DRAINAGE REPORT
FOR
CANTA CIELO SUBDIVISION
(TRACT B, LANDS OF MASSACHUSETTS GENERAL HOSPITAL)

SEPTEMBER 5, 2003

Prepared for:

LAS VENTANAS LIMITED PARTNERSHIP
#10 TRAMWAY LOOP NE
ALBUQUERQUE, NM 87122

Prepared by:

BOHANNAN HUSTON, INC.
COURTYARD I
7500 JEFFERSON STREET NE
ALBUQUERQUE, NM 87109

UNDER THE SUPERVISION OF:

Brad Dixon 9-5-03
Brad Dixon, P.E. **Date**

Craig Hoover 9/5/03
Craig Hoover, P.E. **Date**

PREPARED BY:

Kevin J. Murtagh 9-5-03
Kevin J. Murtagh, E.I. **Date**

Yolanda Padilla
Yolanda Padilla, P.E. **Date**

Bohannan Huston Inc.

I. PURPOSE

The purpose of this report is to present the drainage management plan for Canta Cielo Subdivision at Ventana Ranch (North 20 Acres of the Ventana Ranch Master Plan- Tract B, Lands of Massachusetts General Hospital) and to obtain approval of the preliminary plat and grading plan by the Development Review Board (DRB) and AMAFCA, as coordinated with the City of Albuquerque and AMAFCA staff. The proposed development of Canta Cielo consists of 73 single family detached residential lots on approximately 20 acres.

This report also includes a supplement to Final Addendum No. 4 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities presenting the Ventana Ranch North 20 (Canta Cielo) Storm Drain Design.

II. METHODOLOGIES

Site conditions will be analyzed for a 10-year and 100-year, 6-hour storm event in accordance with the City of Albuquerque Drainage Ordinance and the Development Process Manual (DPM) Volume 2, Design Criteria, Section 22.2, Hydrology, for the City of Albuquerque, January 1993.

The site, as described in the 'Site Location and Characteristics' section below, is approximately 20 acres. Therefore, Part A of the DPM, Section 22.2, which provides a simplified procedure for projects with sub-basins smaller than 40 acres was used.

The existing approved drainage report referenced in the preparation of this plan is the "Las Ventanas Subdivision Drainage Master Plan" (LVDMP) prepared by Bohannan Huston (originally dated April 1995 and updated October 1995). Additional information was provided in "Addendum 4 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities" prepared by Bohannan Huston dated July 2000.

III. SITE LOCATION AND CHARACTERISTICS

Ventana Ranch is a 940-acre development located west of Paradise Hills between Paseo del Norte and Irving Boulevards. Canta Cielo is located in the northern portion of the Ventana Ranch Master Plan. The proposed subdivision is bounded by Universe Blvd. on the east, Irving Blvd. on the south, Tract A, Lands of Massachusetts General Hospital to the west and TVI Westside Campus to the north.

IV. MAIN 66" STORM DRAIN LINE REFERENCED IN ADDENDUM #4

A. Ventana Ranch North 20 (Canta Cielo) Storm Drain Design – Final Addendum No. 4 Supplement

1. INTRODUCTION

This portion of the report is written to supplement the 7/3/2000 Final Addendum No. 4 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities and to present Bohannan Huston Inc.'s (BHI) analyses of the hydrology of the watershed and the hydraulics of the storm drain that contribute to the North Outfall. The AHYMO model from Addendum No. 4 was updated to include changes to drainage basin areas and the storm drain route. Storm & Sanitary SelectCAD© software was used to design and analyze the storm drain according to City of Albuquerque standards.

2. HYDROLOGY

Figure 1 shows the onsite and offsite drainage basins that contribute to the North 20 (Canta Cielo) Storm Drain. Offsite drainage basins include Ventana Ranch Tracts 23, 24, 29A, and 29B to the south and Tract A to the west. Portions of Irving and Rainbow Boulevards and Tract 13 also contribute to the storm drain. The North 20 (Canta Cielo) site is divided into two onsite drainage basins: B-7 and B-8. Modifications to the subdivision grading plan have occurred subsequent to Addendum No. 4. As a result, approximately 1.4 acres from Tract 29A now contribute to the North Outfall rather than the West Branch Calabacillas Storm

Drain Diversion, and 1.8 acres from the North 20 (Canta Cielo) no longer contribute to the North Outfall storm drain. An additional 0.8 acres from Irving Blvd., west of the North 20 (Canta Cielo) site, also contribute to the North Outfall. The overall result is an increase in the area that contributes to the North Outfall storm drain from 123.0 acres to 123.4 acres.

Changes to the storm drain route and the subdivision design required the recalculation of AHYMO input parameters. Flows from Ventana Ranch, which had previously been concentrated at two points, are concentrated at three points. In addition, flows are modeled as being routed through inlets into the storm drain and through streets to more accurately represent the peak discharge in each portion of the system. These changes required the recalculation of drainage basin areas and time to peak values. Land treatment data for each basin was updated based on the current subdivision design. Appendix A of this report contains the updated time to peak calculations, AHYMO input parameters for each drainage area, and a summary of the peak discharges.

The most significant changes in the design flow rates were due to decreased time to peak values. In Addendum No. 4, the conveyance factor for overland flow used to calculate time to peak was for a turf, landscaped, or undisturbed natural condition. The conveyance factor was updated to represent a bare, disturbed, or paved condition, which significantly decreased time to peak values and increased the design flow rates. A model that included all other updates but used the same conveyance factor as the Addendum No. 4 model resulted in the same peak discharge, 330 cfs. Using the updated conveyance factor, the 100-year peak discharge to the arroyo from Ventana Ranch and Tracts A and B is 363 cfs.

3. STORM & SANITARY© ANALYSIS

Storm & Sanitary SelectCAD© software was used to design and analyze the proposed storm drain pipe system. The 66-inch (typ.) storm drain pipe will be connected to the Ventana Ranch portion of the storm drain pipe just south of Irving and to an existing outfall pipe, which was constructed with the new Universe Boulevard bridge crossing (TVI project) and discharges to the Calabacillas Arroyo near the northeast corner of the North 20 (Canta Cielo). The invert elevations at these points of connection will be 5402.5 ft and 5383.5 ft, respectively. A drainage model containing the North 20 (Canta Cielo) portion of the storm drain pipe and the Ventana Ranch portion of storm drain pipe was utilized. For hydraulic grade line calculations, the water level in the arroyo was assumed to be at the soffit of the discharging pipe. The proposed storm drain pipe system is shown in Figure 2. Appendix B contains the Storm & Sanitary© design output.

In Addendum No. 4, the pipes were sized and laid out based on Manning's equation and the assumption of non-pressure flow. In order to raise the pipes, the slopes were decreased from the values presented in Addendum No. 4, and the system was designed to operate under pressure. The pipe size has remained 66 inches, as proposed in Addendum No. 4. The controlling point for the design was a low point in Tract 29 (AHYMO AP3B). The storm drain pipe was positioned so that the hydraulic grade line was below the ground elevation at this point. The pipe slopes are minimized at 0.5% along Street B (Canta Cielo Drive). The slope then becomes steeper along Street D (Venticello Drive and Brezza Dolce Avenue) to meet the existing invert.

4. CONCLUSION

The storm drain pipe design presented in this supplement conforms to City of Albuquerque code. Minimum cover is maintained, as well as vertical separation from other utilities. The hydraulic grade line for the North 20 (Canta Cielo) Storm Drain pipe remains below gutter line elevation at all points.

V. CANTA CIELO SUBDIVISION ANALYSIS

A. Existing Drainage Conditions

Please refer to FIGURE 3, Existing Conditions Basin Map, to accompany the following text.

In its existing condition, the site consists of largely undisturbed terrain with slopes to the east from 2.5% to less than 1%. Existing drainage patterns direct the runoff of existing offsite basins to the west (42.84 cfs) onto the site and combine with the existing onsite flows (22.81 cfs). Universe Blvd. along the eastern boundary of the site directs all easterly flows to the north and into the West Branch Calabacillas Arroyo.

The West Branch Calabacillas Arroyo located just north of the site is located within an existing FEMA Floodplain. See Exhibit 4. The narrow FEMA floodplain is located within the proposed Tract A, see Exhibit 1-Preliminary Plat, to be granted to AMAFCA with Final Plat.

B. Proposed Drainage Conditions

Please refer to FIGURE 4, Proposed Conditions Basin Map, to accompany the following text. Proposed conditions and storm drain design will make use of the Ventana Ranch North 20 (Canta Cielo) Storm Drain system addressed in Section IV.

1. Off-Site Basins

The existing undisturbed lands to the west of the site (42.84cfs) contains two (2) basins that flow directly to the site, ExOffsite 1 (23.35cfs) and ExOffsite 2 (19.49cfs).See Figure 4. ExOffsite 1 flows mainly to the east and south and will drain to a Type "D" inlet on top of a manhole located in the southeast portion of the basin, AP5. ExOffsite 2 flows mainly to the east and north and will drain to a Type "D" inlet on top of a manhole located in the northeast portion of the basin, AP6. Each inlet is within an existing utility easement which will be graded to convey the flows along the western side for the site boundary wall to the inlets. The inlets are tied to the

Ventana Ranch North 20 (Canta Cielo) Storm Drain and will outfall to the West Branch Calabacillas Arroyo.

Basin "AMAFCA" is located on the northeast portion of the tract. Although this basin is located within the 20 acre site, it will not impact any onsite flows. It is located north of the northern wall and will discharge north directly to the West Branch Calabacillas Arroyo.

A small portion of Irving Blvd. contributes approximately 1.48 cfs to onsite flows and is discussed in the On-Site Basins section below.

2. On-Site Basins

The proposed site (Q=57.29cfs) has been divided into 9 sub-basins with 4 analysis points (AP). A small basin (AMAFCA), as described above, does not contribute to onsite flows. The remaining 8 sub-basins are discussed below. All flows are 100yr-6hr storm events.

Analysis Point 1 collects flows from one sub-basin, Basin H. Basin H contains 2 lots, a stub street Terra Dolce Avenue and a portion of the Canta Cielo Drive entry road on 0.66 ac. and generates 2.17cfs. Flows are conveyed in the street to an inlet at AP2. A single Type "A" inlet in sump condition at AP2 is located on the end of stub Terra Dolce Avenue. Since no emergency spillway is provided this inlet has been sized for 2x100yr storm. This inlet is tied to the Ventana Ranch North 20 (Canta Cielo) Storm Drain system and will outfall to the West Branch Calabacillas Arroyo.

Analysis Point 2 comprises flows from three sub-basins, Basins A, C and "Off Irving". The basin "Off Irving" is a small offsite basin that contributes approximately 1.48cfs to onsite flows, this basin combines with Basin C which is the eastern portion of the entry roadway (Canta Cielo Drive) and generates 0.5cfs. Basin A contains 2 lots and a portion of Terra Dolce Drive on 0.77 ac. and generates 2.55cfs. The total flow (4.53cfs) is conveyed in Terra Dolce Avenue and combined at the Canta Cielo Drive

and Terra Dolce Avenue intersection. Flows are then conveyed north in Canta Cielo Drive.

Analysis Point 3 collects flows largely from 3 sub-basins, Basins B, D, and E. Basin B contains 16 lots and the west side of Canta Cielo Drive on 3.58 ac. and generates 11.84cfs. This flow is conveyed on the west side of Canta Cielo Drive north to Brezza Dolce Avenue. Basin D contains 14 lots and the east side of Canta Cielo Drive on 3.14 ac. and generates 10.38 cfs. This flow is conveyed on the east side of Canta Cielo Drive north to Brezza Dolce Avenue. Basins D, B (21.48cfs) and the flows from AP2 (4.53cfs) combine at the intersection of Canta Cielo Drive and Bezza Dolce Avenue and flow on the south side of Brezza Dolce Avenue to an inlet at AP3. Basin E contains 13 lots, the west side of Venticello Drive and the majority of Peggio Avenue on 2.92 ac. and generates 9.64cfs. This flow is conveyed in Peggio Avenue and the west side of Venticello Drive to an inlet at AP3. Contributing flows at AP3 total 35.65cfs.

Analysis Point 4 collects flows largely from 2 sub-basins, Basins G and F. Basin G contains 8 lots and the north side of Brezza Dolce Avenue on 1.86 ac. which generates 6.13cfs. This flow is conveyed on the north side of Brezza Dolce Avenue to an inlet at AP4. Basin F contains 13 lots and the east side of Venticello Drive on 4.05 ac. and generates 13.37cfs. Flows are conveyed on the east side of Venticello Drive to the inlet at AP4. Contributing flows at AP4 total 19.50cfs.

Since the half street capacities of Venticello Drive are over the roadway crown, full street flows assume the flow rate is divided equally in each half street. The total flow at AP3 and 4 is 55.15cfs. This generates a flow rate at AP3 and 4 of 27.58cfs each. Each of the sump inlets at AP3 and 4 are double grate, double wing Type "A" inlets sized for 100yr storm. These inlets are tied to the Ventana Ranch North 20 (Canta Cielo) Storm Drain system and will outfall to the West Branch Calabacillas Arroyo. These

inlets have an emergency spillway located on the utility easement between lots 26 and 27, thus does not have to accommodate the 2x100yr flow.

VI. PROPOSED BANK PROTECTION AND REVISED DRAFT PRUDENT LINE

In 1998 Mussetter Engineering prepared a draft Hydraulic and Sediment Transport Analyses for the Calabacillas Arroyo that among other things established a draft prudent line for the arroyo, including the West Branch in the vicinity of the Canta Cielo Subdivision. The analysis though was fairly macro in nature and was based on arroyo cross sections spaced at approximately 500' intervals. Additionally the analysis did not include the recently constructed Universe Boulevard bridge crossing that acts as a control point limiting both the vertical and lateral movement of the arroyo at this location. The Universe bridge crossing consists of a 220' long corrugated steel super plate low profile arch. Upstream of the bridge crossing is a 50' long concrete lined trapezoidal (3:1 side slopes) channel leading into the crossing with a 4' deep transverse cutoff wall at the upstream end of the lined channel section. Lastly, bank protection along the south side of the arroyo is proposed immediately upstream of Universe Boulevard to ensure the northern edge of the Canta Cielo Subdivision is protected from any potential lateral migration and erosion within the West Branch of the Calabacillas Arroyo. This proposed bank protection will tie into the upstream end of the concrete lined channel section.

As coordinated with AMAFCA, the impact of these improvements warrants a reanalysis of the draft prudent line in this reach of the arroyo. This analysis was completed based on the criteria set forth in the AMAFCA Sediment and Erosion Design Guide. Based on a conservative and fully developed 100 year flow rate in the arroyo of 5,200cfs, taken from work completed by MEI, the dominant discharge for the arroyo was calculated to be 1,040cfs. Using the procedures outlined in the Sediment and Erosion Design Guide the maximum lateral erosion distance was determined to be approximately 240' with a meander wavelength of approximately 960'. Taking into account the proposed bank protection and the Universe bridge crossing, the revised prudent line was established as shown in Appendix G (Exhibit A). As noted previously the improved bridge crossing at Universe Boulevard (as a fixed point) and proposed bank protection will prevent the arroyo from meandering south of its present location and into the

Canta Cielo Subdivision. Upstream of the bank protection the arroyo will remain unimproved and hence be able to meander. Considering this and the maximum lateral erosion distance and the wavelength of the meander the bank protection is proposed to be extended approximately 250' upstream of the concrete section leading into the Universe bridge crossing. By extending the bank protection to this point the proposed prudent line will be contained sufficiently to preserve the prudent line north of the north boundary of the Canta Cielo Subdivision as shown in Appendix G (Exhibit A).

The proposed bank protection will consist of dumped basalt riprap as shown in Section A-A in Appendix G (Exhibit A). The dumped riprap rock will have a median size of 18" and be approximately 3' thick. Filter fabric and bedding material will be installed prior to placing the riprap to prevent piping of subgrade soils and potential failure of the bank protection. The bank protection will extend up the bank of the arroyo to provide a minimum of 2' of freeboard for the 100 year storm. Additionally, the proposed configuration will provide scour protection to a depth of approximately 6'.

VII. CONCLUSION

This report has provided hydrologic and hydraulic considerations for the proposed development of Canta Cielo Subdivision. The LVDMP and addendums govern the development of this Tract. Increases in runoff, depth and velocity due to proposed development are within parameters anticipated within the previously approved Master Drainage Plan for this area. These flows can be safely conveyed by the improvements proposed in this drainage plan to existing drainage facilities, which have adequate capacity to accept such runoff. Erosion and dust control, consisting of erosion control berms, snow fencing and sedimentation basins, are proposed to prevent soil washing or blowing into paved streets, storm drains, and existing development areas. Therefore, we believe this report supports the preliminary/final plat and grading plan submittals and should be approved as requested.

Ventana Ranch Subdivision
Technical Memorandum, North 20 Storm Drain Design

Calculation of Time to Peak
Revised DPM procedure

Revised 2/19/03 for North 20 Storm Drain Design
(Updated analysis of basins contributing to the north outfall).

Description	Var.	Unit														
Basin			29 - 1	29 - 2	29 - 3	29 - 4	29 - 5	29 - 6	Tract 23	Tract 24	Tract 29A	IW	IE	R13	A-1&2	B-1	B-2
Basin Area		acres	7.972	1.646	7.595	4.459	7.105	2.596	15.2	8.083	12.87	6.1	4.9	6.5	18.752	18.752	18.752
Length	L	feet	620	450	1200	1130	1090	540	1045	1800	1515	2650	2450	1000	1180	450	1180
Overland Reach	L_1	feet	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Overland K	K_1		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Overland Slope	s_1	%	2.14	0.70	0.70	2.14	0.70	0.70	1.10	0.95	1.47	1.50	3.00	1.00	1.80	1.05	1.05
Gully Reach	L_2	feet	220	50	800	730	690	140	645	1400	1115	1600	1600	600	780	50	780
Gullly K	K_2		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Gully Slope	s_2	%	2.75	0.70	0.70	2.75	0.70	0.70	0.80	1.24	1.92	1.50	0.50	1.50	1.80	0.40	0.40
Arroyo Reach	L_3	feet	0	0	0	0	0	0	0	0	0	650	450	0	0	0	0
Arroyo K	K_3		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Arroyo Slope	s_3	%	2.75	0.70	0.70	2.75	0.70	0.70	0.80	0.80	0.70	1.50	0.50	2.70	4.12	1.50	1.50
Lca	L_{CA}	feet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Discharge	Q_B	cfs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ground Slope s	s	%	2.36	0.70	0.70	2.53	0.70	0.70	0.91	1.18	1.80	1.50	0.91	1.30	1.80	0.98	0.62
K	K		1.189	1.059	1.500	1.438	1.463	1.149	1.473	1.598	1.542	1.871	1.633	1.360	1.494	1.059	1.488
K_N	K_N		0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.02	0.02	0.021	0.021	0.021
t_C	t_C	hrs	0.094	0.141	0.266	0.137	0.247	0.156	0.206	0.289	0.203	0.321	0.437	0.179	0.164	0.119	0.280
Time to Peak	t_P	hrs	0.133	0.133	0.177	0.133	0.165	0.133	0.137	0.192	0.136	0.214	0.292	0.133	0.133	0.133	0.186

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Ventana Ranch Subdivsion
Technical Memorandum, North 20 Storm Drain Design

AHYMO Input Parameters

Revised 2/19/03 for North 20 Storm Drain Design
(Updated analysis of basins contributing flow to north outfall).

Drainage Area	Area (ac)	Area (sq mi)	Lots	%A	%B	%C	%D	t_P
Tract 23	12.2816	0.01919	73	0.00%	21.75%	21.75%	56.50%	0.137
Tract 24	12.4416	0.01944	76	0.00%	21.15%	21.15%	57.70%	0.192
Tract 29A	12.8700	0.02011	72	0.00%	23.06%	23.06%	53.89%	0.136
Tract 29 - 1	7.9717	0.01246	40	0.00%	25.20%	25.20%	49.60%	0.133
Tract 29 - 2	1.6460	0.00257	8	0.00%	25.75%	25.75%	48.50%	0.133
Tract 29 - 3	7.5952	0.01187	39	0.00%	24.75%	24.75%	50.50%	0.177
Tract 29 - 4	4.4590	0.00697	22	0.00%	25.50%	25.50%	49.00%	0.133
Tract 29 - 5	7.1049	0.01110	44	0.00%	20.00%	20.00%	60.00%	0.165
Tract 29 - 6	2.5960	0.00406	17	0.00%	20.00%	20.00%	60.00%	0.133
Tract A	19.9040	0.03110	-	0.00%	25.00%	25.00%	50.00%	0.133
Tract B-1	2.0284	0.00317	8	0.00%	29.20%	29.20%	41.60%	0.133
Tract B-2	14.9337	0.02333	83	0.00%	23.20%	23.20%	53.60%	0.186
Irving (West)	6.1400	0.00959	-	0.00%	15.00%	10.00%	75.00%	0.214
Rainbow/Tract 13	6.5280	0.01020	-	0.00%	25.00%	10.00%	65.00%	0.133
Irving (East)	4.9280	0.00770	-	0.00%	15.00%	10.00%	75.00%	0.292
Total	123.1740	0.19246						

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CANTA CIELO (NORTH 20 ACRES) AT VENTANA RANCH BASIN CALCULATIONS

Ultimate Development Conditions Basin Data Table

This table is based on the DPM Section 22.2, Zone: 1

BASIN ID	Units #	Area (SQ. FT)	Area (AC.)	Land Treatment Percentages A	B	C	D	Q(100) (cfs/ac.)	Q(100) (cfs)	WT E (inches)	$V(100)_{360}$ (CF)	$V(100)_{1440}$ (CF)
Existing Basins												
ExOffsite 1	0	788357	18.10	100.0%	0.0%	0.0%	0.0%	1.29	23.35	*0.44*	*28906*	*28906*
ExOffsite 2	0	658228	15.11	100.0%	0.0%	0.0%	0.0%	1.29	19.49	*0.44*	*24135*	*24135*
Total									42.84			
ExOnsite 1		24428	0.56	100.0%	0.0%	0.0%	0.0%	1.29	0.72	*0.44*	*896*	*896*
ExOnsite 2		411055	9.44	100.0%	0.0%	0.0%	0.0%	1.29	12.17	*0.44*	*15072*	*15072*
ExOnsite 3		334643	7.68	100.0%	0.0%	0.0%	0.0%	1.29	9.91	*0.44*	*12270*	*12270*
Total		1446585	17.68						22.81		*53041*	*53041*
Proposed Basins												
AMAFCA	0	35526	0.82	50.0%	50.0%	0.0%	0.0%	1.66	1.35	*0.56*	*1643*	*1643*
Off Irving		15321	0.35	0.0%	0.0%	10.0%	90.0%	4.22	1.48	*1.87*	*2390*	*2919*
A	3	33654	0.77	0.0%	27.7%	27.7%	44.5%	3.30	2.55	*1.34*	*3751*	*4325*
C	0	5209	0.12	0.0%	0.0%	10.0%	90.0%	4.22	0.50	*1.87*	*813*	*992*
Total flow at AP 1									4.54			
H	2	28661	0.66	0.0%	27.7%	27.7%	44.5%	3.30	2.17	*1.34*	*3194*	*3683*
Total flow at AP 2									2.17			
B	16	156082	3.58	0.0%	27.7%	27.7%	44.5%	3.30	11.84	*1.34*	*17394*	*20057*
D	14	136829	3.14	0.0%	27.7%	27.7%	44.5%	3.30	10.38	*1.34*	*15249*	*17583*
E	13	127085	2.92	0.0%	27.7%	27.7%	44.5%	3.30	9.64	*1.34*	*14163*	*16331*
Total flow at AP 3									31.86			
G	8	80809	1.86	0.0%	27.7%	27.7%	44.5%	3.30	6.13	*1.34*	*9006*	*10384*
F	17	165814	3.81	0.0%	27.7%	27.7%	44.5%	3.30	12.58	*1.34*	*18479*	*21308*
Total flow at AP 4									18.71			
Total Onsite	73	734143	16.85						*57.29*			
Total Flow From Existing Basins Offsite 1 and 2									*42.84*			
Total Flow Through backbone Storm Drain									*100.13*			

NOTES: Impervious percentages are calculated using the DPM equation A-4, the remaining percentages are distributed evenly between land treatment types B and C.

DPM Eqn. A-4 calculation

acres	16.85	
units	73	
N=	4.33	units/ac
%D=	44.5%	

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Terra Dolce Ave. stub - AP1**

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5		ORIFICE: Q=C*A*(2*G*H)**0.5	
Wing opening	Grate opeining	Grate opening	Wing opening
C= 3.0	C=3.0	C=0.6	C=0.6
L= 4.0 ft	L(single grate)=[(2.67')+2(1.8')]=6.	A(single grate)=4.09 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1	Q=3.0(6.27)H^1.5=18.81*H^1.5	Q=2.46*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR WING OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at single "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.59	6.24	1.35	Weir controls on grate analysis
	0.20	0.20	1.07	1.68	8.82	3.83	Q(100 yr) = 2.17cfs at this depth
	0.30	0.30	1.97	3.09	10.80	7.03	Q(2X100 yr) =4.34cfs at this depth
	0.40	0.40	3.04	4.76	12.47	10.83	
	0.50	0.50	4.24	6.65	13.94	15.14	
	0.60	0.60	5.58	8.74	15.27	19.90	
TOP OF CURB	0.70	0.70	7.03	11.02	16.50	25.07	
	0.80	0.80	8.59	13.46	17.64	30.63	
	0.85	0.85	9.40	14.74	18.18	33.55	
ROW LIMIT	0.95	0.95	11.11	17.42	19.22	39.64	

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

THE 100 YR STORM EVENT = 2.171 CFS at the sump condition

2*100 YR STORM EVENT = 4.34 CFS at the sump condition

1-7

DOUBLE "A" INLETS @ APs-3 & 4 IN SUMP CONDITION

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Brezza Dolce Ave./Venticello Drive - AP3 & AP4**

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5		ORIFICE: Q=C*A*(2*G*H)**0.5	
Wing opening	Grate opeining	Grate opening	Wing opening
C= 3.0	C=3.0	C=0.6	C=0.6
L= 4.0 ft	L(double grate)=[2(2.67')+2(1.8')]=8.94 ft	A(double grate)=8.19 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1.5	Q=3.0(8.94)H^1.5=26.82*H^1.5	Q=4.194*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

			Q (CFS)	Q (CFS)	Q (CFS)	TOTAL		
			WEIR	WEIR	ORIFICE	Q		
	WS	HEIGHT	"A"	DOUBLE	DOUBLE	(CFS)		
	ELEVATION	ABOVE INLET	OPENING	GRATE	GRATE		**COMMENTS:**	
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings	
	0.10	0.10	0.38	0.85	11.87	1.61	Weir controls on grate analysis	
	0.20	0.20	1.07	2.40	16.79	4.55		
	0.30	0.30	1.97	4.41	20.56	8.35		
	0.40	0.40	3.04	6.78	23.75	12.86		
	0.50	0.50	4.24	9.48	26.55	17.97		
	0.60	0.60	5.58	12.46	29.08	23.62	Q(100 yr) = 27.56 cfs at this depth	
TOP OF CURB	0.67	0.67	6.58	14.71	30.73	27.87		
	0.80	0.80	8.59	19.19	33.58	36.36		
ROW AT POND	0.90	0.90	10.25	22.90	35.62	43.39		
	1.00	1.00	12.00	26.82	37.55	50.82		
	1.10	1.10	13.84	30.94	39.38	58.63		
	1.20	1.20	15.77	35.26	41.13	66.80		
ROW LIMIT-LT	1.30	1.30	17.79	39.75	42.81	75.33		

NOTE: The total runoff intercepted by the inlet at the low point in the road is:
Qr(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].
100 YR STORM EVENT = 27.56 CFS at the sump condition on each half of the street.

Single Type "D" Inlet in Sump Condition at AP 5

Q=generate by Basin(s)	23.35	cfs
Grate Clogging Factor	30%	
Required control Q	30.355	cfs

Single D inlet, in sump condition:

Number of sides accepting flow	4
Open Area (for orifice calc in sq. ft.):	3.93
Length of Weir (feet):	8.40

Head (ft)	Head (in)	Weir Q	Orifice Q	Control Q	
0.05	0.6	0.25	4.23	0.25	
0.1	1.2	0.71	5.99	0.71	
0.15	1.8	1.31	7.33	1.31	
0.2	2.4	2.01	8.47	2.01	
0.25	3	2.81	9.46	2.81	
0.3	3.6	3.70	10.37	3.70	
0.35	4.2	4.66	11.20	4.66	
0.4	4.8	5.69	11.97	5.69	
0.45	5.4	6.79	12.70	6.79	
0.5	6	7.96	13.39	7.96	
0.55	6.6	9.18	14.04	9.18	
0.6	7.2	10.46	14.66	10.46	
0.65	7.8	11.79	15.26	11.79	
0.7	8.4	13.18	15.84	13.18	
0.75	9	14.61	16.39	14.61	
0.8	9.6	16.10	16.93	16.10	
0.85	10.2	17.63	17.45	17.45	
0.9	10.8	19.21	17.96	17.96	
0.95	11.4	20.83	18.45	18.45	
1	12	22.50	18.93	18.93	
1.05	12.6	24.21	19.40	19.40	
1.1	13.2	25.96	19.85	19.85	
1.15	13.8	27.75	20.30	20.30	
1.2	14.4	29.58	20.74	20.74	
1.25	15	31.45	21.16	21.16	
1.5	18	41.34	23.18	23.18	
1.75	21	52.09	25.04	25.04	
2	24	63.64	26.77	26.77	
2.25	27	75.94	28.39	28.39	
2.5	30	88.94	29.93	29.93	
2.75	33	102.61	31.39	31.39	Q100= 30.36 cfs
3	36	116.92	32.79	32.79	
3.25	39	131.83	34.13	34.13	
3.5	42	147.33	35.41	35.41	
3.75	45	163.40	36.66	36.66	
4	48	180.01	37.86	37.86	

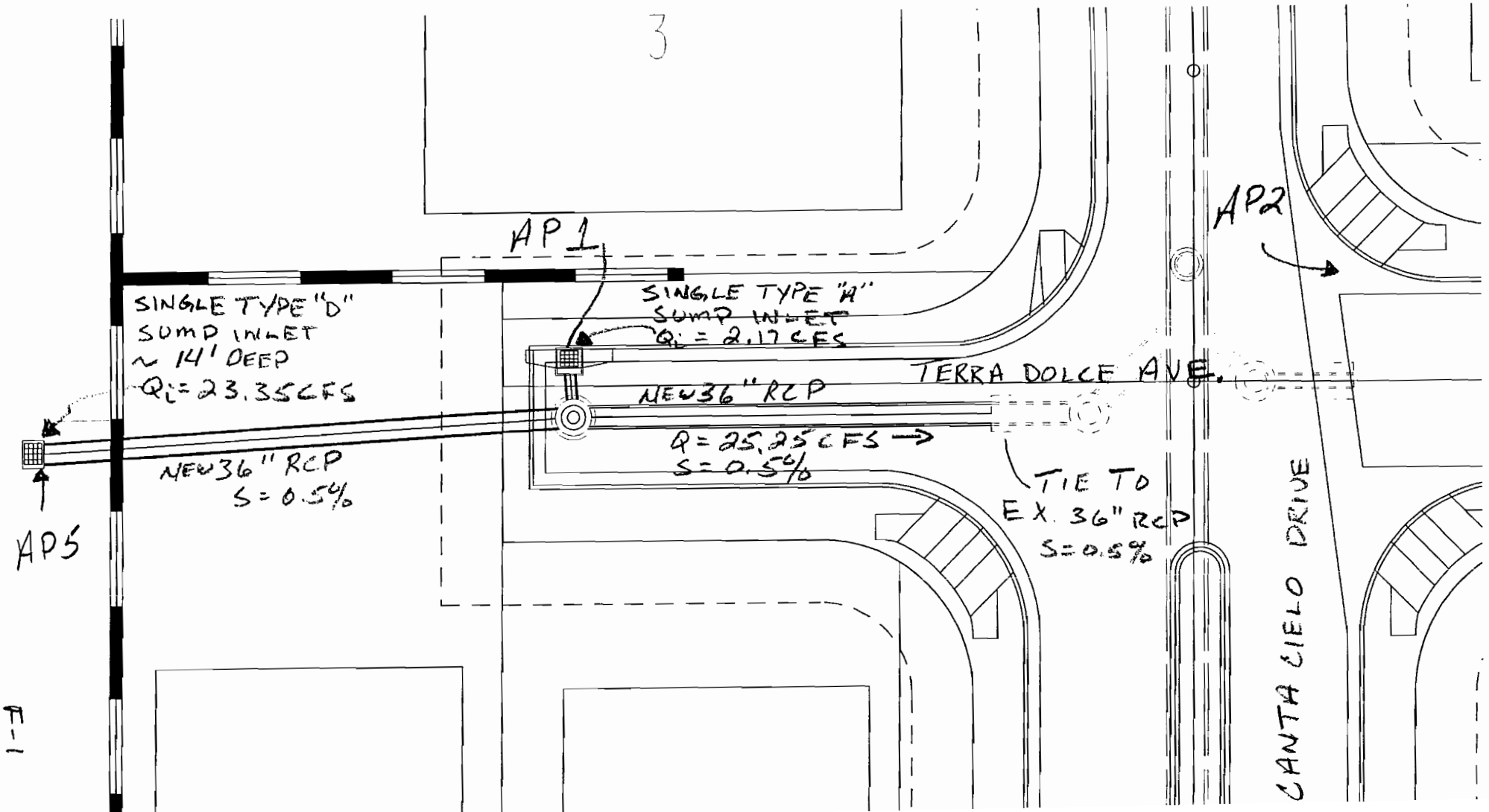
Single Type "D" Inlet in Sump Condition at AP 6

Q=generate by Basin(s)	19.49	cfs
Grate Clogging Factor	30%	
Required control Q	25.337	cfs

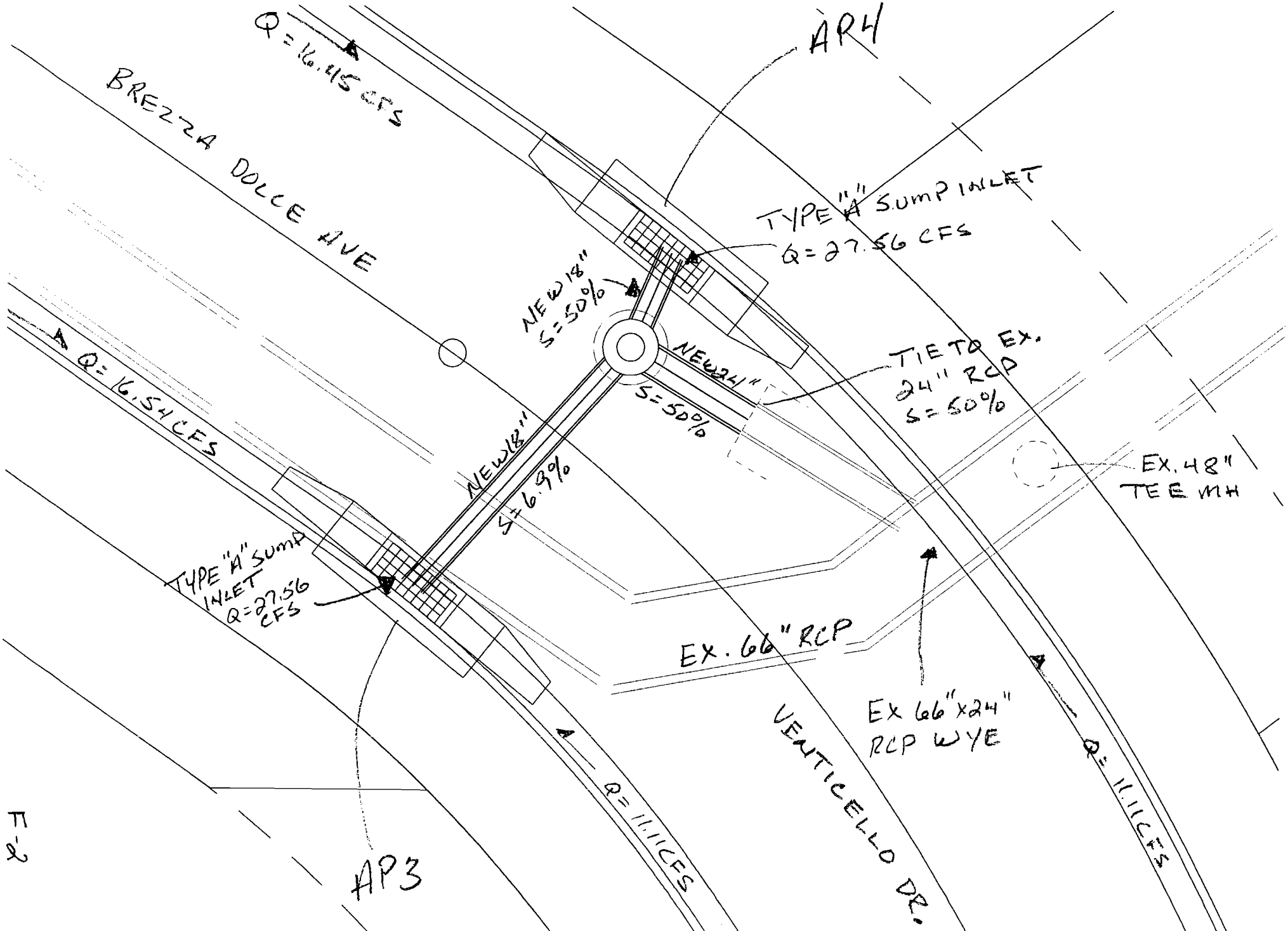
Single D inlet, in sump condition:

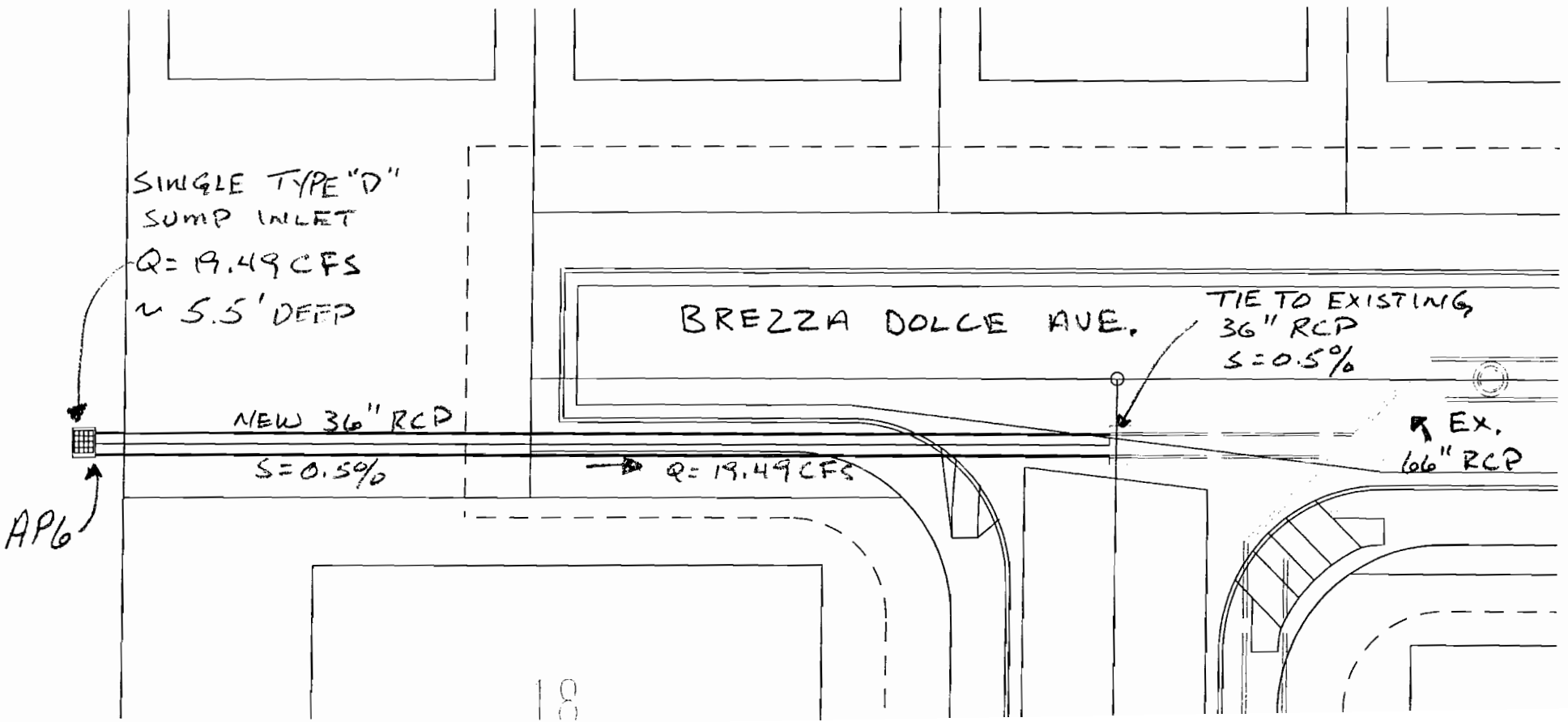
Number of sides accepting flow	4
Open Area (for orifice calc in sq. ft.):	3.93
Length of Weir (feet):	8.40

Head (ft)	Head (in)	Weir Q	Orifice Q	Control Q	
0.05	0.6	0.25	4.23	0.25	
0.1	1.2	0.71	5.99	0.71	
0.15	1.8	1.31	7.33	1.31	
0.2	2.4	2.01	8.47	2.01	
0.25	3	2.81	9.46	2.81	
0.3	3.6	3.70	10.37	3.70	
0.35	4.2	4.66	11.20	4.66	
0.4	4.8	5.69	11.97	5.69	
0.45	5.4	6.79	12.70	6.79	
0.5	6	7.96	13.39	7.96	
0.55	6.6	9.18	14.04	9.18	
0.6	7.2	10.46	14.66	10.46	
0.65	7.8	11.79	15.26	11.79	
0.7	8.4	13.18	15.84	13.18	
0.75	9	14.61	16.39	14.61	
0.8	9.6	16.10	16.93	16.10	
0.85	10.2	17.63	17.45	17.45	
0.9	10.8	19.21	17.96	17.96	
0.95	11.4	20.83	18.45	18.45	
1	12	22.50	18.93	18.93	
1.05	12.6	24.21	19.40	19.40	
1.1	13.2	25.96	19.85	19.85	
1.15	13.8	27.75	20.30	20.30	
1.2	14.4	29.58	20.74	20.74	
1.25	15	31.45	21.16	21.16	
1.5	18	41.34	23.18	23.18	
1.75	21	52.09	25.04	25.04	
2	24	63.64	26.77	26.77	Q100= 25.34 cfs
2.25	27	75.94	28.39	28.39	
2.5	30	88.94	29.93	29.93	
2.75	33	102.61	31.39	31.39	
3	36	116.92	32.79	32.79	
3.25	39	131.83	34.13	34.13	
3.5	42	147.33	35.41	35.41	
3.75	45	163.40	36.66	36.66	
4	48	180.01	37.86	37.86	


3
AP1
AP2
AP5
SINGLE TYPE "D"
SUMP INLET
~ 14' DEEP
Qi = 23.35 CFS
SINGLE TYPE "A"
SUMP INLET
Qi = 2.17 CFS
NEW 36" RCP
Q = 25.25 CFS →
S = 0.5%
NEW 36" RCP
S = 0.5%
TERRA DOLCE AVE.
TIE TO
EX. 36" RCP
S = 0.5%
CANTA CIELO DRIVE

F-1


Q=16.45 CFS
BREZZA DOLCE AVE
AR4
TYPE "A" SUMP INLET
Q=27.56 CFS
NEW 18"
S=50%
NEW24"
S=50%
TIE TO EX.
24" RCP
S=50%
EX. 48"
TEE MH
A Q=16.54 CFS
NEW18"
S=6.9%
TYPE "A" SUMP
INLET
Q=27.56
CFS
EX. 66" RCP
Ex 66"x24"
RCP WYE
VENTICELLO DR.
Q=11.11CFS
Q=11.11CFS
AP3


SINGLE TYPE "D"
SUMP INLET
Q= 19.49 CFS
~ 5.5' DEEP
BREZZA DOLCE AVE.
TIE TO EXISTING
36" RCP
S=0.5%
NEW 36" RCP
S=0.5%
Q= 19.49 CFS
EX.
66" RCP
AP6
18

Lateral Erosion Widths
Ventana Ranch - North 20

Basin Name	Q100 (cfs)	Qd (cfs)	S (ft/ft)	Sc (ft/ft)	Sub or Super	Δmax (feet)	Wd (feet)	λ/Wd	Lv (feet)	Total Erosion Width
Calabacillas Arroyo Q_{in}	5260	1052.0	0.019	0.015	super	239.7	74.4	12.9	479	554

Note: Formulas from AMAFCA Sediment Erosion Design Guide (see pgs. 3-68 through 3-75)
Assumptions:

1) Approximate method based on optimal bend shape
2) Dominant Discharge = Qd = 0.2*Q100; Qd<2000cfs
3) Critical Slope = Sc = 0.037*Qd^-0.133; assumes wide rectangular channel, uniform flow, n=0.035, W/D=40
4) Maximum lateral erosion distance (Δmax) varies due to Qd and S; presence of lateral controls not considered
5) Meander wavelength to channel width (λ/Wd) varies due to Qd
6) Downvalley length = Lv = λ/2
7) Total Erosion Width = 2*(Δmax+0.5*Wd)
8) Critical bank height not considered
9) 100-year flood zone not considered