DRAINAGE REPORT

FOR

COUNTRY MEADOWS UNIT IV AT VENTANA RANCH
(TRACT 29E)

JANUARY 14, 2004

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

YOLANDA O. PADILLA
NEW MEXICO
16035
LICENSED PROFESSIONAL ENGINEER

Prepared By:

Yolanda Padilla 1/14/04

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

TABLE OF CONTENTS

APPENDICES

EXHIBITS

I. PURPOSE

The purpose of this report is to present the drainage management plan for Country Meadows Unit IV Subdivision at Ventana Ranch (Tract 29E) and to obtain approval of the preliminary/final plat and grading plan by the Development Review Board (DRB). The proposed development of the Country Meadows Unit IV Subdivision consists of 69 single family detached residential lots on approximately 11.16 acres.

II. METHODOLOGIES

Drainage conditions were analyzed utilizing 10-year, 6-hour and 100-year, 6-hour storm events 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 11.16 acres. Therefore, Part A of the DPM, Section 22.2 was used, which provides a simplified procedure for projects with sub-basins smaller than 40 acres.

This report will reference the following City of Albuquerque and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) approved studies prepared for the Ventana Ranch Subdivision development:

1) *Las Ventanas Subdivision Drainage Master Plan*, dated April 1995
2) *Final Addendum No. 4 For The Design Analysis Report For Ventana Ranch Subdivision Drainage Facilities*, dated July 2000
3) *Drainage Report for Tract 23 At Ventana Ranch,* dated January 17, 2002
4) *Drainage Report for Tract 24 at Ventana Ranch*, dated March 30, 2001
5) *Drainage Report for Country Meadows Unit III at Ventana Ranch*, dated April 19, 2002
6) *Drainage Report for Canta Cielo at Ventana Ranch*, dated September 5, 2003
7) *Drainage Report for Vista de Arenal Unit II at Ventana Ranch*, dated July 18, 2003.

The *Las Ventanas Subdivision Drainage Master Plan*, (LVDMP) prepared by Bohannan Huston (originally dated April 1995 and updated October 1995).dated April 1995 (hereafter referred to as the LVSDMP), was prepared to summarize the findings of a hydrologic analysis of existing and developed drainage conditions for the proposed Las Ventanas Subdivision and formulates a drainage master plan for the development of the property. The report evaluated drainage in Las Ventanas Subdivision based on the Piedras Marcadas Hydrologic model prepared by Molzen-Corbin & Associates in 1993, and provided a conceptual plan for drainage in order to determine drainage facilities sizes and total costs. In addition, it provided drainage outfall alternatives for the Las Ventanas Subdivision. Additional information was provided in "The Final Addendum No. 4 for The Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities" prepared by Bohannan Huston dated December 1997. This report identifies downstream drainage improvements and confirms that the storm drain hydraulics for the North Outfall or the West Branch Calabacillas Storm Drain Diversion presented in Addendum 3, have not been changed. The developed flows from this tract will ultimately drain into the West Branch Calabacillas Storm Drain.

The Final Addendum No. 4 For the Design Analysis Report For Ventana Ranch Subdivision Drainage Facilities, approved by the City of Albuquerque July 2000, was prepared to re-evaluate the hydrology and hydraulics for drainage outfall options for tracts in the north central portion of Ventana Ranch, a subdivision in the northwest Albuquerque. In addition, this report confirmed that the proposed changes in the subdivision and the resulting changes in the hydrology do not change the storm drain hydraulics for the North Outfall or the West Branch Calabacillas Storm Drain diversion, as presented in Addendum No. 3. Addendum No. 3 was approved by the City of Albuquerque and by AMAFCA. Using the revised hydrology, the hydraulics for the North Outfall and the West Branch Calabacillas Storm Drain Diversion were checked to assure adequate capacity for the revised flow rates.

The *Drainage Report For Travilla Subdivision (Tract 23) At Ventana Ranch,* dated January 17, 2002 was prepared to present the drainage management plan for Tract 23 of the Ventana Ranch Subdivision for preliminary plat and grading plan approval by the Development Review Board (DRB).

The *Drainage Report for Tract 24 at Ventana Ranch*, dated March 30, 2001 was prepared to present the drainage management plan for Tract 24 of the Ventana Ranch Subdivision for preliminary plat and grading plan approval by the Development Review Board (DRB).

The *Drainage Report for Country Meadows Unit III at Ventana Ranch (A Portion of Tract A, Travilla Subdivision)*, dated April 19, 2002 was prepared to present the drainage management plan for a portion of Tract A, Travilla Subdivision of the Ventana Ranch Subdivision for preliminary plat and grading plan approval by the Development Review Board (DRB).

The *Drainage Report for Canta Cielo at Ventana Ranch* , dated September 5, 2003 was prepared to present the drainage management plan for Tract 29C of the Ventana Ranch Subdivision for preliminary plat and grading plan approval by the Development Review Board (DRB).

The Drainage Report for Vista De Arenal Unit II at Ventana Ranch *(Tract 29C)*, dated July 18, 2003 was prepared to present the drainage management plan for Tract 29C of the Ventana Ranch Subdivision for preliminary plat and grading plan approval by the Development Review Board (DRB).

Please refer to the above referenced reports for the specific methodologies used in preparing those individual reports or plans.

III. SITE LOCATION AND CHARACTERISTICS

Ventana Ranch is a 940-acre development located west of Paradise Hills between Paseo del Norte and Irving Boulevards. Country Meadows Unit IV (Tract 29E) is located in the northeastern quadrant of the Ventana Ranch Master Plan. The proposed subdivision is bounded by Irving Blvd. to the north, Universe Blvd. to the east, Country Meadows Unit III (Tract 29A) to the south, and Vista De Arenal Unit II (Tract 29C) and a vacant parcel (Tract 29B) to the west. The subdivision consists of 69 lots and will be accessible from Irving Blvd.

IV. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

For additional assistance throughout this portion of the report, please refer to the Existing Drainage Basin Map enclosed in the Exhibit section of this report.

The proposed subdivision is located within existing Basin 2 (11.21 ac, Q100=32.14 cfs) and consists of mass graded terrain with gradual slopes ranging 1% to 5%. Existing Basin 1 (13.23 ac, Q100=34.76 cfs) borders the west side of Basin 2 and consists of 85% mass graded terrain. The soil throughout this region has a Hydrologic Soil Group (HSG) classification of Type "A". Types "A" soils are known to have infiltration rates and are typically found in desert climates similar to that of Ventana Ranch. Existing drainage patterns direct the runoff to a lowpoint within the future Paese Place. At this lowpoint, the 66" storm drain manholes, which were built with Vista de Arenal Unit 2, have been built with Neenah beehive grates to accept this flow. This lowpoint collects flows from Travilla Subdivision, Vista De Arenal, Vista De Arenal Unit II, Country Meadows Unit III, and the undeveloped flows generated by the offsite Basin 1 and 2. There are no recognized FEMA Floodplains within the proposed development.

V. INTERIM HYDRAULIC AND HYDROLOGIC CONDITIONS

For additional assistance throughout this portion of the report, please refer to the Interim Drainage Basin Map and the Inlet Layout Map enclosed in the Exhibit section of this report and Appendix C, Inlet Analysis, for flow distributions.

In the interim conditions, the Country Meadows Unit IV Subdivision will be constructed, while the remaining area to the west will remain in the undeveloped state. Discharge generated by Country Meadows IV will flow through the internal streets, with all of the flow being collected by inlets throughout the subdivision.

A. Onsite Basins

Developed discharge generated by the proposed subdivision (11.21 ac, Q_{100}= 41.61 cfs), and the offsite flows from the Country Meadows Unit III (Q_{100}= 44.88 cfs), will be captured by inlets that will connect to an existing storm drain system. The undeveloped

Basin 1 (13.23 ac, Q_{100}= 32.65 cfs), Vista de Arenal Unit II (Q_{100}= 30.31 cfs), and Travilla (Q_{100}= 6.42 cfs) will drain to a low point west of the site and be collected by a beehive grate tying to the existing storm drain. The existing storm drain system was constructed with Vista De Arenal Subdivision Unit II and Irving Blvd. The flow will be carried via storm drain north through the Canta Cielo Subdivision and discharge into the West Branch Calabacillas Arroyo.

The proposed site is comprised of one large basin, broken into fifteen (15) sub-basins (Basins A - O) for analysis reasons. Each of the basins is discussed in further detail below. All onsite flow will be captured by inlets throughout the site. The completion of the storm drain system and development of this site allows the beehive maholes to be removed.

Basin A (1.09 ac, Q_{100}=3.85 cfs) encompasses nine (9) lots, #53-61. Basin B (0.48 ac, Q_{100}=2.03 cfs) encompasses Ventana Hills Road. Basin C (1.03 ac, Q_{100}=3.67 cfs) encompasses nine (9) lots, #44-52. The combined flow (48.71 cfs) from Basin A, Basin B, Basin C, and the offsite flow from Country Meadows Unit III (39.16 cfs) will travel north and will be captured by inlets 1 (9.45cfs captured, 13.73cfs bypassed), 2 (9.45cfs captured, 13.73cfs bypassed), 3 (6.95cfs captured, 7.97cfs bypassed), and 4 (7.30cfs captured, 7.62cfs bypassed) at the northern end of Ventana Hill Road, with the residual flow (15.94cfs) being collected by inlets 5 and 6 at the low point in Paese Place.

Basin D (1.11 ac, Q_{100}=3.95 cfs) encompasses nine (9) lots, #17-25. Basin E (0.47 ac, Q_{100}=1.98 cfs) encompasses Country Hills Court. Basin F (1.31 ac, Q_{100}=4.67 cfs) encompasses nine (9) lots, #26-34. The combined flow from Basin D, Basin E and Basin F (10.60 cfs) will travel west on Country Hills Court and discharge into Country Manor Place.

Basin G (0.48 ac, Q_{100}=2.03 cfs) encompasses Country Manor Place. Basin H (1.07 ac, Q_{100}=3.78 cfs) encompasses nine (9) lots, #35-43. The flow from Basin G, Basin H, and the offsite flow from Country Meadows Unit III (5.72 cfs) will combine with flow from Basin D, Basin E, and Basin F, and travel north on Country Manor Place. The combined flow (22.13 cfs) will be captured by inlets 8 (5.78cfs captured, 5.32cfs bypassed) and 9 (6.60cfs captured, 4.50cfs bypassed) at the northern end of Country Manor, with the residual flow (9.82cfs) being carried to Paese Place.

Basin I (0.92 ac, Q_{100}=3.25 cfs) encompasses eight (8) lots, #1-7. Basin J (0.45 ac, Q_{100}=1.90 cfs) encompasses Paese Place east of Country Manor Place. Basin K (1.09 ac, Q_{100}=3.85 cfs) encompasses nine (9) lots, #8-16. Basin O (0.32 ac, Q_{100}=1.35 cfs) encompasses the intersection of Paese Place and Country Manor Place at the entrance to the subdivision. The combined flow (20.17cfs) from Basin I, Basin J, Basin K, Basin O, and residual from Country Manor Place will flow west on Paese Place and be captured by inlet 7 (5.58cfs captured, 14.59cfs bypassed).

Basin L (0.93 ac, Q_{100}=3.33 cfs) encompasses eight (8) lots, #62-69. Basin M (0.41 ac, Q_{100}=1.73 cfs) encompasses Paese Place west of Country Manor Place. Inlets 5 and 6 at the low point on Paese Place are both Double Wing, Double Grate Type "A" inlets. These inlets will capture the flow from Basins L and M as well as all residual flow from all upstream inlets ($Qtotal_{100}$=46.36cfs). These two inlets also accommodate the 2 x 100yr flow of 92.72cfs (46.36cfs each) since there is no emergency spillway.

In the interim condition 69.38cfs of offsite flow west of the site will discharge to low point west of the site and be collected by a beehive grate tying to the existing storm drain. Ultimately a residual of 11.07 cfs from this offsite basin will discharge to Paese Place and be collected by inlets 5 and 6 on the site. For analysis reasons, the ultimate condition was used in order to design onsite storm drain system to accommodate the larger flow.

B. Offsite Basins

Basin N (0.05 ac, Q_{100}=0.21 cfs) encompasses the entrance into the subdivision. The developed flow from this basin will flow north out of the subdivision and be captured by inlets on Irving Boulevard downstream.

The offsite flows from Basin 1 (13.23 ac, Q_{100}=34.76 cfs), Vista de Arenal Unit II (Q_{100}=30.31 cfs), and Travilla Subdivision (Q_{100}=6.42 cfs) will travel to a low point west of the site and be collected by the existing storm drain within the future development as mentioned above in the Onsite Basins section.

VI. ULTIMATE HYDRAULIC AND HYDROLOGIC CONDITIONS

For additional assistance throughout this portion of the report, please refer to the Ultimate Conditions Basin Map and the Grading and Drainage Plan enclosed in the Exhibit section of this report.

In the ultimate condition, the Country Meadows IV Subdivision and the area to the west will be developed.

A large portion of the developed flow from Basin 1 (13.23 ac, Q_{100}=47.50 cfs) combined with flow from Vista de Arenal Unit II (Q_{100}=30.31 cfs), and Travilla Subdivision (Q_{100}=6.42 cfs) would be captured by inlets built with the future development. The residual flow of 11.07cfs from these future inlets was accommodated in the design of the on-site storm and inlets. The inlets would connect to a 36" stub provided by the storm drain system built with Vista de Arenal Unit II and Irving Boulevard. The captured flow would be carried via storm drain through Canta Cielo Subdivision to the West Branch of the Calabacillas Arroyo. Any residual flows would continue to travel east on Paese Place, enter the proposed subdivision, and be captured by inlets located at a low point in Paese Place.

VII. CONCLUSION

The Final Addendum No. 4 governs the development of Country Meadows Unit IV (Tract 29E) of the Ventana Ranch Subdivision. 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. This report supports the preliminary/final plat and grading plan submittals and should be approved as requested.

BASIN SUMMARY FOR COUNTRY MEADOWS UNIT IV AT VENATNA RANCH

HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA

	BASIN I.D.	AREA (AC)	UNITS #		% LAND TREATMENT A	B	C	D		DISCHARGE (CFS) 10 YR	100YR
	EXISTING CONDITIONS										
Offsite	1	13.23			15.0%	0.0%	85.0%	0.00%		**17.09**	**34.76**
Onsite	2	11.21			0.0%	0.0%	100.0%	0.00%		**16.54**	**32.14**
	PROPOSED CONDITIONS										
Offsite	1	13.23			15.0%	0.0%	85.0%	0.00%		**17.09**	**34.76**
	A	1.09	9		0.0%	21%	21%	58%		2.34	3.88
	B	0.48	0		0.0%	0%	10.0%	90%		1.32	2.03
	C	1.03	9		0.0%	21%	21%	58%		2.21	3.67
	D	1.11	9		0.0%	21%	21%	58%		2.38	3.95
	E	0.47	0		0.0%	0%	10.0%	90%		1.29	1.98
	F	1.31	9		0.0%	21%	21%	58%		2.81	4.67
	G	0.48	0		0.0%	0%	10.0%	90%		1.32	2.03
	H	1.07	9		0.0%	21%	21%	58%		2.27	3.81
	I	0.92	7		0.0%	21%	21%	58%		1.95	3.28
	J	0.45	0		0.0%	0%	10.0%	90%		1.24	1.90
	K	1.09	9		0.0%	21%	21%	58%		2.31	3.88
	L	0.93	8		0.0%	21%	21%	58%		2.01	3.31
	M	0.41	0		0.0%	0%	10.0%	90%		1.13	1.73
	N	0.05	0		0.0%	0%	10.0%	90%		0.14	0.21
	O	0.32	0		0.0%	0%	10.0%	90%		0.88	1.35
Onsite	**TOTAL**	**11.21**	**69**							**25.59**	**41.68**

NOTES: Impervious percentages were calculated from the DPM equation A-4, with the remaining percentages distributed to land treatment type B, due to the relatively flat terrain

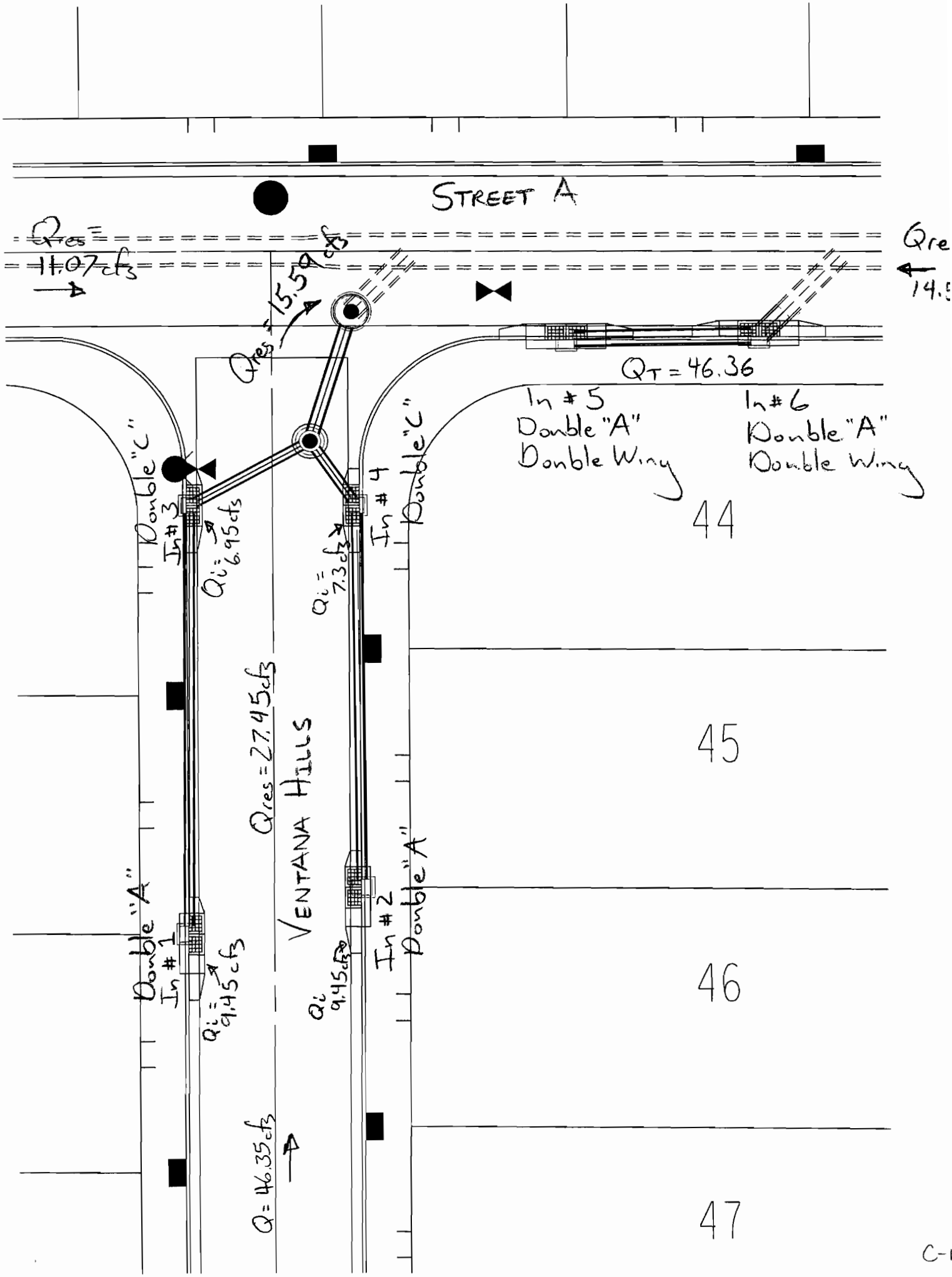
N=UNITS/ACRES = 6.2

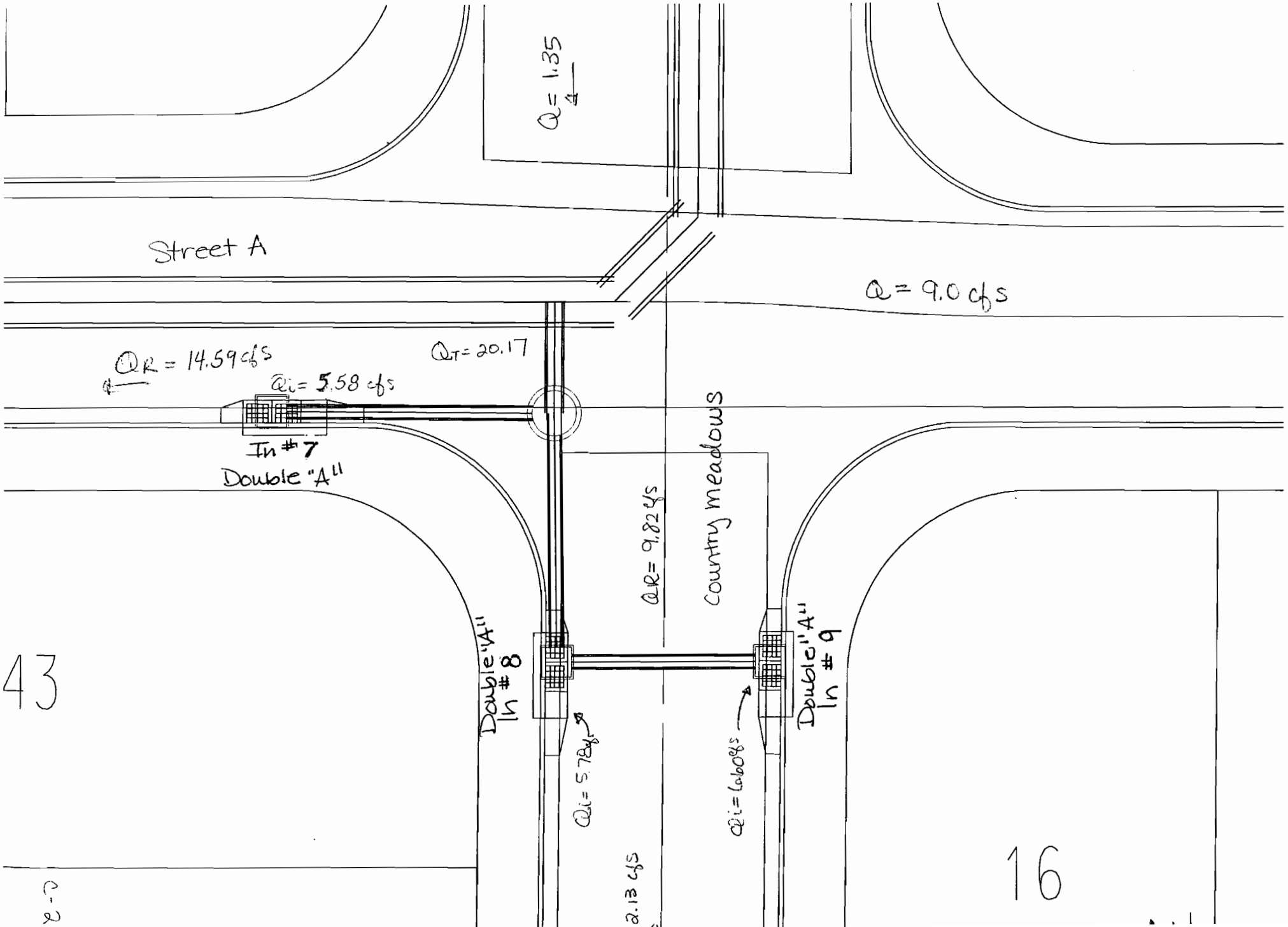
%D= 7*SQRT((N*N)+(5*N)) = 58.0 %

*Table A-4

**Table A-11

	FUTURE CONDITIONS										
Offsite	**1**	**13.23**			**0.0%**	**20.0%**	**20.0%**	**60.0%**		**28.71**	**47.50**


STREET A
Qres = 11.07 cfs
Qres = 15.59 cfs
Qres
14.5
QT = 46.36
In #5
Double "A"
Double Wing
In #6
Double "A"
Double Wing
Double "C"
In #3
Qi = 6.95 cfs
Qi = 7.3 cfs
In #4
Double "C"
Qres = 27.45 cfs
VENTANA HILLS
Double "A"
In #1
Qi = 9.45 cfs
Qi 9.45 cfs
In #2
Double "A"
Q = 46.35 cfs
44
45
46
47


Q= 1.35
Street A
Q= 9.0 cfs
QR = 14.59 cfs
QT= 20.17
Qi= 5.58 cfs
In #7
Double "A"
Country meadows
QR= 9.82 cfs
Double "A"
In #8
Double "A"
In #9
Qi= 5.78 cfs
Qi= 4.04 cfs
2.13 cfs
43
16

ANALYSIS OF AN INLET IN A SUMP CONDITION - **STREET A - INLETS 5&6**

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.		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

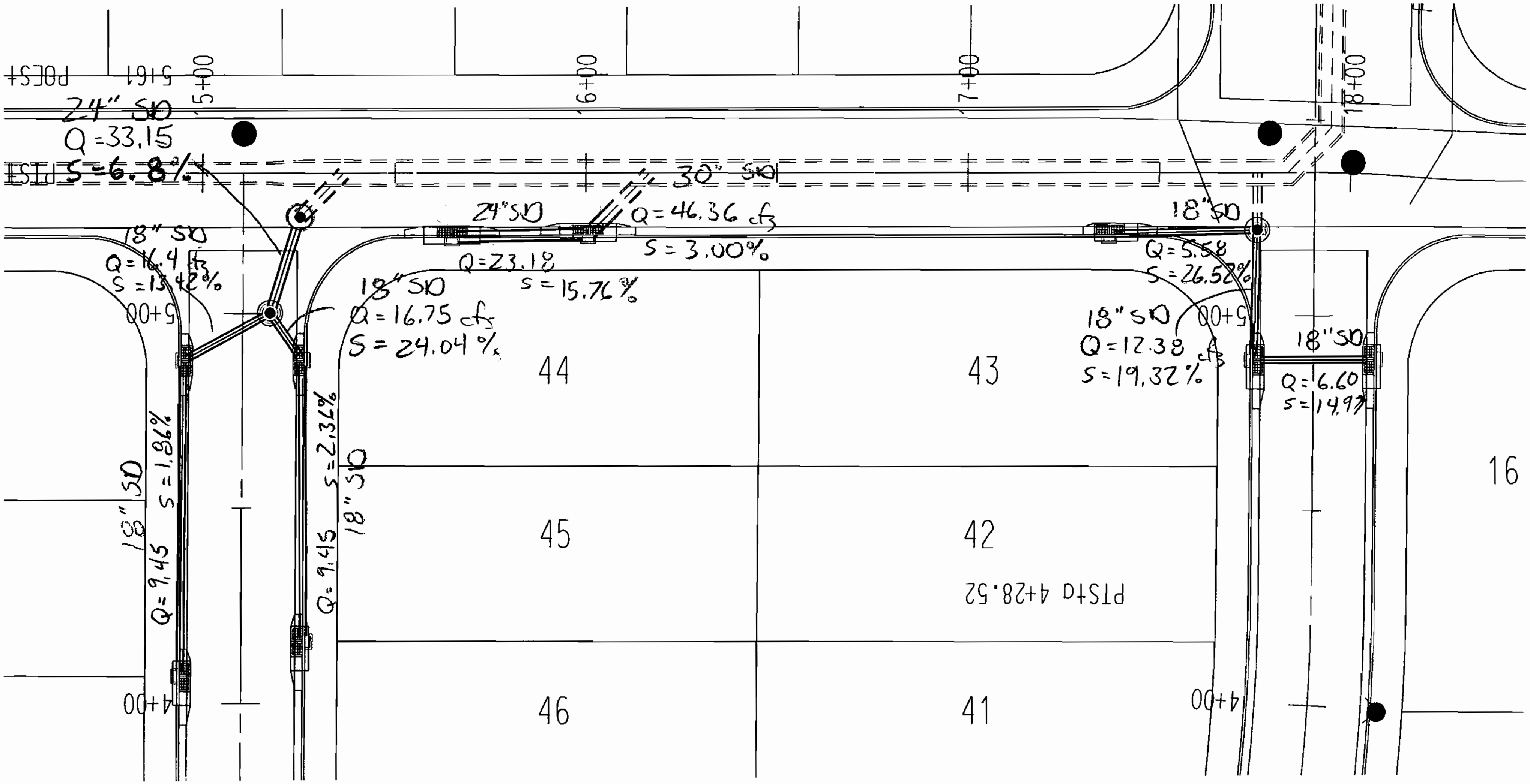
	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	1.07	2.40	17.64	4.55	
	0.30	0.30	1.97	4.41	21.60	8.35	
	0.40	0.40	3.04	6.78	24.94	12.86	
	0.50	0.50	4.24	9.48	27.88	17.97	
	0.60	0.60	5.58	12.46	30.55	23.62	Q(100 yr) = 23.18 cfs is provided at this depth
TOP OF CURB	0.70	0.70	7.03	15.71	32.99	29.76	
	0.80	0.80	8.59	19.19	35.27	36.36	
	0.90	0.90	10.25	22.90	37.41	43.39	
ROW LIMIT	1.00	1.00	12.00	26.82	39.43	50.82	Q(2x100 yr) = 46.36 cfs is provided at this depth

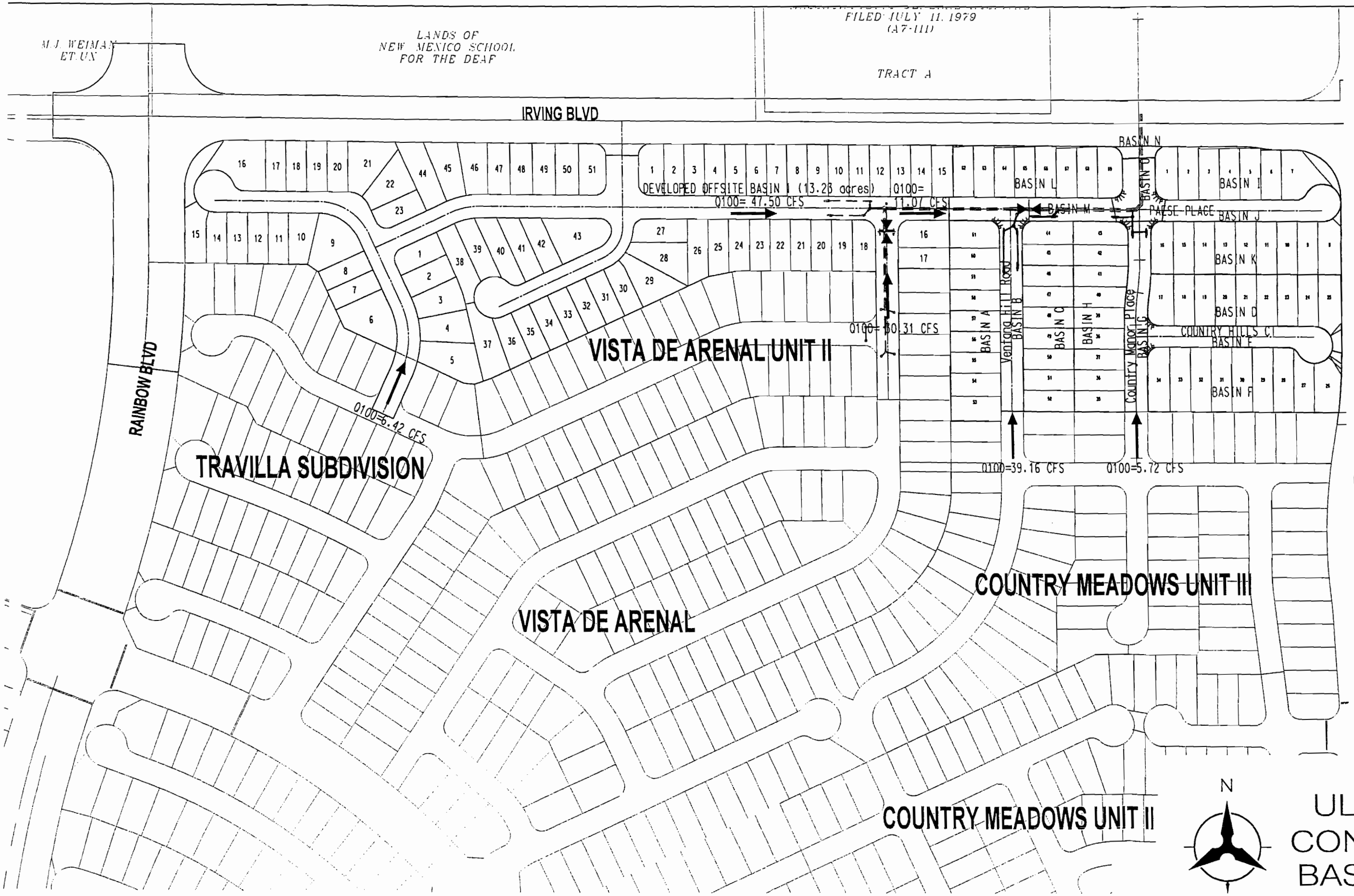
NOTE: The total runoff intercepted by the inlet at the low point in the road is:

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

THE 100 YR STORM EVENT = 23.18 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 46.36 at the sump condition


24" SD
Q = 33.15
S = 6.8%
15+00
16+00
17+00
18+00
30" SD
Q = 46.36 cfs
S = 3.00%
24" SD
Q = 23.18
S = 15.76%
18" SD
Q = 16.4 cfs
S = 13.42%
18" SD
Q = 16.75 cfs
S = 24.04%
18" SD
Q = 9.45
S = 1.86%
18" SD
Q = 9.45
S = 2.36%
18" SD
Q = 5.58
S = 26.52%
18" SD
Q = 12.38 cfs
S = 19.32%
18" SD
Q = 6.60
S = 14.97
5+00
4+00
44
43
45
42
46
41
16
PTSta 4+28.52
D-2



DEVELOPED ONSITE BASINS		
BASIN ID	Q100(cfs)	A(acres)
A	3.88	1.09
B	2.03	0.48
C	3.67	1.03
D	3.95	1.11
E	1.98	0.47
F	4.67	1.31
G	2.03	0.48
H	3.78	1.07
I	3.25	0.92
J	1.90	0.45
K	3.85	1.09
L	3.33	0.93
M	1.73	0.41
N	0.21	0.05
O	1.35	0.32
Total	41.61	11.21

LEGEND

DIRECTION OF FLOW

LOW POINT

EXISTING SD LINE SD

PROPOSED SD INLET

PROPOSED SD LINE

PROPOSED SD MANHOLE

N

200 100 0 200

SCALE: 1" = 200'

(HORIZ.)

ULTIMATE CONDITIONS BASIN MAP

COUNTRY MEADOWS UNIT IV SUBDIVISION

ALBUQUERQUE, NEW MEXICO
OCTOBER, 2003

Bohannan ▲ Huston INC.
Courtyard I 7500 Jefferson St NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

*040242*cdp*design*ultimate basins.dgn

EXHIBIT 5