (S_c)^{.4}}$  hours

Peak Discharge:

1.008 qA (acres): 44 cfs.

645.33qA (square miles): \_\_\_\_\_ cfs.

Note: For impervious areas, CN\* = 99 (constant).

HYDROLOGIC DATA SHEET

Project Name and Location: VENTANA CANYON

Drainage Concentration Point: 3 (C/28 OFF)

Watershed Area (A): 43.7 acres/square miles.

Length of Watercourse ( $L_c$ ): 3850 ft. Length to Center of Gravity ( $L_{ca}$ ): 2280 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ )-ft.

920, 900  
1300  
730

540, 20  
80  
2938 - 2910 = 28

Mean Slope ( $S_c$ ): .056 ft./ft. Watershed Type(s): 22% Sub Fl. 78% Mtn (future)

Basin Factor ( $n_b$ ): 0.046 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 22% B, 78% D Cover Type (s): DESERT BRUSH

Cover Density (pervious areas): 40% Impervious Cover: 15% in B (future)

CN(s): 81, 89, 99 (pervious & impervious areas) CN\*(s): 86.16, 91.96, 99  
(curve number) (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .552, .715 (pervious areas) .955 (impervious areas)

Runoff Supply Rate (q): 0.692 1 in./hr. (function of i)

Time of Concentration ( $T_c$ ): 24.53  $i^{-.4}$  hrs. (mins) (function of i)

Iterative Solution of  $T_c$ : 11 hrs. (mins)

Rainfall Intensity (i) at  $T_c$ : 7.67 in./hr. Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 5.31 in./hr.  $T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50(S_c)^4}$  hours

Peak Discharge:

1.008 qA (acres): 234 cfs.

645.33qA (square miles): \_\_\_\_\_ cfs.

Note: For impervious areas, CN\* = 99 (constant).

HYDROLOGIC DATA SHEET

Project Name and Location: BRANDT

Drainage Concentration Point: 4 (c/1+3)

Watershed Area (A): 50.5 acres/square miles.

Length of Watercourse ( $L_c$ ): 3900 ft. Length to Center of Gravity ( $L_{ca}$ ): 2340 ft.

Incremental Change in Length ( $L_i$ ) - ft.

Incremental Change in Elevation ( $H_i$ )-ft.

920, 900  
1300  
830

540, 20  
80  
2938 - 2905 = 33

Mean Slope ( $S_c$ ): .055 ft./ft. Watershed Type(s): MTN (78%) SUB FOOTHILLS (22%) (future)

Basin Factor ( $n_b$ ): .046 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): ~~22% B~~ 78% D Cover Type (s): DESERT BRUSH

Cover Density (pervious areas): 40% Impervious Cover: 15% (future)

CN(s): 81, 99, 99 (pervious & impervious areas) CN\*(s): 86.16, 99, 91.96  
(curve number) (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .552, .715 (pervious areas) .955 (impervious areas)

Runoff Supply Rate (q): 0.692 l in./hr. (function of i)

Time of Concentration ( $T_c$ ): 24.99  $i^{-.4}$  hrs./mins (function of i)

Iterative Solution of  $T_c$ : 11 hrs./mins.

Rainfall Intensity (i) at  $T_c$ : 7.67 in./hr.

Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 5.31 in./hr.

$$T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50 (S_c)^{.4}} \text{ hours}$$

Peak Discharge:

1.008 qA (acres): 270 cfs.

Note: For impervious areas, CN\* = 99 (constant).

645.33qA (square miles): \_\_\_\_\_ cfs.

HYDROLOGIC DATA SHEET

Project Name and Location: VENTANA CANYON

Drainage Concentration Point: 5 (6/4)

Watershed Area (A): 57.4 acres/square miles.

Length of Watercourse ( $L_c$ ): 5100 ft. Length to Center of Gravity ( $L_{ca}$ ): 2800 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ ) - ft.

920,900  
2030,150  
1100

540,200  
122,14  
2896 - 2850 = 46

Mean Slope ( $S_c$ ): 0.087 ft./ft. Watershed Type(s): 40% S. Flks. 60% MTN (future)

Basin Factor ( $n_b$ ): 0.043 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.27 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 40% B 60% D Cover Type (s): DESERT BRUSH

Cover Density (pervious areas): 40% Impervious Cover: 15% in B (future)

CN(s): 81, 89, 99 (pervious & impervious areas) CN\*(s): 86.16, 91.96, 99  
(curve number) (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .552, .715 (pervious areas), .955 (impervious areas)

Runoff Supply Rate (q): 0.674 1 in./hr. (function of i)

Time of Concentration ( $T_c$ ): 22.5  $i^{-.4}$  hrs. (mins) (function of i)

Iterative Solution of  $T_c$ : 8 hrs. (mins)

Rainfall Intensity (i) at  $T_c$ : 7.94 in./hr. Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 5.35 in./hr.  $T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50(S_c)^{.4}}$  hours

Peak Discharge:

1.008 qA (acres): 310 cfs.

645.33qA (square miles): \_\_\_\_\_ cfs.

Note: For impervious areas, CN\* = 99 (constant).

HYDROLOGIC DATA SHEET

Project Name and Location: VENTANA CANYON

Drainage Concentration Point: 7 (C/546)

Watershed Area (A): 60.2 acres/square miles.

Length of Watercourse ( $L_c$ ): 5400 ft. Length to Center of Gravity ( $L_{ca}$ ): 3000 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ )-ft.

720, 700  
1100, 150  
1100  
1500

540, 200  
122, 14  
46  
2850 - 2844 = 6

Mean Slope ( $S_c$ ): 0.078 ft./ft. Watershed Type(s): 40% F+H, 60% MTN (future)

Basin Factor ( $n_b$ ): 0.043 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.27 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 40% B, 60% D Cover Type (s): DESERT BRUSH

Cover Density (pervious areas): 40% Impervious Cover: 15% in B (future)

CN(s): 81, 89, 99 (pervious & impervious areas) CN\*(s): 86.16, 91.96, 99  
(curve number) (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .552, .715 (pervious areas), .955 (impervious areas)

Runoff Supply Rate (q): .674 in./hr. (function of i)

Time of Concentration ( $T_c$ ): 24.39  $i^{-.4}$  hrs. (mins) (function of i)

Iterative Solution of  $T_c$ : 10 hrs. (mins)

Rainfall Intensity (i) at  $T_c$ : 7.94 in./hr. Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 5.35 in./hr.  $T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50 (S_c)^{.4}}$  hours

Peak Discharge:

1.008 qA (acres): 325 cfs.

645.33qA (square miles): \_\_\_\_\_ cfs.

Note: For impervious areas, CN\* = 99 (constant).

HYDROLOGIC DATA SHEET

Project Name and Location: Ventana Canyon

Drainage Concentration Point: 28 OFFSITE (Revised)

Watershed Area (A): 413 acres square miles.

Length of Watercourse ( $L_c$ ): 3120 ft. Length to Center of Gravity ( $L_{ca}$ ): 1800 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ )-ft.

920

540

900

200

1300

80

Mean Slope ( $S_c$ ): .140 ft./ft. Watershed Type(s): 17% Sub Hills, 83% Mh (future)

Basin Factor ( $n_b$ ): .0473 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 17% B 83% D Cover Type (s): Desert Brush

Cover Density (pervious areas): 40% Impervious Cover: 15% in B (future)

CN(s): 81, 87, 99 (pervious & impervious areas) CN\*(s): 80, 16, 91, 96, 99  
(curve number) small (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .552, .715 (pervious areas) .968 (impervious areas)

Runoff Supply Rate (q): .698 l in./hr. (function of i)

Time of Concentration ( $T_c$ ): 15.2  $i^{-.4}$  hrs. (mins.) (function of i)

Iterative Solution of  $T_c$ : 6 hrs. (mins.)

Rainfall Intensity (i) at  $T_c$ : 9.76 in./hr. Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 6.81 in./hr.  $T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50 (S_c)^4}$  hours

Peak Discharge:

1.008 qA (acres): 284 cfs.

645.33qA (square miles): \_\_\_\_\_ cfs.

Note: For impervious areas, CN\* = 99 (constant).

HYDROLOGIC DATA SHEET

Project Name and Location: Ventana Canyon

Drainage Concentration Point: 30 entering (Esperero Canyon Wash) OFFSITE

Watershed Area (A): 2297 acres/square miles.

Length of Watercourse ( $L_c$ ): 25200 ft. Length to Center of Gravity ( $L_{ca}$ ): 16800 ft.

Incremental Change in Length ( $L_i$ ) - ft.

Incremental Change in Elevation ( $H_i$ ) - ft.

3800  
4000  
5600  
8000 & 3800

1600  
800  
600  
1400, 280

Mean Slope ( $S_c$ ): .150 ft./ft. Watershed Type(s): Mountain (future)

Basin Factor ( $n_b$ ): .05 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 33.1% C (58.9% & 8%) D Cover Type(s): 92% Mountain & 8% Desert Brush

Cover Density (pervious areas): 40% Impervious Cover: 0 (future)

CN(s): 76, 86, 89, 99 (pervious & impervious areas) <sup>MU, MID, DID</sup> CN\* (s): 82.41, 89, 86, 91, 96, 99  
(curve number) (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): .462, .652, .715 (pervious areas) .960 (impervious areas)

Runoff Supply Rate (q): .594 i in./hr. (function of i)

Time of Concentration ( $T_c$ ): 1.02  $i^{-.4}$  hrs./mins. (function of i)

Iterative Solution of  $T_c$ : 34 hrs./mins.

Rainfall Intensity (i) at  $T_c$ : 4.292 in./hr.

Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 2.551 in./hr.

$$T_c = \frac{nh}{50} \frac{(L_c L_{ca})^{.3}}{(S_c)^{.4}} q^{-.4} \text{ hours.}$$

Peak Discharge:

1.008 qA (acres): 5907 cfs.

Note: For impervious areas, CN\* = 99 (constant).

645.33qA (square miles): \_\_\_\_\_ cfs.

HYDROLOGIC DATA SHEET

Project Name and Location: Ventana Canyon

Drainage Concentration Point: 30.1 OFFSITE

Watershed Area (A): 3865 acres/square miles.

Length of Watercourse ( $L_c$ ): 25400 ft. Length to Center of Gravity ( $L_{ca}$ ): 15600 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ )-ft.

3800, 4000

1600, 800

5600, 8000

600, 1400

4000

285

Mean Slope ( $S_c$ ): 0.148 ft./ft. Watershed Type(s): MOUNTAIN (future)

Basin Factor ( $n_b$ ): 0.05 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.74 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 30.3% C (55.7 + 14.0%) Cover Type (s): 86% Mln Gr. 14% Pevlt Br.

Cover Density (pervious areas): 40% Impervious Cover: 0 (future)

CN(s): 76, 86, 89, 99 (pervious & impervious areas) CN\*(s): 82, 41, 87, 96, 97 (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): .462, .452, .715 (pervious areas), .955 (impervious areas)

Runoff Supply Rate (q): 0.603 1 in./hr. (function of i)

Time of Concentration ( $T_c$ ): 59.88  $i^{-.4}$  hrs./mins. (function of i)

Iterative Solution of  $T_c$ : 33 hrs./mins.

Rainfall Intensity (i) at  $T_c$ : 4.35 in./hr.

Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 2.62 in./hr.

$$T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50(S_c)^{.4}} \text{ hours}$$

Peak Discharge:

1.008 qA (acres): 10,207 cfs.

Note: For impervious areas, CN\* = 99 (constant).

645.33qA (square miles): \_\_\_\_\_ cfs.



HYDROLOGIC DATA SHEET

Project Name and Location: VENTANA CANYON

Drainage Concentration Point: 110 (Future) OFFSITE

Watershed Area (A): 3948 acres/square miles.

Length of Watercourse ( $L_c$ ): 26800 ft. Length to Center of Gravity ( $L_{ca}$ ): 16100 ft.

Incremental Change in Length ( $L_i$ ) - ft. Incremental Change in Elevation ( $H_i$ )-ft.

3800    4000  
5600    8000  
4000  
1400

1600, 800  
600, 1400  
785  
2870 - 2830 = 40

Mean Slope ( $S_c$ ): 0.13 ft./ft. Watershed Type(s): MOUNTAIN (future)

Basin Factor ( $n_b$ ): 0.05 (future) Flood Frequency: 100 yrs.

$P_{24}$  (24 hour): 4.39 in. Areal Value: \_\_\_\_\_ in.

$P_6$  (6 hour): 3.77 in. Areal Value: \_\_\_\_\_ in.

$P_1$  (1 hour): 2.94 in. Areal Value: \_\_\_\_\_ in.

$P_2$  (2 hour): 3.22 in. Areal Value: \_\_\_\_\_ in.

$P_3$  (3 hour): 3.41 in. Areal Value: \_\_\_\_\_ in.

Soil Group(s): 30% C<sub>1</sub> (56% + 14%) D Cover Type (s): 14% DESERT BRUSH, 86% MOUNTAIN

Cover Density (pervious areas): 40% Impervious Cover: 0 (future)

CN(s): 76, 86, 89, 99 (pervious & impervious areas) CN\*(s): 92, 41, 89, 86, 91, 96, 99  
(curve number) small (adjusted curve number)

Runoff to Rainfall Ratio(s), (c): 462, 652, 715 (pervious areas) 955 (impervious areas)

Runoff Supply Rate (q): 0.603 1 in./hr. (function of i)

Time of Concentration ( $T_c$ ): 64.71  $i^{-.4}$  hrs. (mins) (function of i)

Iterative Solution of  $T_c$ : 37 hrs. (mins)

Rainfall Intensity (i) at  $T_c$ : 4.06 in./hr.

Equation for  $T_c$ :

Runoff Supply Rate (q) at  $T_c$ : 2.45 in./hr.

$$T_c = \frac{nb(L_c L_{ca})^{.3} q^{-.4}}{50 (S_c)^{.4}} \text{ hours}$$

Peak Discharge:

1.008 qA (acres): 9742 cfs.

645.33qA (square miles): \_\_\_\_\_ cfs.

Note: For impervious areas, CN\* = 99 (constant).

PROJECT: VENTANA CANYON ESTATES

DESIGNER: \_\_\_\_\_

EXISTING PULVERT

DATE: \_\_\_\_\_

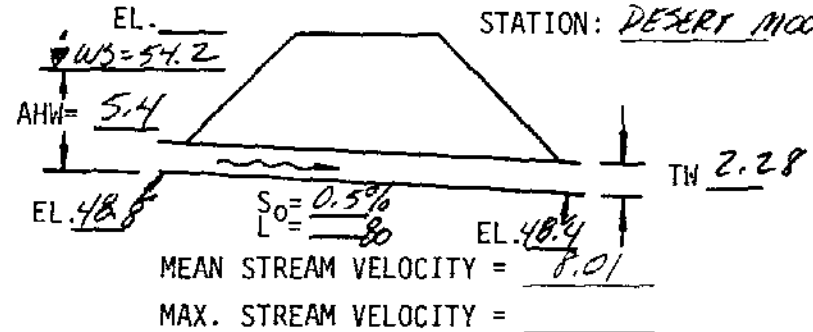
HYDROLOGIC AND CHANNEL INFORMATION

$Q_1 =$  \_\_\_\_\_  $TW_1 =$  \_\_\_\_\_  
 $Q_2 =$  430  $TW_2 =$  2.28  
 $Q_1 =$  DESIGN DISCHARGE, SAY  $Q_{25}$   
 $Q_2 =$  CHECK DISCHARGE, SAY  $Q_{50}^{CR}$  OR  $Q_{100}$

SKETCH

WSO 5 @

STATION: DESERT MOON



CULVERT DESCRIPTION (Entrance Type)	Q	SIZE	HEADWATER COMPUTATION										CONTROL LINE HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW = H + h <sub>o</sub> - LS <sub>o</sub>											
			HW/D	HW	K <sub>e</sub>	H	d <sub>c</sub>	(d <sub>c</sub> +D)/2	TW	h <sub>o</sub>	LS <sub>o</sub>	HW				
(8) CMP-HDWL	54	36"	1.45	4.35	.25	3.1	2.4	2.7	2.28	2.7	.24	5.4	5.4	7.64		

SUMMARY & RECOMMENDATIONS:

OSBORN, PETERSON, WALBERT & ASSOCIATES

SUBJECT VENTANA CANYON ESTATES

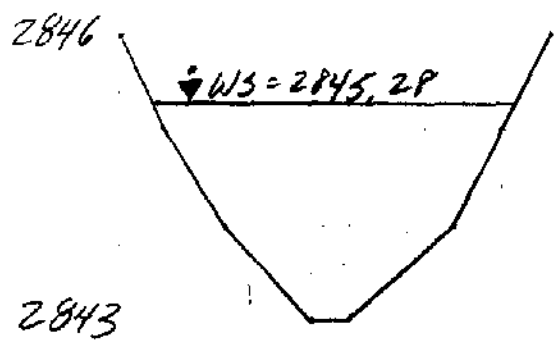
COMPUTATION  
AND DATA SHEET

DESCRIPTION CROSS-SECTION HYDRAULICS

FILE No. 82019-577-203

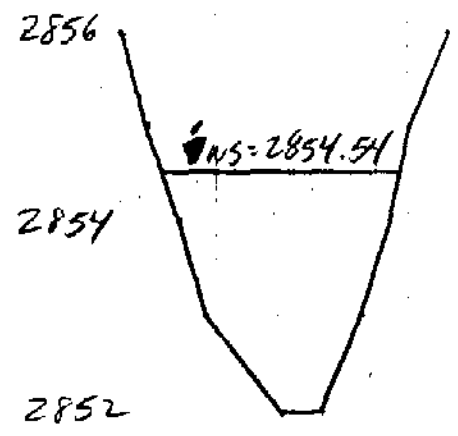
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_

152



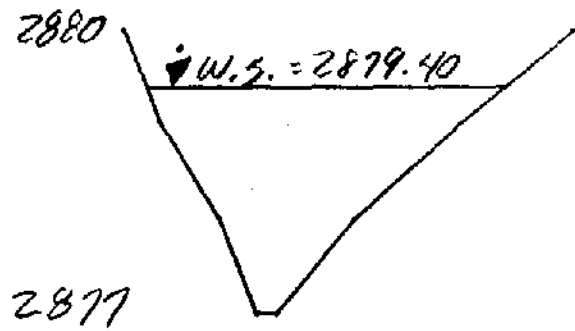
$Q_{100} = 430 \text{ cfs}$   
 $S = 4.6 \%$   
 $n = .05$   
 $A = 53.7 \text{ ft}^2$   
 $P = 38.14 \text{ ft.}$   
 $V = 8.01 \text{ fps}$

154



$Q_{100} = 310 \text{ cfs}$   
 $S = 3.3 \%$   
 $n = .05$   
 $A = 41.6 \text{ ft}^2$   
 $P = 25.43 \text{ ft.}$   
 $V = 7.50 \text{ fps}$

158



$Q_{100} = 310 \text{ cfs}$   
 $S = 4.6 \%$   
 $n = .05$   
 $A = 44.2 \text{ ft}^2$   
 $P = 37.78 \text{ ft.}$   
 $V = 7.08 \text{ fps}$

SCALE: 1" = 20' H  
 1" = 2' V  
 24  
 upstream view

OSBORN, PETERSON, WALBERT & ASSOCIATES

SUBJECT VENTANA CANYON ESTATES

COMPUTATION  
AND DATA SHEET

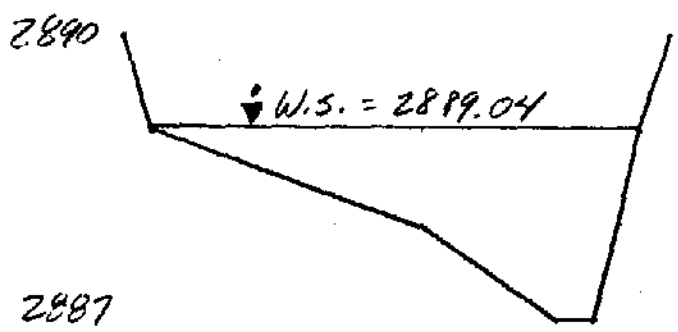
DESCRIPTION CROSS-SECTION HYDRAULICS

FILE No. 82019-517-203

W.O. No. \_\_\_\_\_

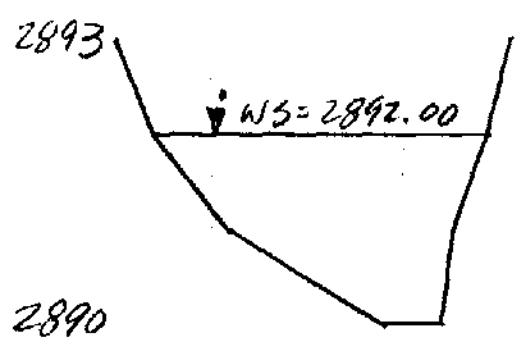
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_

160



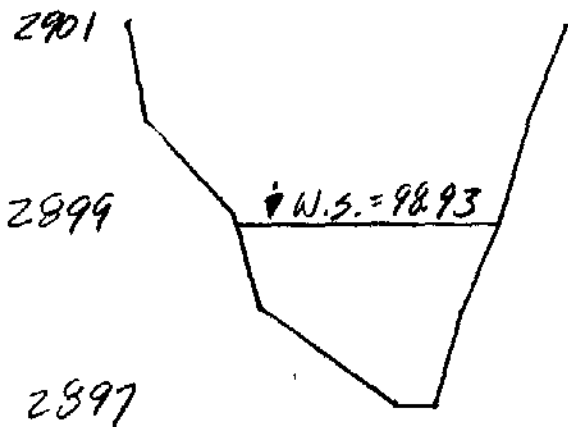
$Q_{100} = 270 \text{ cfs}$   
 $S = 3.33\%$   
 $n = .05$   
 $A = 50.5 \text{ ft}^2$   
 $P = 51.70 \text{ ft.}$   
 $V = 5.34 \text{ fps}$

162



$Q_{100} = 270 \text{ cfs}$   
 $S = 3.5\%$   
 $n = .05$   
 $A = 43.5 \text{ ft}^2$   
 $P = 35.63 \text{ ft}$   
 $V = 6.35 \text{ fps}$

164



$Q_{100} = 270 \text{ cfs}$   
 $S = 5\%$   
 $n = .05$   
 $A = 35.1 \text{ ft}^2$   
 $P = 27.97 \text{ ft.}$   
 $V = 7.72 \text{ fps}$

SCALE:  $1'' = 20' \text{ H}$   
 $1'' = 2' \text{ V}$

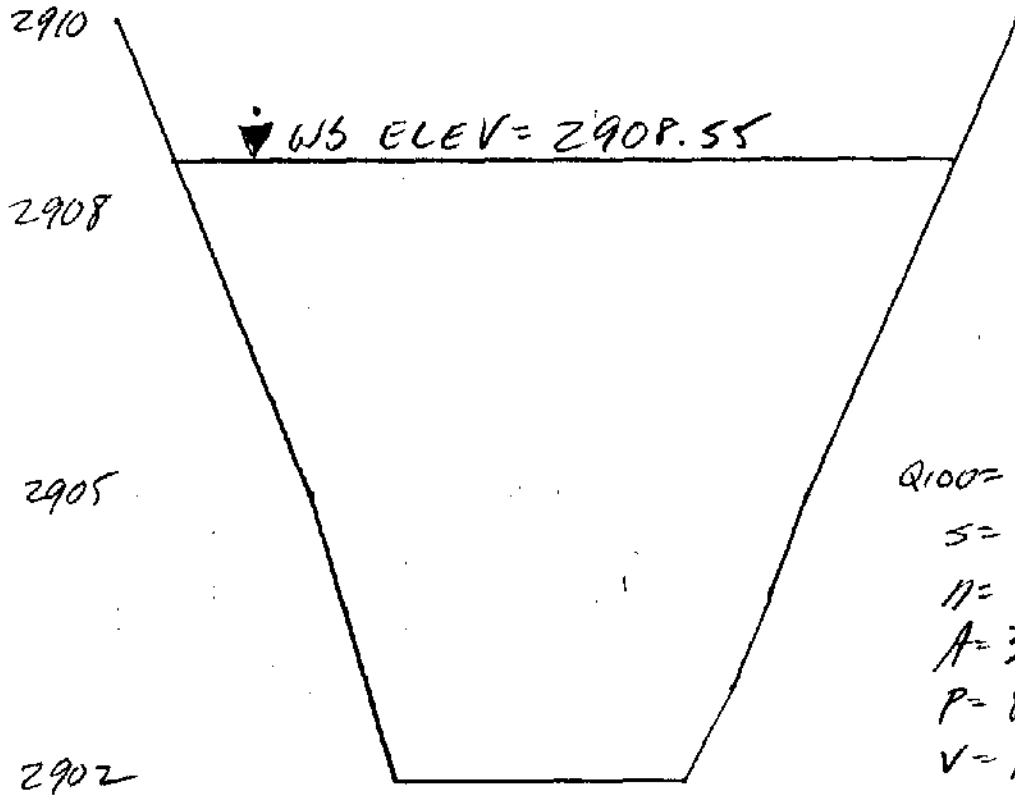
view is upstream  
 25

OSBORN, PETERSON, WALBERT & ASSOCIATES

SUBJECT VENTANA CANYON ESTATES  
 DESCRIPTION CROSS-SECTION HYDRAULICS  
ESPERERO CANYON WASH  
 COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

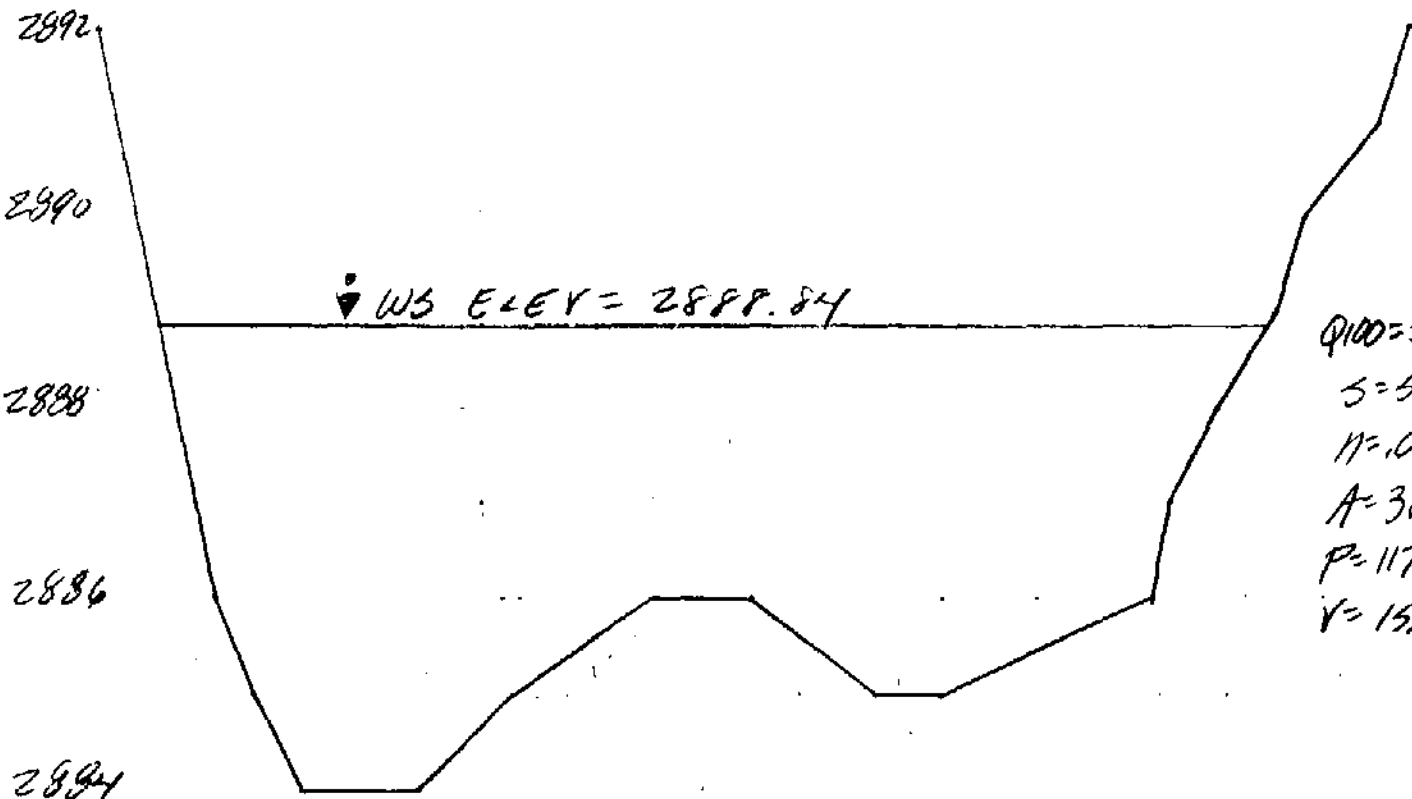
COMPUTATION AND DATA SHEET  
 FILE No. 82019-203  
 W.O. No. \_\_\_\_\_  
 PAGE \_\_\_\_\_ OF \_\_\_\_\_

E1



$Q_{100} = 5907 \text{ cfs}$   
 $S = 4.3\%$   
 $n = .05$   
 $A = 361.5 \text{ ft}^2$   
 $P = 83.49 \text{ ft}$   
 $V = 16.37 \text{ fps}$

E2



$Q_{100} = 5907 \text{ cfs}$   
 $S = 5.7\%$   
 $n = .05$   
 $A = 380.4 \text{ ft}^2$   
 $P = 117.16 \text{ ft}$   
 $V = 15.56 \text{ fps}$

OSBORN, PETTERSON, WALBERT & ASSOCIATES

SUBJECT VENTANA CANYON ESTATES

COMPUTATION  
AND DATA SHEET

DESCRIPTION CROSS-SECTION HYDRAULICS

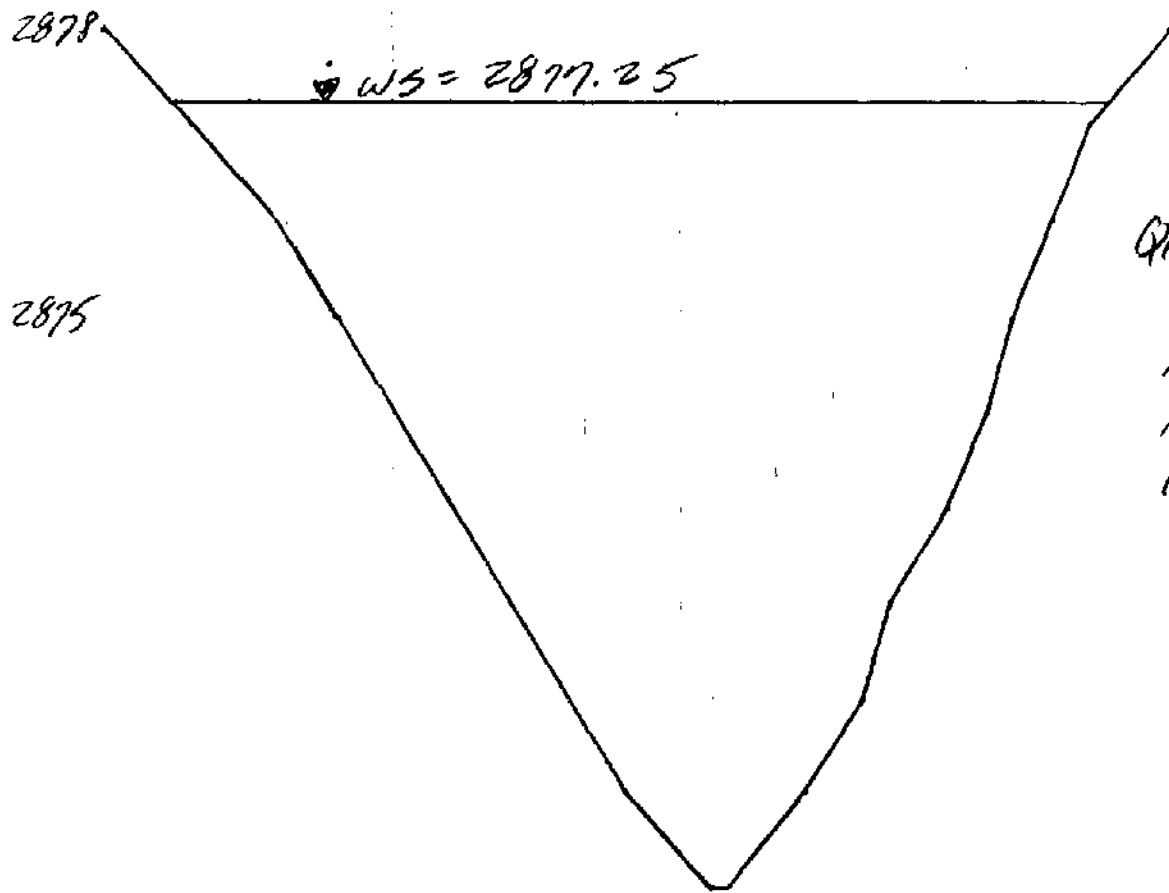
FILE No. 82019-203

ESPERERO CANYON WASH

W.O. No. \_\_\_\_\_

COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_

E3



$Q_{100} = 5907 \text{ cfs}$   
 $S = 3.1\%$   
 $n = .05$   
 $A = 428 \text{ ft}^2$   
 $P = 99.81 \text{ ft.}$   
 $V = 13.81 \text{ fps}$

Summary Table

Cross-Section	Existing Conditions Velocity			Future Conditions Velocity		
	W.S.	Channel	Overbank	W.S. (Increase)	Channel(*)	Overbank (*)
8	70.06	14.84	3.01	71.21 (+.61 )	13.44 (-10 )	0 (-100 )
7	63.94	17.21	5.39	64.08 (+.59 )	15.92 (-7.5)	4.99 (-7.5 )
6	56.99	10.21	6.35	57.44 (+.45 )	10.78 (+5.6)	6.93 (+9.1 )
5	52.77	11.49	7.27	53.81 (+1.04)	11.02 (-4 )	7.97 (+9.6 )
4	48.87	12.46	6.75	50.11 (+1.24)	11.92 (-4 )	7.18 (+6.4 )
3	44.68	12.38	8.31	45.49 (+.81 )	13.42 (+8.4)	8.17 (+1.7 )
2	39.14	11.71	9.90	40.13 (+0.99)	12.16 (+3.8)	10.74 (+8.4 )
1	34.61	10.61	7.15	34.59 (-.02 )	10.53 (-1 )	7.30 (+2.2%)

\* = % Increase

OPW Job No. 82019-218-577  
 JS/mat 1-11-85

## REFERENCES

1. Pima County Department of Transportation and Flood Control District, Hydrology Manual for Engineering Design and Flood Plain Management Within Pima County, Arizona, September, 1979.
2. Pima County Department of Transportation and Flood Control District, Drainage Development and Channel Design Standards for Flood Plain Management Within Pima County, Arizona, June, 1984.
3. U. S. Department of Transportation, Federal Highway Administration, Hydraulic Charts for the Selection of Highway Culverts, HEC-5, Washington, D. C., April, 1977.
4. Osborn, Petterson, Walbert & Associates, Hydrologic/Hydraulic Report for Ventana Canyon Estates, Lots 110-183, Tucson, Arizona, January, 1985.
5. Osborn, Petterson, Walbert & Associates, Flood Plain Use Permit Application and Hydrologic/Hydraulic Report for a Portion of Ventana Canyon Estates, Lots 110-183, Esperero Canyon Wash, Tucson, Arizona, January, 1985.

**OSBORN, PETTERSON, WALBERT & ASSOCIATES**  
Engineering, Surveying & Planning, Inc.

P.O. Box 31330  
6383 East Grant Road  
Tucson, Arizona 85751-1330  
Phone: (602) 296-8544

Paul Osborn, P.E.  
Art Petterson, R.L.S.  
Dick Walbert, A.I.C.P.

Robert Kelch, R.L.S.  
Jeffrey Stanley, P.E.  
William Baker, Jr. P.E.  
Stephen Magelli, P.E.



February 24, 1988

Mr. Jim DeGrood, P.E., Supervisor  
Permits and Compliance Section  
Pima County Department of Transportation  
and Flood Control District  
1313 South Mission Road  
Tucson, Arizona 85703



RE: Lots 152-172 of Ventana Canyon  
Estates; OPW Job 82019-203

Dear Jim:

As you may recall, you recently approved a report for the referenced project. In particular, the report addressed erosion setback limits for those lots. I have since discovered that the erosion setback limit for Lot 152 was not shown on the hydrology plan. For Lot 152 the setback was agreed to be 10 feet from the 100 year floodprone limit. Accompanying this letter is a revised hydrology plan that shows the erosion setback line. Please put the plan in your files so that future problems can be averted.


Sincerely,

OSBORN, PETTERSON, WALBERT & ASSOCIATES

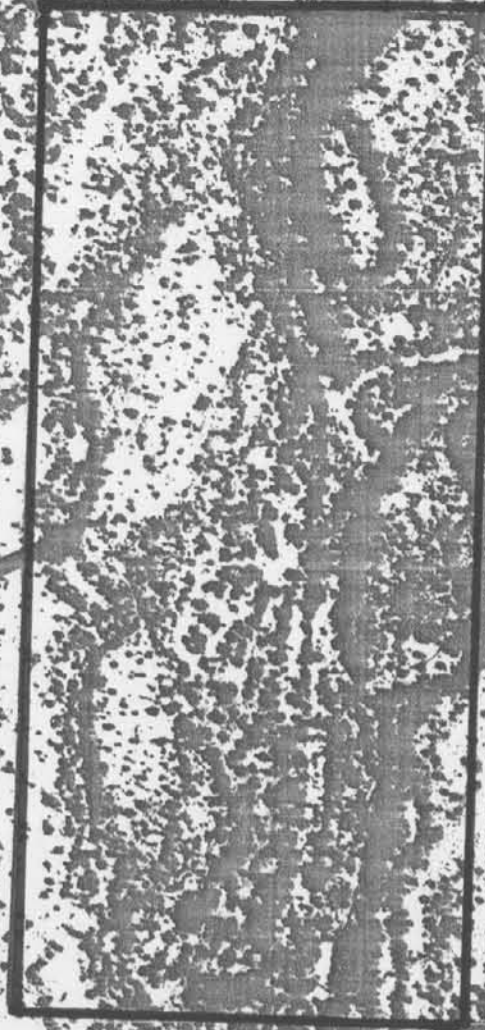
*Jeff Stanley*  
Jeff Stanley, P.E.

JS:gk

Enclosure

  
**NORTH**  
SCALE: 1" = 400' ±

PROJECT  
SITE



1967 AERIAL PHOTO  
VENTANA CANYON ESTATES  
LOTS 151-171

Drawn by	JAS
Checked by	
Drawn by	BC
Scale	Horizontal Vertical
Date	2/1/88
Sheet	1 of 1
Job Number	82019-203

**OSBORN, PETTERSON, WALBERT & ASSOCIATES**  
Engineering, Surveying & Planning, Inc.

6383 East Grant Road  
Tucson, Arizona 85715  
Phone (602) 296 8544

FEB 4 1988





NORTH

PROJECT SITE

1986 AERIAL PHOTO

VENTANA CANYON ESTATES  
LOTS 151-171

Drawn by	JAS
Checked by	BC
Date	2/1/88
Sheet	1 of 1
Lot Number	82019-203

**OSBORN, PETTERSON, WALBERT & ASSOCIATES**  
Engineering, Surveying & Planning, Inc.

6383 East Grant Road  
Tucson, Arizona 85715  
Phone: (407) 996-8568

7

FEB 4 1988

CPW