DRAINAGE REPORT

FOR

VENTANA RIDGE AT VENTANA WEST

SEPTEMBER 3, 2004

Prepared for:

D.R. HORTON CUSTOM HOMES
4400 ALAMEDA NE, SUITE B
ALBUQUERQUE, NM 87113

Prepared by:

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

PREPARED BY:

9-3-04

Kevin J. Murtagh, E.I. **Date**

UNDER THE SUPERVISION OF:

9/3/04

Kevin Patton, P.E. **Date**

KEVIN G. PATTON
NEW MEXICO
13685
REGISTERED PROFESSIONAL ENGINEER

Bohannan Huston Inc.

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APPENDICES

EXHIBITS

I. PURPOSE

The purpose of this report is to present the drainage management plans for Ventana Ridge at Ventana Ranch West (Tracts 6 of the Ventana Ranch West Master Plan) and to obtain approval of the preliminary/final plat and grading plan by the City of Albuquerque. The proposed development of Ventana Ridge consists of 115 single family detached residential lots on approximately 23.45 acres.

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 23.45 acres. Part A of the DPM, Section 22.2, provides a simplified procedure for projects with sub-basins smaller than 40 acres; therefore, the site was divided into smaller sub-basins.

The existing approved drainage report referenced in the preparation of this plan is the "Ventana Ranch West Subdivision Drainage Master Plan" (VRWDMP) prepared by Bohannan Huston (dated October 2003). This report provides a comprehensive analysis of the developed hydrologic conditions for Ventana Ranch West.

Additional information supporting this report can be found in the Drainage Report for Pinon Pointe V & VI at Ventana Ranch, dated April 2003 , as well as Drainage Report for Pinon Pointe III & IV at Ventana Ranch, dated April 2002.

III. SITE LOCATION AND CHARACTERISTICS

Ventana Ranch West Subdivision is a 290 acre development located west of Ventana Ranch Subdivision between Paseo del Norte and Irving Boulevards. Tract 6 is located at the northeast corner of Ventana Ranch West is bounded by Ventana Ridge Road on the west, Irving Blvd. to the north, Tract 5 of Ventana Ranch West to the south, and existing Piñon Pointe II and VI to the east. The site will be accessible from Ventana Ridge Road. The southern boundary of Tract 6 has changed since the approval of the VRWDMP and now encompasses a portion of the Tract 5 as per the VRWDMP.

IV. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

In its existing condition, the site consists of mass graded terrain with slopes ranging from 2% to 5%. There are three existing basins through the site, Basins 1, 2 and 3; see Existing Drainage Basin Map (Exhibit 3) at the back of this report. The soils within existing Tract 6 are generally fine to medium grained silty sands. The runoff generated from existing Basin 1, (5.34 acres, Q_{100}=15.3cfs) flows southwest across a portion of Tract 5 to a run down built with the Pinon Pointe Subdivision. The runoff generated from Basin 2 (8.11 acres, Q_{100}=23.3cfs) east across Tract 6 and into a beehive grate. The runoff generated from existing Basin 3, (10.01 acres, Q_{100}=28.7cfs) flows to a temporary rundown built with Piñon Pointe VI. There are no recognized FEMA Floodplains within the proposed development.

V. PROPOSED HYDRAULIC AND HYDROLOGIC CONDITIONS

For additional support throughout this portion of the report, please refer to the Proposed Drainage Basin Map (Exhibit 4), the Basin Analysis (Appendix A) and the Grading and Drainage Plan (Exhibit 5).

The Ventana Ridge has been divided in to 3 major basins which will drain to sump conditions on-site. The runoff will be collected by new onsite storm drain improvements and discharge to existing storm drain structures off-site. Other smaller basins will drain from backyards through turn blocks to either Ventana Ridge Road or Irving BLvd. The following is a detailed description of the basins and their drainage properties.

A. On-Site Basins

The proposed site is broken into four (3) major basins. These basins have been divided into sub-basins for analysis purposes. For sub-basin data, see Appendix A at the back of this report.

Basins A (5.49 ac, Q100=18.93 cfs) consists of the Oso Ridge Place cul-de-sac, Rough Rock Road, Pintado Cout and a portion of Borrego Creek Drive, in addition 23 lots are included in this basin, lots 51-55 and 87-104, and is divided into Sub-basins A1 and A2; see Appendix A for more information. The runoff from Basin A will flow in the streets and be collected at a low point at the southern end of Pintado Court, where it will be collected by a double Type A inlet in sump condition. The collected flow, 18.93 cfs, will be conveyed through a 24" strom drain and tie to an existing 66" storm drain built with the Ventana Ranch Backbone Roadway Infrastructure (please see Appendix E for pipe flow information). Since there will be no emergency spillway, the inlet will be designed for the two times the 100-year storm event (37.86 cfs), see Inlet Analysis in Appendix C.

Basin B (8.47 ac, Q100=28.78cfs), which is divided into Sub-basins B1 and B2, encompasses Angel Peak Road as well as portions of Oso Ridge Road, Borrego Creek Drive, in addition 44 lots are included in this basin lots 35-50, 56-64, 77-86 and 105-113. Runoff in Basin B will be conveyed in the streets and flow to a low point in where it will be collected by a double Type A inlet in a sump condition (see Appendix C) in Borrego Creek Place. The collected flow, 28.78 cfs, will be conveyed through a 24" storm drain and tie to an existing 36" storm drain built with Pinon Pointe VI (see Appendix E). A pedestrian access and storm drain easement between lots 79 and 80 will act as an emergency spillway and will be collected by a manhole grate inlet at the east end of the pedestrian access, therefore the inlet will be sized for the 100-yr storm.

Basin C (7.1 ac, Q100=24.14cfs), which is divided into Sub-basins C1 and C2, encompasses Seven Springs Road and Puerco Ridge Road as well as portions of Standing Rock Road, Oso Ridge Road, Borrego Creek Drive, in addition 31 lots are included in this basin lots, 1-7, 18-34, 72-76, and 114-115. Runoff in Basin C will be

conveyed in the streets and flow to a low point in where it will be collected by inlets in a sump condition at the north end of Borrego Creek Drive. The collected flow, 24.14 cfs, will be conveyed through a 36" storm drain and tie to an existing 36" storm drain stub in Irving Blvd. built with the Ventana Ranch Backbone Roadway Infrastructure (see Appendix E). A pedestrian access at the end of Borrego creek Drive will act as an emergency spillway, and therefore the inlet will be sized for the 100-yr storm.

The VRWDMP describes Tract 6 as having an allowable discharge of 20 cfs (Tract 6A) and 26 cfs (Tract 6B) see Appendix E. However Tract 6 has increased in size since the VRWDMP was approved. In general Basin A is contained within Tract 5 of the VRWDMP and the flows from Basin A will drain through the 66" to the spillway and therefore the 19 cfs from Basin A is included in the 432 cfs design flow per VRWDMP. In addition the flows in Basins B and C are generally in Tracts 6A and 6B (per the VRWDMP) respectively. The 53 cfs discharging from Basins B and C to the downstream storm drain are within tolerance of the 46 cfs allowed to discharge from Tract 6 per the VRWDMP, and therefore it is my recommendation that the downstream storm drain can accommodate minor additional flows from Tract 6.

Basin D1 (0.76 ac, Q100=2.58 cfs) consists of lots 11-17. These lots drain from the front of the pads to the backyards to turn blocks where they outfall to Irving Blvd. The total flow from Basin D1 will be conveyed in Irving Blvd. and collected by existing inlets downstream at Irving Blvd. and Rainbow built with the Rainbow Blvd. Improvements project (see Appendix E). Similarly, Basin D2 (0.85 ac, Q100= 2.89 cfs) drains lots 65-71 from the front of the pads to the backyard through turnblocks where they outfall to a ribbon channel (along the outside of the east boundary), which conveys the flow to Irving Blvd. and is collected in the same existing downstream sump condition inlet at Irving Blvd. and Rainbow. The 18" lateral from this inlet is at capacity, and will flow under pressure with the additional 5.46 cfs from Tract 6. The flow continues under pressure until it reaches Junco Place where the flow enters a 36" RCP which has capacity. (See Appendix E for pipe capacities) Taking into consideration the lag time and time of concentration, the additional flow from Tract 6 will not adversely impact them downstream storm drain.

Basin E2 (0.55 ac, Q100=2.30 cfs) consists of lots 8-10 and the stub street on the north end of Oso Ridge Place. The runoff from this area drains to Irving Blvd. via the stub street, with exception of portions of lots 9 &10 which drains to the backyard through turnblocks. The runoff from these areas will combine in Irving Blvd. and flow west to be collected by future downstream inlets.

Basins E1, a portion of Standing Rock Road (0.37 cfs) drains to Ventana Ridge Road and is collected by existing inlets downstream built with the Ventana Ranch West Backbone Roadway Infrastructure.

VI. CONCLUSION

The VRWDMP governs the development of Tract 6 of the Ventana Ranch West 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. Therefore, we believe this report supports the preliminary/final plat and grading plan submittals and should be approved as requested.

Ventana Ridge at Ventana Ranch West										
BASIN I.D.	AREA (AC)	UNITS #		% LAND TREATMENT A	B	C	D[1]		DISCHARGE (CFS) 10 YR	100YR
HYRDOLOGICAL DISCHARGE DATA (EXISTING CALCULATED)										
BASIN 1	5.34			0.0%	0.0%	100.0%	0.0%		7.9	15.3
BASIN 2	8.11			0.0%	0.0%	100.0%	0.0%		12.0	23.3
BASIN 3	10.01			0.0%	0.0%	100.0%	0.0%		14.8	28.7
TOTAL	**23.46**								**34.6**	**67.3**
HYRDOLOGICAL DISCHARGE DATA (DEVELOPED)										
ONSITE										
A1	2.98	11		0.0%	25.3%	25.3%	49.5%		5.9	10.13
A2	2.59	12		0.0%	25.3%	25.3%	49.5%		5.2	8.80
B1	5.95	24		0.0%	25.3%	25.3%	49.5%		11.9	20.22
B2	2.52	20		0.0%	25.3%	25.3%	49.5%		5.0	8.56
C1	3.91	14		0.0%	25.3%	25.3%	49.5%		7.8	13.30
C2	3.19	17		0.0%	25.3%	25.3%	49.5%		6.4	10.84
D1	0.76	9		0.0%	25.3%	25.3%	49.5%		1.5	2.59
D2	0.85	7		0.0%	25.3%	25.3%	49.5%		1.7	2.87
E1	0.11	0		0.0%	25.3%	25.3%	49.5%		0.2	0.38
E2	0.55	1		0.0%	5.0%	5.0%	90.0%		1.5	2.32
SUBTOTAL	**23.42**	**115**							**47.1**	**80.0**

ANALYSIS OF AN INLET IN A SUMP CONDITION - **AP 1 - Pintado Court**

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	Q(100 yr) = 18.93 cfs is provided at this depth
	0.60	0.60	5.58	12.46	30.55	23.62	
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	Q(2x100 yr) = 37.86 cfs is provided at this depth
	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	

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 = 18.93 CFS at the sump condition
THE 2 x 100 YR STORM EVENT = 37.86 at the sump condition

1-2

ANALYSIS OF AN INLET IN A SUMP CONDITION - **AP 2 - Borrego Place**

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	
TOP OF CURB	0.70	0.70	7.03	15.71	32.99	29.76	Q(100 yr) = 28.78 cfs is provided at this depth
	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	

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 = 28.78 CFS at the sump condition

ANALYSIS OF AN INLET IN A SUMP CONDITION - **AP 4 - Borrego Place stub street**

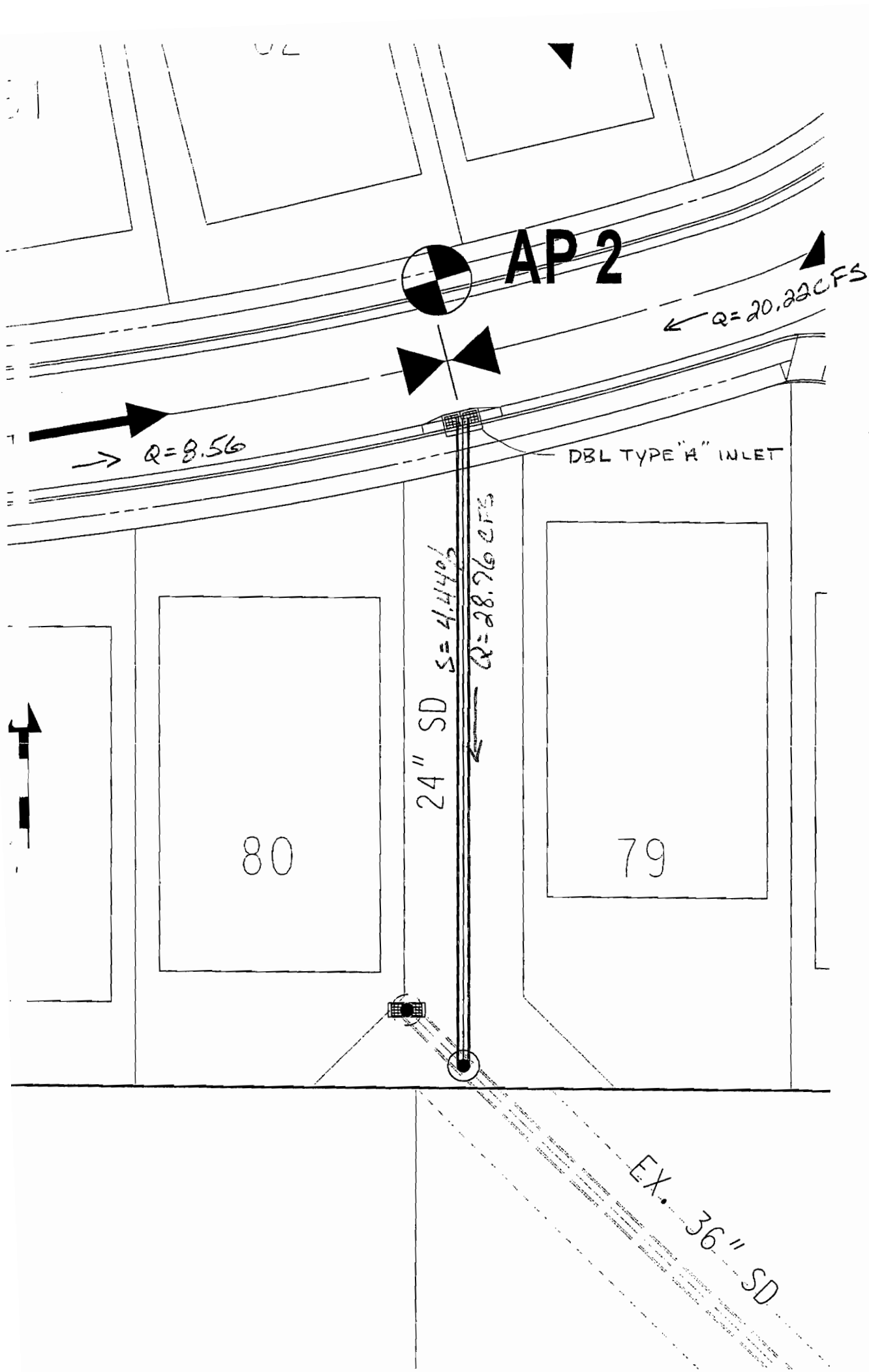
INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

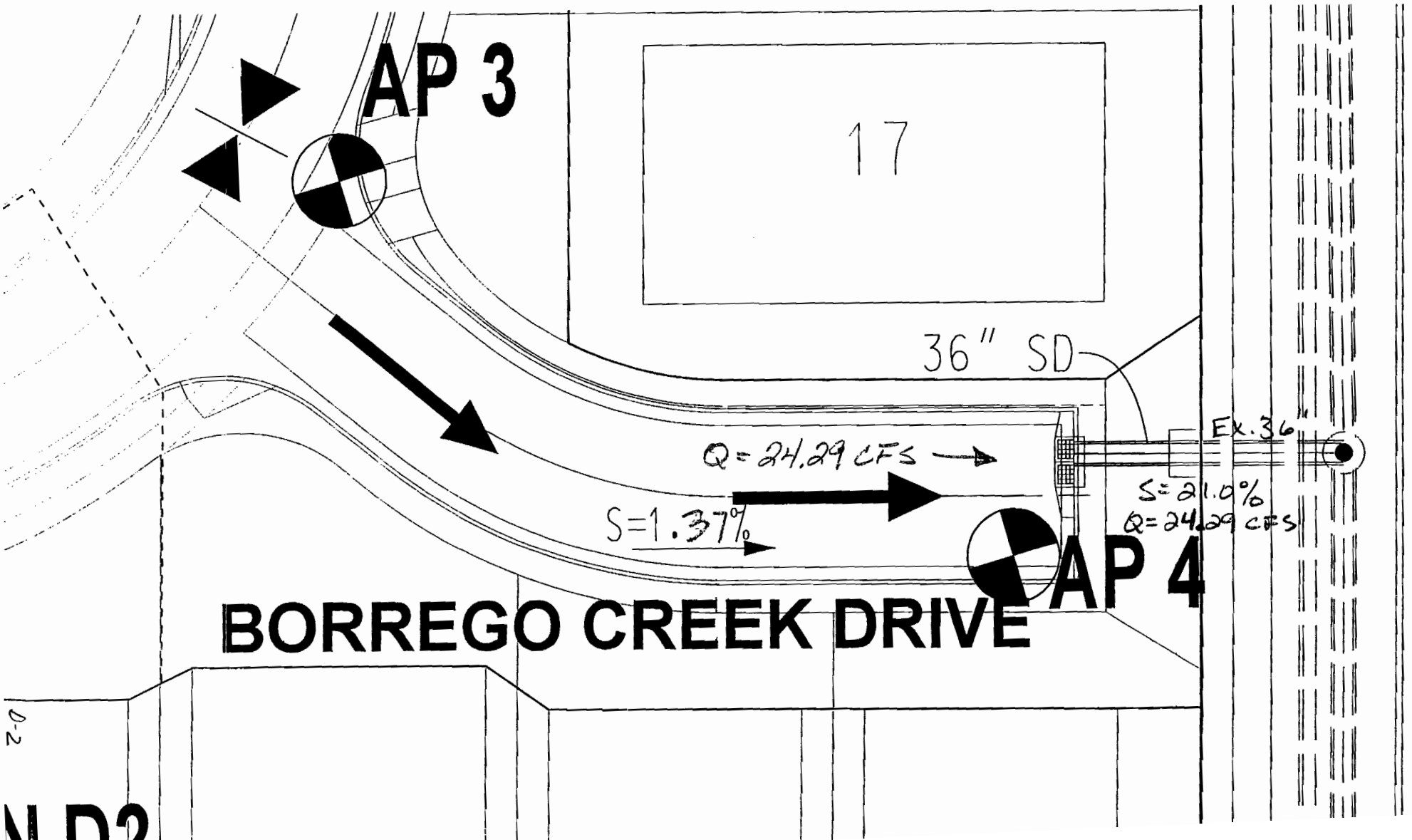
WEIR:	Q=C*L*H^1.5		ORIFICE:	Q=C*A*(2*G*H)**0.5
Wing opening	Grate opeining		Grate opening	Wing opening
C= 3.0	C=3.0		C=0.6	C=0.6
L= 4.0 ft	L(double grate)=[2(2.67')+2(1.8')]=8.		A(double grate)=8.19 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1.5	Q=3.0(8.94)H^1.5=26.82*H^1.5		Q=4.194*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

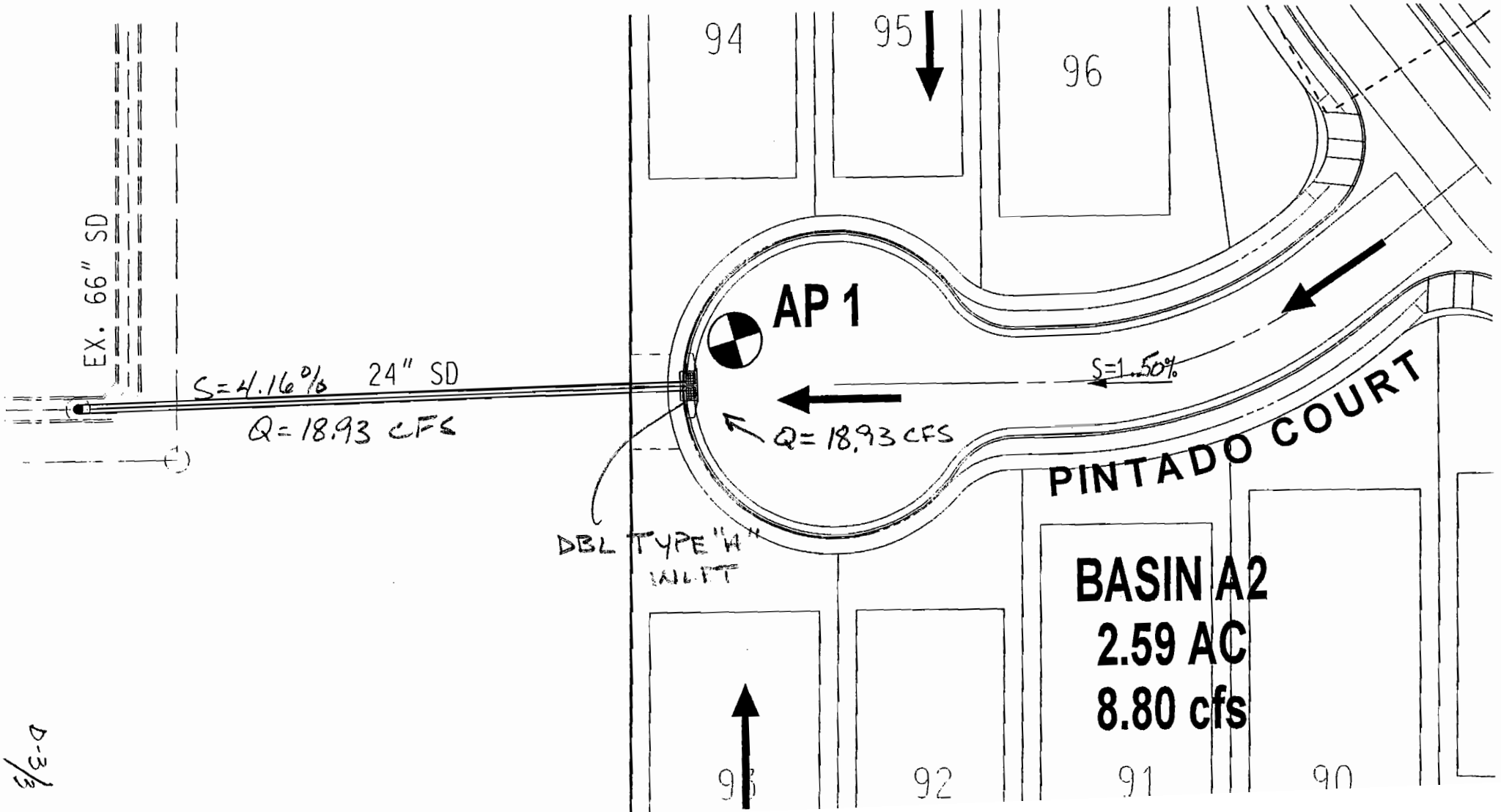
	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	1.07	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) = 24.14 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	

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 = 24.14 CFS at the sump condition

2-3-2


AP 2
Q=20.22CFS
Q=8.56
DBL TYPE "R" INLET
24" SD S=4.44%
Q=28.76 CFS
80
79
EX. 36" SD


AP 3
17
36" SD
Ex. 36"
Q = 24.29 CFS
S = 21.0%
Q = 24.29 CFS
S=1.37%
AP 4
BORREGO CREEK DRIVE

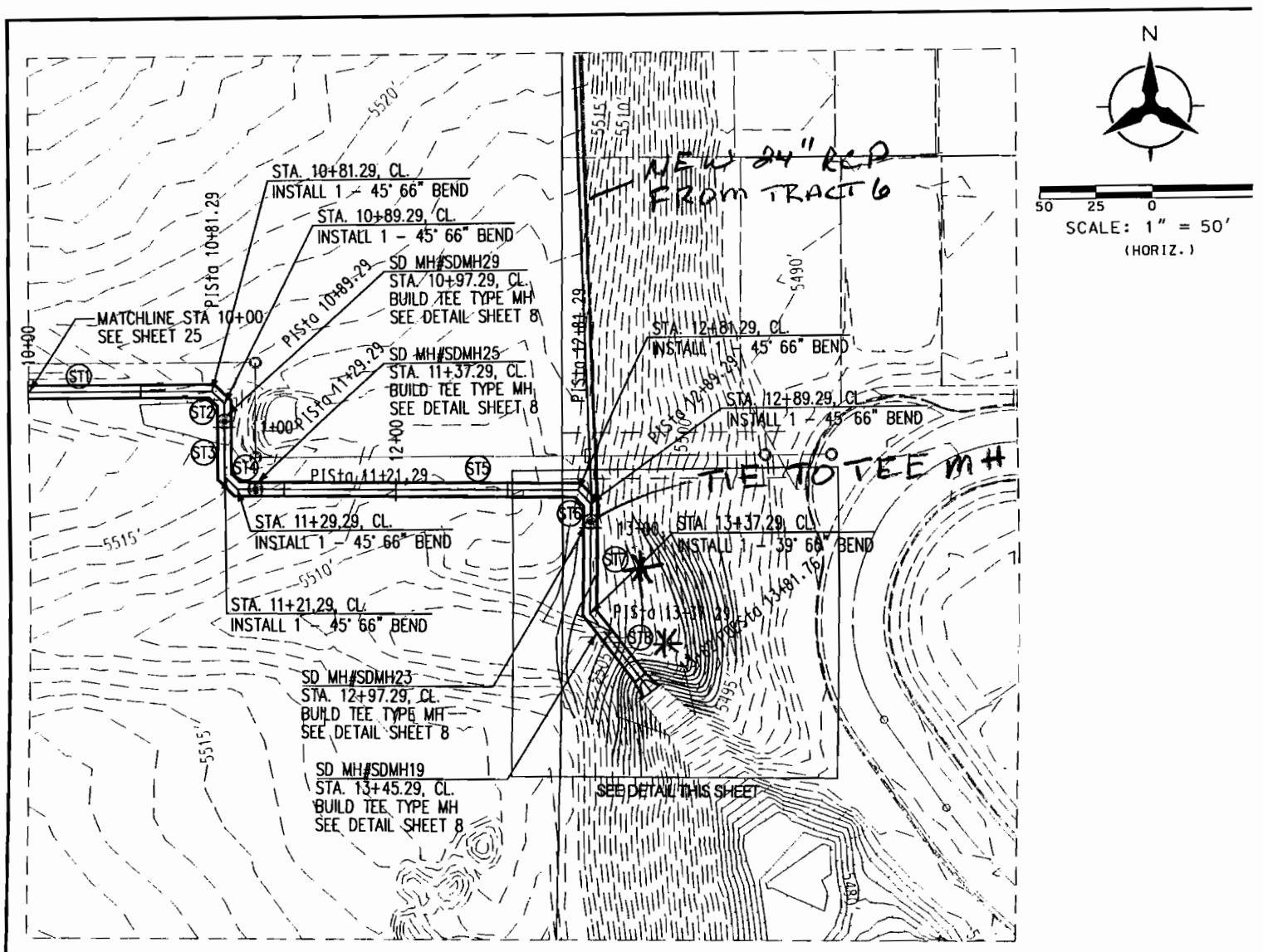

94
95
96
EX. 66" SD
S=4.16% 24" SD
Q=18.93 CFS
AP 1
S=1.50%
Q=18.93 CFS
PINTADO COURT
DBL TYPE "H" INLET
BASIN A2
2.59 AC
8.80 cfs
93
92
91
90

D-3/3

STORM DRAIN FLOW TABLE						
NUMBER	Q(cfs)	V(f/s)	DEPTH	LENGTH	SIZE	SLOPE
ST1	422.7	20.82	52.61 "	149.20'	66"	1.67%
ST2	422.7	20.82	52.61 "	8.00'	66"	1.67%
ST3	422.7	20.82	52.61 "	32.00'	66"	1.67%
ST4	422.7	20.82	52.61 "	8.00'	66"	1.67%
ST5 *	422.7	20.82	52.61 "	12.00'	66"	1.67%
ST5 *	422.7	24.15	45.59 "	8.00'	66"	2.34%
ST5 *	422.7	26.70	41.72 "	132.00'	66"	3.00%
ST6	422.7	26.70	41.72 "	8.00'	66"	3.00%
ST7	422.7	26.70	41.72 "	48.00'	66"	3.00%
ST8	422.7	26.70	41.72 "	44.47'	66"	3.00%

* VELOCITY CHANGE DUE TO VERTICAL DEFLECTION AT PIPE JOINT. SEE PROFILE.

Storm Drain Tangent Table		
ID	BEARING	LENGTH
ST1	S89°39'17"E	149.20'
ST2	S44°39'17"E	8.00'
ST3	S00°20'43"W	32.00'
ST4	S44°39'17"E	8.00'
ST5	S89°12'31"E	152.00'
ST6	S44°15'35"E	8.00'
ST7	S00°44'25"W	48.00'
ST8	S38°15'35"E	44.47'



66" STORM DRAIN TO EXISTING SPILLWAY
STA. 10+00.00 TO 13+81.76

FROM VRW BACKBONE PID PLANS

FROM VRWDMP

LINEAR POND
V=3.73 ac. ft.

36"SD

36" SD

TRACT 7

TRACT 6

TRACT 8

TRACT 5

TRACT 4

TRACT 9

CT 10

CT 11

ENTRANCE ROAD

EAST-WEST ROAD

60"SD

42"SD

APPROXIMATE NEW TRACT BOUNDARY (SEE PLAT)

Model Q= 436 cfs

66"SD

Model Q= 68 cfs

Design Q= 76 cfs

WEST BRANCH CALABACILLAS
STORM DRAIN DIVERSION

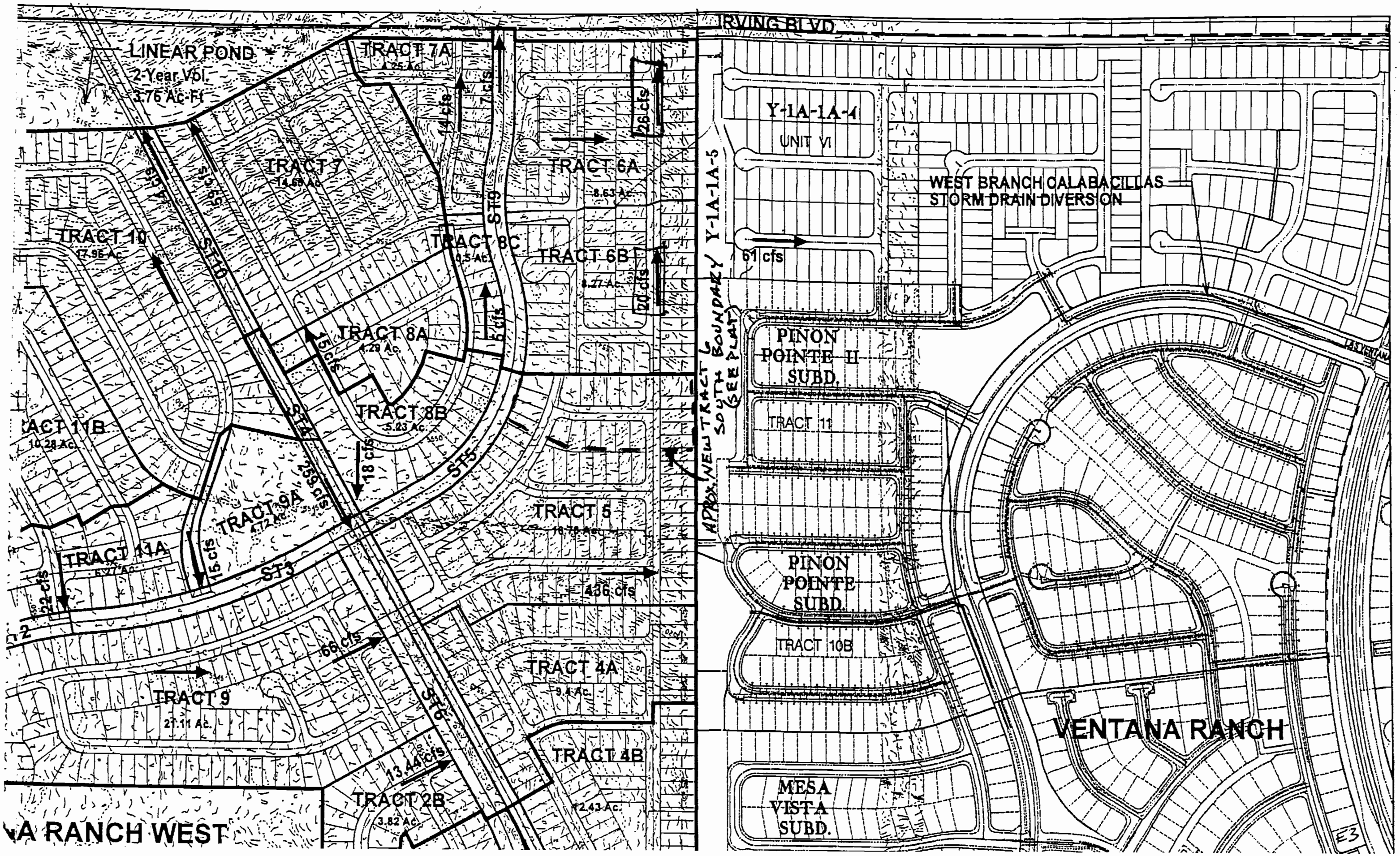
DESIGN FLOW

Design Q=432 cfs

EX.66"SD

E2

FROM VRWDMP


IRVING BLVD
LINEAR POND
2-Year Vol.
3.76 Ac-Ft
TRACT 7A
2.5 Ac.
TRACT 7
14.69 Ac.
TRACT 6A
8.63 Ac.
TRACT 8C
0.5 Ac.
TRACT 6B
8.27 Ac.
TRACT 10
17.96 Ac.
TRACT 8A
8.29 Ac.
TRACT 8B
5.23 Ac.
TRACT 11B
10.28 Ac.
TRACT 9A
4.12 Ac.
TRACT 11A
6.27 Ac.
TRACT 5
16.78 Ac.
TRACT 9
21.11 Ac.
TRACT 4A
9.4 Ac.
TRACT 4B
12.43 Ac.
TRACT 2B
3.82 Ac.
ST1
ST2
ST3
ST4
ST5
ST6
ST9
ST10
7 cfs
14 cfs
26 cfs
20 cfs
5 cfs
15 cfs
18 cfs
259 cfs
15 cfs
22 cfs
436 cfs
66 cfs
134 cfs
Y-1A-1A-4
UNIT VI
Y-1A-1A-5
61 cfs
WEST BRANCH CALABACILLAS
STORM DRAIN DIVERSION
PINON
POINTE II
SUBD.
TRACT 11
PINON
POINTE
SUBD.
TRACT 10B
MESA
VISTA
SUBD.
VENTANA RANCH
A RANCH WEST
APPROX. NEW TRACT BOUNDARY
(SEE PLAT)
E3

IRVING BLVD

SUMP INLET

RAINBOW BOULEVARD

PETREL DRIVE

ROSE FINCH DRIVE

FUNCO PLACE

C-3
0.13 Ac

E-2
0.30 Ac

D-1
1.72 Ac

E-3
1.60 Ac

D-2
3.13 Ac

A-3
Acres

1.43%
Q100=9.3CFS
1.43%
Q100=1.0CFS
Q=6.0CFS
Q100=4.08CFS
0.60%
Q100=20.98CFS
QR=16.21CFS
1.53%
1.53%

Irving Blvd. + RAINBOW

Input Data (I1)

Shape	Circular
Material	RC C76-A
Roughness	0.013000
Method	Manning
Flow Rate	8.4000 cfs
Slope	0.650%
Size (W x T):	18.00 x 2.5000 LATERAL

Output Results

Flow Rate	8.4000 cfs
Slope	0.650%
d/D	0.81
Capacity	8.4689 cfs
Velocity	5.47 ft/s
Depth	1.22 ft
Critical Depth	1.12 ft
Size (W x T):	18.00 x 2.5000

Junco Place

Input Data (J1)

Shape	Circular
Material	RC C76-A
Roughness	0.013000
Method	Manning
Flow Rate	36.8300 cfs
Slope	0.432%
Size (W x T):	36.00 x 4.7500

Output Results

Flow Rate	36.8300 cfs + 5.46 CFS
Slope	0.432% = 42.29 CFS
d/D	0.70
Capacity	43.8387 cfs < 43.84 CFS
Velocity	6.95 ft/s
Depth	2.10 ft
Critical Depth	1.97 ft
Size (W x T):	36.00 x 4.7500

E.T./5