City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 9, 1999

Diane Hoelzer, P.E.
Mark Goodwin & Associates
P. O. Box 90606
Albuquerque, New Mexico 87199

RE: Grading and Drainage Certification Plan for Aerie at High Desert Unit II (E23/D3G) Submitted for Release of Financial Guarantees, Engineer's Certification Stamp Dated 7/9/99.

Dear Ms. Hoelzer:

The above referenced plan is adequate to satisfy the Grading and Drainage Certification requirement per the Infrastructure List dated July 14, 1998 for the Release of Financial Guarantees for the Aerie at High Desert Unit II.

If you have any questions, or if I may be of further assistance to you, please call me at 924-3982.

Sincerely,

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Terri Martin, City Project # 536491
Larry Stroup, Clara Vista LLC
File

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

CITY OF
Albuquerque

November 6, 1996

Martin J. Chávez, Mayor

Mark Goodwin
Mark Goodwin & Associates
P.O. Box 90606
Albuquerque, NM 87199

RE: CLARA VISTA SUBDIVISION (E23-D3G). ENGINEER'S CERTIFICATION FOR RELEASE OF FINANCIAL GUARANTEE. ENGINEER'S CERTIFICATION DATED NOVEMBER 1, 1996.

Dear Mr. Goodwin:

Based on the information provided on your November 4, 1996 submittal, City Hydrology accepts the Engineer's Certification of grading and drainage for the release of financial guarantees.

If I can be of further assistance, please feel free to contact me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Andrew Garcia
File

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 2, 1996

Mark Goodwin
Mark Goodwin & Associates
P.O. Box 90606
Albuquerque, NM 87199

RE: CLARA VISTA SUBDIVISION (E23-D3G) GRADING PLAN FOR FINAL PLAT AND WORK ORDER PERMIT APPROVAL. ENGINEER'S STAMP DATED MARCH 13, 1996.

Dear Mr. Goodwin:

Based on the information provided on your March 20, 1996 submittal, the above referenced project is approved for Final Plat and Work Order Permits.

If I can be of further assistance, please feel free to contact me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Andrew Garcia
File

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

HYDRAULIC REPORT FOR

CLARA VISTA SUBDIVISION

MAIN LINE STORM DRAIN

REVISED MARCH 14, 1996

CITY OF ALBUQUERQUE

PROJECT NO. 5364.90

D.MARK GOODWIN AND ASSOC.

JOB NO. 95080

RECEIVED
MAR 20 1996
HYDROLOGY

Run date: 03-18-1996
File: A:\CLARA.ST3

Return Period = 5 Yrs
Rainfall file: Your_County

LINE 1 / Q = 187.6 / HT = 48 / WID = 48 / N = .013 / L = 69 / JLC = .25

1 / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	102.37	28.87	99.96	23.76	111.13	47.00	N/A	7.89
UPSTRM	105.02	28.87	102.61	23.76	113.78	47.00	5.08	7.89

Drainage area (ac)	= 0	Slope of invert (%)	= 3.841
Runoff coefficient	= 0	Slope energy grade line (%)	= 3.841
Time of conc (min)	= 2	Critical depth (in)	= 46.18
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 187.6	Confluence angle (deg)	= 0
Default Q (cfs)	= 187.6	Natural ground elev (ft)	= 111.7
Line capac. (cfs)	= 281.5	Line storage (cuft)	= 545

LINE 2 / Q = 171.8 / HT = 48 / WID = 48 / N = .013 / L = 46.3 / JLC = .25

2 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	107.21	48.00	103.11	13.67	110.11	0.00	4.58	12.56
UPSTRM	107.87	48.00	103.57	13.67	110.77	0.00	4.12	12.57

Drainage area (ac)	= 0	Slope of invert (%)	= 0.994
Runoff coefficient	= 0	Slope energy grade line (%)	= 1.431
Time of conc (min)	= 2	Critical depth (in)	= 45.16
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 171.8	Confluence angle (deg)	= 8.539
Default Q (cfs)	= 171.8	Natural ground elev (ft)	= 111.7
Line capac. (cfs)	= 143.2	Line storage (cuft)	= 582

RECEIVED
MAR 20 1996

LINE 3 / Q = 171.8 / HT = 48 / WID = 48 / N = .013 / L = 200 / JLC = .25

3 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	108.60	48.00	103.62	13.67	111.50	0.00	4.07	12.56
UPSTRM	121.77	45.21	118.00	14.00	124.81	22.45	7	12.27

Drainage area (ac) =	0	Slope of invert (%)	= 7.190
Runoff coefficient =	0	Slope energy grade line (%)	= 6.655
Time of conc (min) =	1	Critical depth (in)	= 45.16
Inlet time (min) =	0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr) =	0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A =	0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs) =	171.8	Confluence angle (deg)	= 0
Default Q (cfs) =	171.8	Natural ground elev (ft)	= 129
Line capac. (cfs) =	385.2	Line storage (cuft)	= 2484

LINE 4 / Q = 156.0 / HT = 48 / WID = 48 / N = .013 / L = 142.22 / JLC = .25

4 / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	122.53	48.00	118.05	12.42	124.92	0.00	6.94	12.56
UPSTRM	124.21	48.00	120.00	12.41	126.60	0.00	6.5	12.57

Drainage area (ac) =	0	Slope of invert (%)	= 1.371
Runoff coefficient =	0	Slope energy grade line (%)	= 1.180
Time of conc (min) =	0	Critical depth (in)	= 44.57
Inlet time (min) =	0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr) =	0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A =	0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs) =	156	Confluence angle (deg)	= 0
Default Q (cfs) =	156	Natural ground elev (ft)	= 130.5
Line capac. (cfs) =	168.2	Line storage (cuft)	= 1787

RECEIVE
MAR 2 0 1996

LINE 5 / Q = 156.0 / HT = 42 / WID = 42 / N = .013 / L = 40 / JLC = .25

5 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	124.81	42.00	120.06	16.22	128.89	0.00	6.94	9.62
UPSTRM	126.79	42.00	121.42	16.21	130.87	0.00	6.08	9.62

Drainage area (ac)	= 0	Slope of invert (%)	= 3.400
Runoff coefficient	= 0	Slope energy grade line (%)	= 2.405
Time of conc (min)	= 0	Critical depth (in)	= 41.11
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 156	Confluence angle (deg)	= 0
Default Q (cfs)	= 156	Natural ground elev (ft)	= 131
Line capac. (cfs)	= 185.5	Line storage (cuft)	= 385

RECEIVED
MAR 2 0 1996
HYDROLOGY DIVISION

D. Mark Goodwin & Associates, P.A.
Consulting Engineers and Surveyors

PROJECT Clark Vista
SUBJECT Drainage
BY MG DATE 1/17/96
CHECKED _____ DATE _____
SHEET 1 OF 1

We need to size Rear Yard Ponds:

AVG Area = 756 ft² = 0.0174 Ac

Volume comes out ok anyway

D = 2.90 in

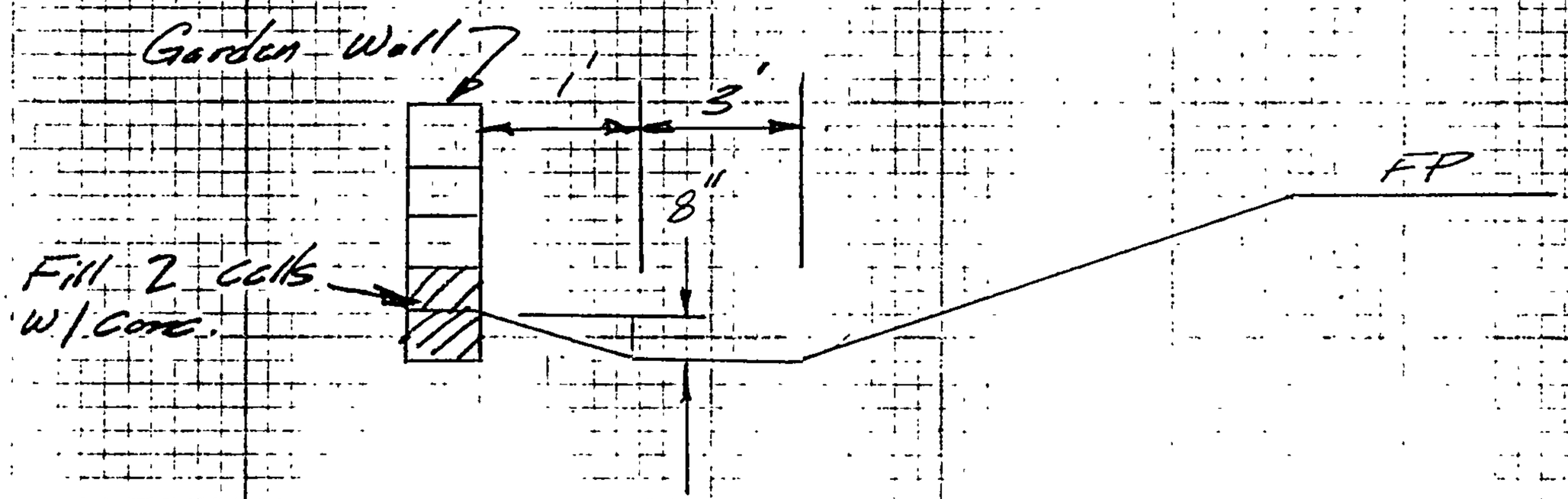
C = 0.35 (no roofs) If back yard is assumed to be grass C = .52 (Land type B, Zone 4)

Vol. = CDA = 65 cu. Ft.

A_B = .017 acres = 756 sf

$V = EA_B = (756 sf)(.09) = \underline{67 cf}$ ✓

$E = E_B$ = 1.08 inches = .09 ft



Vol. Prov'd. = 0.67' X 39' X 3 = 78 cu. Ft. ✓

RECEIVED
JAN 23 1996

DRAINAGE REPORT
for
CLARA VISTA SUBDIVISION

PREPARED FOR

Clara Vista LLC
4100 Prospect NE
Albuquerque, NM 87110

November 1995

NOV 2 2
HYDROLOGY DIV.

D. MARK GOODWIN
NEW MEXICO
8948
REGISTERED PROFESSIONAL ENGINEER

11/17/95

PURPOSE

The purpose of this report is to present the Drainage Management and Grading Plan for Final Plat and Work Order approvals for Tracts 2A-1A-1 and 2A-1A-2, High Desert. All applicable MasterPlans, Ordinances and the DPM were utilized for this study.

EXISTING CONDITIONS

These tracts are currently undeveloped and comprise an area of 11.02 acres, bounded by Spain Road (improved) on the north and vacant lands on the south east and west. The site is comprised of decomposed granites with medium vegetative cover. The site slopes from east to west at approximately 6%. Current on-site runoff is collected at two existing sedimentation ponds and discharged to two storm drain systems. Off-site runoff enters this site from the east.

These tracts were included in the approved Drainage Master Plan for High Desert, prepared by Bohannan-Huston, Inc. This plan does not deviate from the masterplan.

PROPOSED CONDITIONS

Clara Vista is to be developed into 82 single family townhome lots. The interior streets will drain to three locations for collection via curb inlets into proposed storm drains. Per the attached calculations, all of the streets have capacity for the anticipated flow rates including the potential for hydraulic jumps utilizing mountable curb and gutter.

In an effort to reduce retaining walls for this steep site, 34 lots will have rear yard ponds that will collect no impervious areas. All roof drainage and driveways will drain to the streets. Two – 100 year, 24 hour volumes for these ponds equals 281 CU. FT. A triangle shaped rear yard that is 16' inches (2 blocks) by 15 feet by 42 feet provides an available volume of 420 CU. FT. The bottom 2 courses of the garden walls will therefore be concrete filled to provide an impervious barrier.

The approved MasterPlan has this site in two different drainage basins based on existing topography. This plan proposes to grade such that the MasterPlan concept is adhered to. The developed, allowable flow rates are conformed to. Approximately 1/3 of this project will be collected in inlets at the southwest corner then conveyed to an existing storm drain near Spain and Tramway. The remaining 2/3 of the site will be collected in two locations then conveyed to an existing storm drain in Spain approximately mid-project. This storm drain will be extended through this project to Cortaderia for future extension to the east per the MasterPlan. Bohannan-Huston is currently designing Cortaderia and its drainage system such that there will be no off-site flows reaching this project. Cortaderia will be constructed ahead of this project or concurrently.

It is proposed to construct this project in two phases. The earthwork and all storm drains, retaining walls, etc. will be constructed in Phase I. Temporary sedimentation ponds will be constructed in Phase I within public right-of-way at the end of paved areas to prevent sedimentation.

INTERIM EROSION CONTROL

The erosion control plan centers on the fact that storm waters will not be allowed free discharge during the construction process nor off the finished lots prior to home construction. This detail is shown on the plans.

CONCLUSIONS

This report has shown that this project as presented can adequately handle stormwaters while meeting all current City of Albuquerque criteria. It has been shown how this site fits into the larger scheme off-site, and what off-site improvements will be necessary.

D. Mark Goodwin & Associates, P.A.
Consulting Engineers and Surveyors

PROJECT Clara Vista
SUBJECT Drainage
BY MG DATE 11/6/95
CHECKED _____ DATE _____
SHEET 1 OF 14

This project entails development of 83 Townhouse lots on 11.02 Ac. of undeveloped property within High Desert.

This site was part of the approved "High Desert Drainage Management Plan" by Bohannan - Huston.

Per the attached excerpts from the B-H-I report, this site comprises all of Basin 16 (7.7 Ac.) and 30 % of Basin 17 (3.32 Ac).

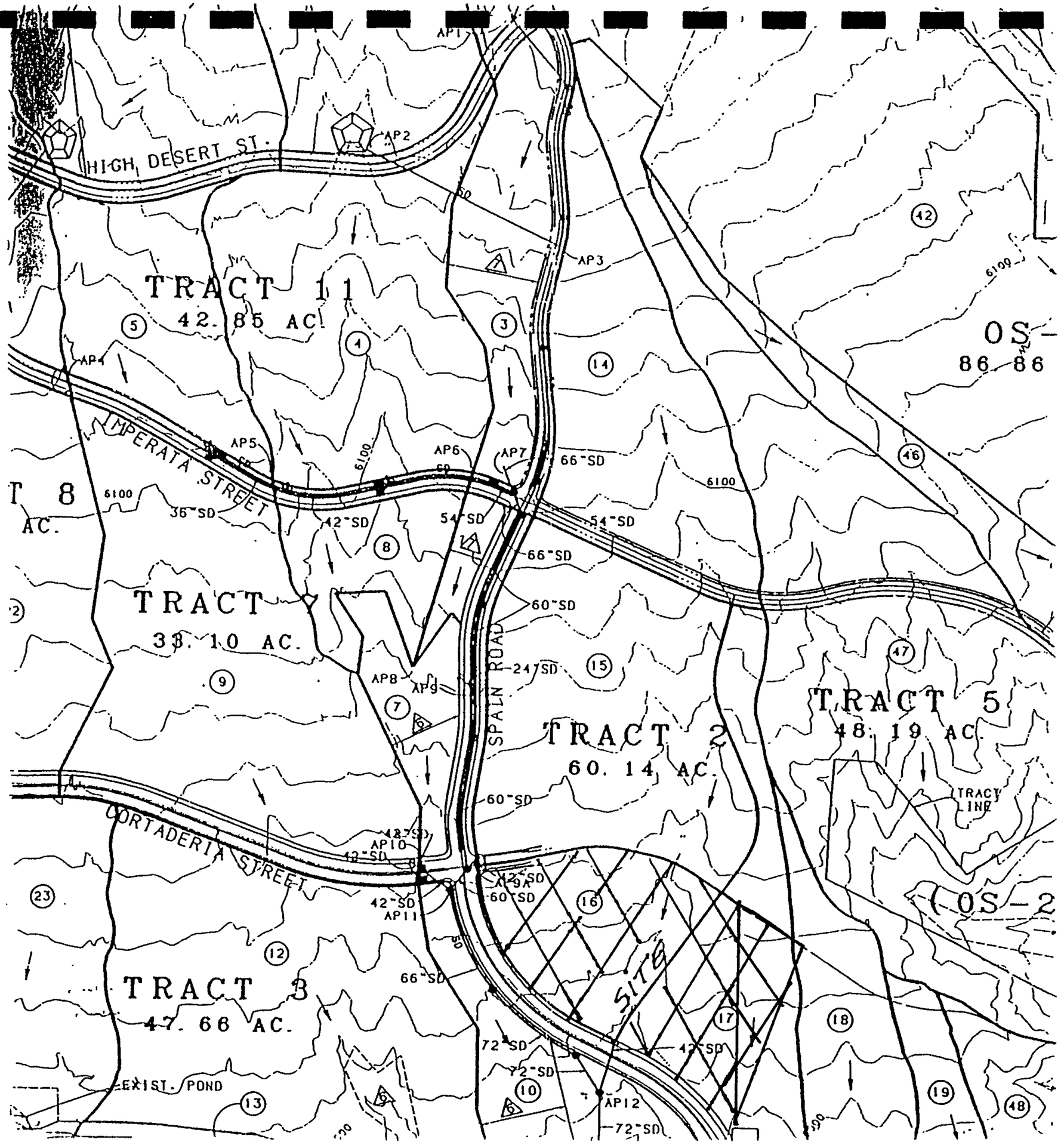
Per the approved report, Basin 16 is to be collected in the existing Storm Drain stubbed out from the 72" SD in Spain Rd.

Basin 17 is to drain to the Storm Drain at Tramway S. of Spain.

The allowable discharge for Basin 16 = 27 cfs
The allowable discharge for Basin 17 = 47 cfs
= 4.3 cfs./Ac.

The allowable Q for this sites portion of Basin 17 = 14.3 cfs How does the rest get to S.D.? 47 - 14.3 = 32.7 cfs

Off-site flows per the B-H-I report will come from Basins 14 & 15 = 147 cfs = 55 + 92
The masterplan requires that we route a 42" SD through this site to intercept the 147 cfs. No other off-site flows impact this site.


HIGH DESERT ST.
TRACT 11
42.85 AC.
IMPERATA STREET
T 8
AC.
TRACT
38.10 AC.
SPAIN ROAD
TRACT 2
60.14 AC.
TRACT 5
48.19 AC.
TRACT LINE
CORTADERIA STREET
TRACT 3
47.66 AC.
EXIST. POND
SITE
OS-
86.86
OS-2
AP1
AP2
AP3
AP4
AP5
AP6
AP7
AP8
AP9
AP9A
AP10
AP11
AP12
6100
36"SD
42"SD
54"SD
66"SD
60"SD
24"SD
48"SD
72"SD

BASIN HYDROLOGY - DEVELOPED C

BASIN NO.	BASIN ID	AREA (ACRES)	DISCHARGES TO	UNBULKED Q(100)	BULKED Q(100)	
	PA1-PA19					
1	NMBA-1(1)	31.4	42" SD	80	88	
2	NMBA-2(1)	16.6	36" SD	54	59	
3	NMBA-3A(3)	10.2	54" SD	25	27	
4	NMBA-3B(2)	20.5	36" SD	87	89	
5	NMBA-3C(2)	10.9	30"SD	47	48	
6	NMBA-3D(2)	8.3	IMPERATA STREET	36	36	
7	NMBA-4A(4)	7.7	24" SD	23	25	
8	NMBA-4B(2)	5.8	24" SD	27	27	
9	NMBA-4C(2)	24.3	42" SD	112	114	
10	NMBA-5(4)	10.2	EXISTING 60" CULVERT	30	32	
11	NMBA-6(1)	3.8	EXISTING 60" CULVERT	12	13	
12	NBA-1(2)	26.9	EXISTING 60" CULVERT	114	120	
13	NBA-2(1)	3.2	EXISTING 60" CULVERT	10	10	
14	SMBA-1(2)	15.4	BASIN 21	54	55	147
15	SMBA-2(2)	26.2	54" SD	90	92	
16	SMBA-3(2)	7.7	48" ~~42"~~ SD	27	27	
17	SBA-1(2)	10.9	EXISTING 36" CULVERT		47	
18	SBA-2(2)	13.4	EXISTING 36" CULVERT		28	
19	SBA-3		EXISTING 36" CULVERT		30	
20	SBT-1(1)	88.7	BASIN 21	244	268	
21	SBT-2(1)	61.4	54" SD	195	244	
22	SBT-3(2)	23.7	42" SD	94	96	
23	SBT-4(2)	15.4	EXISTING 84" CULVERT	65	66	
24	NBT-1(1)	44.8	36" SD	118	130	
25	NBT-2A(3)	14.7	30" CULVERT	42	45	
26	NBT-2B(2)	21.1	60" SD	89	90	
27	NBT-3A(5)	9	EXISTING 96" CULVERT	27	29	
28	NBT-3B(2)	17.3	EXISTING 96" CULVERT	73	74	
29	NBT-4(1)	1.9	EXISTING 96" CULVERT	6	6	
30	SPT-1(1)	133.1	BASIN 33	401	442	
31	SPT-2(1)	151	BASIN 34	563	620	
32	SPT-3(1)	51.2	BASIN 36	118	130	
33	SPT-4(1)	81.3	BASIN 35	147	162	
34	SPT-5(1)	103.7	BASIN 33	241	265	
35	SPT-6A(1)	23.7	BASIN 37	71	78	
36	SPT-6B(1)	89.6	BASIN 37	213	235	
37	SPT-7A(1)	38.4	96" SD	109	120	
38	SPT-7B(1)	29.4	96" SD	84	92	
39	SPT-8A(5)	17.3	120" SD	47	50	
40	SPT-8B(2)	23	120" SD	97	100	

DEVELOPED CONDITIONS - STOR

ALYSIS POINT	CONTRIBUTING BASINS	COMBINED Q(100) (CFS)	STORM DRAIN SIZE	MIN. PIPE SLOPE (%)	STORM DRAIN CAPACITY*	
AP1	1	88	30"	5.5	89	Flow in storm drain below
AP2	2	59	36"	1.75	82	Flow in storm drain below
AP3	1,2	146	42"	3.6	177	Total flow in storm drain
AP4	6	36	N/A	N/A	N/A	Flow from basin 6 discharg
AP5	6,5	81	42"	0.75	81	Flow in storm drain from b
AP6	6,5,4	166	54"	0.75	158	Flow in storm drain from b
AP7	1-6	193	66"	1.25	349	Total flow in storm drain
AP7A	1-6	340	60"	2.85	408	Total flow in storm drain
AP8	8	27	24"	2	30	Flow in storm drain from b
AP9	1-6, 8	366	60"	4.6	519	Total flow in storm drain :
AP9A	1-6, 8,14,15	510	60"	4.2	495	Total flow in storm drain :
AP10	7, 9	114	42"	3	162	Flow in storm drain from b.
AP11	1-9, 14, 15	642	66"	5.2	711	Total flow in storm drain :
AP12	1-9, 14-16	668	72"	3.1	692	Total flow in storm drain :
AP13	AP12 (Routed)	668	2 EX. 60" CULVER	5.2	1102	Flow in storm drain at pip
AP14	12	126	EX. 60" CULVERT	N/A	230	Flow at existing Tramway c
AP15	17	47	EX. 36" CULVERT	N/A	42	Flow at existing Tramway c
AP16	18	28	EX. 36" CULVERT	N/A	24	Flow at existing Tramway c
AP17	19	30	EX. 36" CULVERT	N/A	37	Flow at existing Tramway c
AP18	20	268	N/A	N/A	N/A	Flow from basin 20.
AP19	21	466	66"	2.7	512	Flow in storm drain below :
AP20	24	130	36"	4.4	130	Flow in storm drain below
AP20A	20, 21, 24	584	66"	4.2	639	Total flow in storm drain :
AP21	20-22, 24-26	788	78"	3.1	857	Total flow in storm drain a
AP22	21-29	948	EX. 96" CULVERT	1.94	**1269	Total flow at Tramway. Pip
AP23	30, 31, 33, 3	1335	N/A	N/A	N/A	Flow from basins 33 & 34 a
AP24	30, 31, 33-35	1380	N/A	N/A	N/A	Flow from basins 34-35 and
AP25	32, 36	235	N/A	N/A	N/A	Flow from basin 36 and ups
AP26	30-37	1730	96"	4.2	1736	Flow in storm drain beneat
AP27	30-38	1795	96"	4.5	1796	Total flow in storm drain :
AP28	30-39	1835	120"	1.57	1924	Total flow in storm drain
AP29	40,	100	42"	1.57	117	Flow in storm drain basin
AP30	30-40	1895	120"	1.44	**1984	Total flow in storm drain
AP31	30-41	1930	6 EX. 60" CULVER	1.84	**2120	Total flow at Tramway. Pip

Storm drain capacity based on non-pressurized full pipe flow, unless otherwise noted, and
* n = 0.013

ON-SITE DEVELOPED CONDITIONS

Precipitation Zone 4: $P_1 = 2.23$ in. $P_6 = 2.90$ $P_{24} = 3.65$

Basin Land Treatments:

Treatment B = 45%
Treatment C = 5%
Treatment D = 50%

Per Attached HYMO Runs:

Q (Basin 16) = 31.6 cfs
Q (Basin 17) = 13.7 cfs

Basin 16 is 4 cfs over which is negligible given that SD is sized for open channel

Basin 17 is 0.6 cfs under

D. Mark Goodwin & Associates, P.A.
Consulting Engineers and Surveyors

PROJECT Clara Vista
SUBJECT Drainage
BY MG DATE 11/6/
CHECKED _____ DATE _____
SHEET 10 OF 14

Street Capacities :

We wish to use mountable curb & Gutter wherever possible. We have the following worst case conditions :

- 15.8 cfs, 28' FF, 3%
- 15.8 cfs, 28' FF, 1½%
- 13.7 cfs, 28' FF, 2%

Allowable depth including potential for Hydraulic Jump = 0.33 + 0.18 = 0.51'

Per attached calculations, all flows are confined to 2/w & do not need standard curb.

FINDING STREET CAPACITY – 28 F–F CROSS–SECTION FOR 4" CURB

$Q = 1.49/n\ A\ R\hat{}(2/3)\ S\hat{}\frac{1}{2}$
$n = 0.017$
SLOPE = STREET SLOPE
$R\hat{}2/3 = (A/P)\hat{}2/3$
D2 = HYDRAULIC DEPTH AFTER HYDRAULIC JUMP = $D1/2\ [SQRT\ (1 + 8Fr^2) - 1]$
$E = V^2 / 2g$

HALF STREET CALCULATIONS

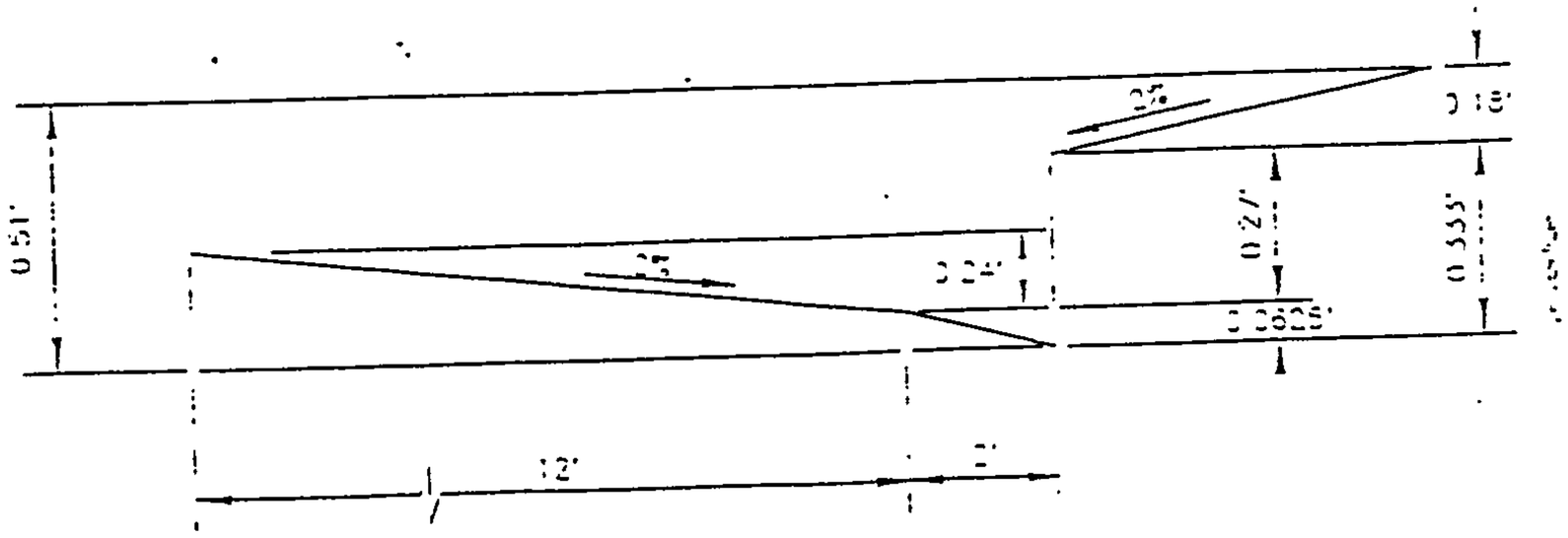
$@Y \leq 0.0625$
$A1 = \frac{1}{2} Y\ (Y/0.03125) = 16Y^2$
$P1 = SQRT[Y^2 + (Y/0.03125)^2] + Y = SQRT(1025\ Y^2) + Y$

$@\ 0.0625 < Y \leq 0.3025\ \&\ \ Y1 = Y - 0.0625$
$A2 = A1 + \frac{1}{2}Y1\ (Y1/0.02) + 2Y1 = A1 + 25Y1^2 + 2Y1$
$P2 = P1 + SQRT[Y1^2 + (Y1/0.02)^2] + Y1 = P1 + SQRT(2501\ Y^2) + Y1$

$@\ 0.3025 < Y \leq 0.333\ \&\ \ Y2 = Y - 0.3025$
$A3 = A2 + 14Y2$
$P3 = P2 + Y2$

$@\ 0.333 < Y \leq 0.513\ \&\ \ Y3 = Y - 0.333$
$A4 = A3 + 14Y3 + \frac{1}{2}Y3[Y3/(0.02)] = A3 + 14\ Y3 + 25\ Y3^2$
$P4 = P3 + SQRT(Y3^2 + [Y3/(0.02)]^2) = P3 + SQRT(2501\ Y3^2)$

SEE THE FOLLOWING SHEET FOR INPUT AND OUTPUT FILE FOR CALCULAITON RESULTS FROM COMPUTER PROGRAM USING THE EQUATION SHWON ABOVE



28' F–F
4" CURB

NOT TO SCALE

28-FT F-F, 4" CURB STREET SECTION

STREET CAPACITY BASED ON 100-YR STORM

FLOW CFS	SLOPE FT/FT	Dn FT	Vn FT/S	D*V FT3/S	Fr	E FT	D2 FT
15.80	.03000	.300	4.045	1.215	1.301	.554	.422
15.80	.01500	.333	3.273	1.091	.999	.500	----
13.70	.02000	.306	3.373	1.032	1.075	.483	.336

END OF THE OUTPUT FILE

D. Mark Goodwin & Associates, P.A.
Consulting Engineers and Surveyors

PROJECT Clara Vista
SUBJECT Drainage
BY MG DATE 11/6/95
CHECKED _____ DATE _____
SHEET 13 OF 14

STORM DRAIN SIZING :

For this report, we will analyze the required storm drains as open channels - for work order we will calculate hydraulic grade lines.

Basin 16 :

We are required to route a SD through this site to pick up Basins 14 + 15 E. of Cortaderia :

Q = 147 cfs

AVG. Slope = $\frac{12'}{400'}$ = 3%

SD = 42"

At Vulcan Vista AVE. we will Add 15.8 cfs.
Q = 162.8 S = 3%
SD = 42"

At Bosque Vista Rd. we will add another 15.8 cfs

Q = 178.6 cfs S = 3%

SD = 48"

Basin 17 :

At Oso Vista & Bosque Vista
Q= 13.7
Avg. slope = 1%
SD = 24"

Inlet Requirements :

Vulcan Vista & Bosque Vista
Q= 15.8 cfs
inlets will be placed in a sump condition – we will double no. of inlets for this reason.

D = 0.30' worst case
inlets will act as weirs
Type "A" has perimeter of
= 6.45' + 2 + 2 = 10.45'

$Q = CLH^{3/2} = 2.9(10.45)(0.3)^{3/2} = 4.98$ cfs/EA.

No. REQ'D = $\frac{15.8}{4.98} = 3.17$ use 4 @ EA location

For Bosque Vista @ Oso Vista we need 3

DRAINAGE REPORT
FOR
HIGH DESERT- CORTADERIA STREET EXTENSION

NOVEMBER 1995

Prepared by:

BOHANNAN-HUSTON INC.
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Prepared for:

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NEW MEXICO
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REGISTERED PROFESSIONAL ENGINEER

PREPARED BY: **UNDER THE SUPERVISION OF:**

11/3/95

Pierce Runnels, E.I. **Date** **James Topmiller, P.E.** **Date**

11/3/95

RECEIVED
NOV 6 1995
HYDROLOGY DI

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I. PURPOSE

The purpose of this report is to present historic and proposed drainage conditions for the proposed extension of Cortaderia Street in High Desert Subdivision, and to obtain approval of the drainage report to support the construction plans for this project.

II. METHODOLOGIES

Site conditions are 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.

This report will reference the following City of Albuquerque approved studies prepared for the High Desert Development: 1) the *High Desert Drainage Management Master Plan*, dated December 1993, and 2) the *Final High Desert Phase 1 Hydrology and Design Drainage Report*, dated March 1994.

The *High Desert Drainage Management Master Plan*, dated December 1993, was prepared to support future drainage plans submitted for the development of individual land parcels within High Desert, and to provide design guidance to the installation of major drainage infrastructure to be constructed by High Desert in advance of, or simultaneously with, individual parcel development. In addition, it provides fully developed flow rates for basins that influence Tracts within the High Desert Development infrastructure. Copies of the Hydrology and Hydraulic Summary Map and Summary Table for the Ultimate Developed Conditions are included in the plates section of this report.

The *Final High Desert Phase 1 Hydrology and Design Drainage Report*, dated March 1994 (Phase 1 report), was prepared to provide the necessary

hydrologic and hydraulic information for the design of the High Desert Phase 1 infrastructure. That report provides the existing hydrology for this report and is based upon the above mentioned *High Desert Drainage Management Master Plan*. A copy of the Phase 1 Development Conditions Map is included in the plates section of this report.

III. SITE LOCATION AND CHARACTERISTICS

Please refer to the plat map enclosed with this report.

The Cortaderia Street Extension is a southerly continuation of the existing Cortaderia Street. Cortaderia Street is the first street east of and parallel to Tramway Boulevard, and the Extension covered by this report is located between Spain Road and the tract boundary of Tract 2A-1B-1. The construction of the Cortaderia Street Extension affects the runoff from Drainage Basins 14 and 16, as shown on the High Desert Phase 1 Development Conditions Map.

The roadway right-of-way for the Cortaderia Street Extension is 72 feet wide. The street typical section consists of a driving lane and bicycle lane in each direction with a 12 foot wide median. This report will reflect the construction of the roadway improvements.

Existing vegetation consists primarily of prairie grasses and a few juniper trees. Slopes in the project site range from 2% to 8%, with the majority of the project sloping at 5% to the west. The Soil Conservation Service has classified the soils in this site area as Embudo-Tijeras complex, Embudo gravelly fine sandy loam, and Tijeras gravelly fine sandy loam, all of which correspond to a common hydrological soil group classification of B.

IV. EXISTING HYDROLOGIC AND SITE DRAINAGE CONDITIONS

Please refer to the existing drainage conditions map enclosed with this report.

The existing conditions are a result of the High Desert Phase 1 improvements, and the hydrology and hydraulic calculations supporting that construction are included in the Phase 1 report. As shown on the Existing Drainage Conditions Map, the existing basins consist of Basin 14, Basin 16 and a portion of Tract 5A. Basin 14, with a peak runoff of 80 cfs, flows into Basin 16 (peak runoff=27 cfs) via sheet flow and a pair of defined natural channels. The combined flows, totaling 107 cfs, continue west to Ponds 5A and 5B, where they are intercepted into a 48" storm drain which connects to the existing 72" storm drain line on the east side of Spain Road.

The area to the south, a portion of Tract 5A, flows to the south and west and is intercepted in Tract 2A-1B-1. The drainage report for the development of Tract 2A-1B-1 is being submitted concurrently with this report and details the treatment of these flows as off-site flows accepted by that development.

FEMA Floodplain

According to the latest FEMA floodplain maps, there are no existing floodplains within the site. The closest FEMA floodplains lie to the south in the Bear Canyon Arroyo and north in the Bear Arroyo, north of Spain.

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ALBUQUERQUE LAS CRUCES SANTA FE

V. PROPOSED (DEVELOPED) HYDROLOGIC AND HYDRAULIC CONDITIONS

Please refer to the Proposed Drainage Conditions Map enclosed with this report.

The Cortaderia Street Extension is divided into two new drainage basins, Cort1 and Cort2. Basin Cort1 is approximately 1.38 acres in size and is assumed to be 100% impervious for the hydraulic analyses. This basin generates a total of 7.3 cfs which is intercepted by three catch basins located at the low point in the new roadway. Two double grate type "D" storm inlets and one single grate type "D" storm inlet will be constructed with the roadway. These inlets discharge into a 42" storm drain line which runs under the Cortaderia Extension at the location of a "Future Street." The Basin Cort2 discharges to Tract 2A-1B-1, where it is conveyed along the street to catch basins. The storm inlets were designed with an additional basin, "Yards," contributing to the roadway peak flows. It is possible that the lots along the east side of Cortaderia will contribute to the street flow, and so we added in the flow from a 60' strip of Type B Land Treatment on the east side of Cortaderia Street.

The construction of the Cortaderia Extension interrupts the flow from Basin 14 to Basin 16. Seventy-five percent of the runoff from Basin 14, 60 cfs, is captured in a sedimentation pond in the northeast corner of the Cortaderia/Future Street intersection. The pond discharges into a channel alongside Cortaderia which discharges into the 42" storm drain line running under Cortaderia. This 42" line is a portion of the ultimate developed conditions and therefore is sized to handle the ultimate developed flow of 147 cfs (as indicated by the Drainage Master Plan).

The 42" storm drain outfalls in Basin 16 and is conveyed via a new earthen swale to the existing natural channel. The flows are combined in the natural channel where they are conveyed to the existing Ponds 5a and 5b adjacent to Spain Road. From these sedimentation ponds, the flows enter an existing 48" storm drain which goes west under Spain Road and ties into the 72" storm drain system west of Spain Road.

When Tract 2A-1A is developed, it will be the responsibility of the developer of that parcel to complete the 42" storm drain line between the outflow of Ponds 5a and 5b and the line running under Cortaderia Street at the location of the "Future Street."

VI. CONCLUSION

This report presents a workable drainage management plan for the proposed Cortaderia Street Extension construction. The plan provides safe and adequate drainage protection for the proposed development and is consistent with the previous, approved *High Desert Drainage Management Master Plan* and the *Final High Desert Phase 1 Hydrology and Design Drainage Report*. It is recommended this plan be approved as presented.

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BASIN HYDROLOGY - PHASE I

BASIN NO.	BASIN ID	AREA (ACRES)	DISCHARGES TO	UNBULKED Q(10)	BULKED Q(10)	UNBULKED Q(100)	BULKED Q(100)	
1	NMBA-1A(1)	88.77	NMBA-1B	91	100	218	240	--
2	NMBA-1B(1)	67.2	POND #1	47	52	124	136	--
3	NMBA-1C(1)	46.1	POND #3	28	31	78	86	West basin bo
4	NMBA-2A(1)	16.6	POND #2	7	8	19	21	West basin bo
5	NMBA-2B(1)	8.3	POND #2A	7	8	19	21	West basin bo
6	NMBA-2C(1)	26.2	IMPERATA STREET CHANNEL	22	24	59	64	West basin bo
7	NMBA-2D(2)	2.6	IMPERATA STREET STORM DRAIN	7	8	12	12	Imperata St.
8	NMBA-4A(3)	7.7	POND #4	10	11	21	23	South basin b
9	NMBA-4B(2)	5.8	NMBA-4A	17	18	27	27	--
10	NMBA-4C(2)	22.4	CORTADERIA STREET CHANNEL	63	65	101	103	--
11	NMBA-4D(2)	3.2	CORTADERIA STR. STORM DRAIN	9	9	15	15	Cortaderia St
12	NMBA-5(4)	9.2	EXISTING 60" CULVERT	9	10	23	25	South basin b
13	NMBA-6(1)	3.8	EXISTING 60" CULVERT	6	6	12	13	Basin within
14	SMBA-1A(2)	35.2	POND #5B	28	29	78	80	--
15	SMBA-1B(2)	1.3	SPAIN ROAD STORM DRAIN	4	4	6	6	South half of
16	SMBA-2A(2)	7.7	POND #5A	15	15	27	27	--
17	SMBA-2B(2)	0.6	SPAIN STORM DRAIN @ TRAMWAY	2	2	3	3	South half of
18	SBA-1(2)	10.9	EXISTING 36" CULVERT	28	28	46	47	--
19	SBA-2(2)	6.6	EXISTING 36" CULVERT	17	17	28	28	--
20	SBA-3(2)	6.8	EXISTING 36" CULVERT	18	18	29	30	--
21	NBA-1(2)	26.2	EXISTING 60" CULVERT	67	68	110	112	--
22	NBA-2(1)	3.2	EXISTING 60" CULVERT	5	5	10	11	Basin within
23	NBT-1A(1)	49.9	NBT-2B	30	33	83	91	--
24	NBT-1B(1)	2.6	NBT-1A	4	4	8	8	Includes High
25	NBT-2A(1)	7.0	NBT-2B	7	8	17	19	--
26	NBT-2B(1)	53.1	EXISTING 96" CULVERT	42	47	115	127	--
27	NBT-4(2)	1.9	EXISTING 96" CULVERT	3	3	6	7	Basin within
28	SBT-3(1)	25.6	POND #1	23	26	60	66	--
29	SBT-4(2)	14.7	EXISTING 84" CULVERT	38	39	62	63	--
30	SBT-5(2)	3.2	ACADEMY RD. STORM DRAIN	9	9	14	15	South half of
31	SBT-6 (1)	1.3	ACADEMY STORM DRAIN TRAMWAY	4	4	6	7	South half of

REPRINTED FROM "FINAL HIGH DESERT PHASE I HYDROLOGY AND DESIGN DRAINAGE REPORT"

CORTADERIA STREET EXTENSION BASINS
PROPOSED CONDITIONS
100-YEAR STORM

BASIN ID	AREA AC	AREA SQ.MI.	% LAND TREATMENT A	B	C	D	TIME OF CONCENT	RATIONAL METHOD COMPOSITE C	I (IN/HR)	Q (CFS)
CORT1	1.383	0.0022	0	0	0	100	0.2	0.94	5.61	7.293
CORT2	0.501	0.0008	0	20	5	75	0.2	0.842	5.61	2.367
YARDS	0.988	0.0015	0	100	0	0	0.2	0.52	5.61	2.882

CORTADERIA

MANNING'S N = .0170 SLOPE = .0068

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	5.00	5	29.00	4.57	9	62.63	4.82
2	7.38	4.82	6	41.00	4.57	10	72.00	5.00
3	9.00	4.32	7	60.00	4.38			
4	10.00	4.38	8	61.00	4.32			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
4.33	0.01	0.0	0.0	0.4	0.2	0.38
4.34	0.02	0.0	0.0	0.8	0.3	0.76
4.35	0.03	0.0	0.0	1.2	0.4	1.15
4.36	0.04	0.0	0.0	1.5	0.5	1.53
4.37	0.05	0.0	0.0	1.9	0.6	1.91
4.38	0.06	0.1	0.0	2.3	0.7	2.29
4.39	0.07	0.1	0.1	3.9	0.6	3.86
4.40	0.08	0.1	0.1	5.9	0.6	5.92
4.41	0.09	0.2	0.1	8.0	0.6	7.99
4.42	0.10	0.3	0.2	10.1	0.7	10.05
4.43	0.11	0.4	0.3	12.2	0.8	12.12
4.44	0.12	0.5	0.4	14.2	0.8	14.18
4.45	0.13	0.7	0.6	16.3	0.9	16.25
4.46	0.14	0.9	0.8	18.4	0.9	18.31
4.47	0.15	1.1	1.1	20.4	1.0	20.38
4.48	0.16	1.3	1.4	22.5	1.1	22.44
4.49	0.17	1.5	1.7	24.6	1.1	24.51
4.50	0.18	1.8	2.1	26.6	1.2	26.57
4.51	0.19	2.0	2.5	28.7	1.2	28.64
4.52	0.20	2.3	3.0	30.8	1.3	30.70
4.53	0.21	2.7	3.6	32.8	1.3	32.77
4.54	0.22	3.0	4.2	34.9	1.4	34.83
4.55	0.23	3.4	4.9	37.0	1.5	36.90
4.56	0.24	3.7	5.6	39.0	1.5	50.96
4.57	0.25	4.1	6.4	41.1	1.6	53.03
4.58	0.26	4.6	7.5	41.8	1.6	53.69
4.59	0.27	5.0	8.6	41.8	1.7	53.76
4.60	0.28	5.7	9.2	53.9	1.6	53.82
4.61	0.29	6.3	10.7	54.0	1.7	53.89
4.62	0.30	6.8	12.2	54.0	1.8	53.95
4.63	0.31	7.3	13.9	54.1	1.9	54.01
4.64	0.32	7.9	15.6	54.2	2.0	54.08
4.65	0.33	8.4	17.4	54.3	2.1	54.15
4.66	0.34	9.0	19.3	54.3	2.2	54.21
4.67	0.35	9.5	21.3	54.4	2.2	54.28
4.68	0.36	10.0	23.4	54.5	2.3	54.34
4.69	0.37	10.6	25.5	54.5	2.4	54.40
4.70	0.38	11.1	27.7	54.6	2.5	54.47
4.71	0.39	11.7	29.9	54.7	2.6	54.53
4.72	0.40	12.2	32.3	54.7	2.6	54.60
4.73	0.41	12.8	34.7	54.8	2.7	54.67
4.74	0.42	13.3	37.2	54.9	2.8	54.73
4.75	0.43	13.9	39.7	54.9	2.9	54.79
4.76	0.44	14.4	42.4	55.0	2.9	54.86
4.77	0.45	15.0	45.0	55.1	3.0	54.93
4.78	0.46	15.5	47.8	55.1	3.1	54.99
4.79	0.47	16.1	50.6	55.2	3.2	55.06
4.80	0.48	16.6	53.5	55.3	3.2	55.12
4.81	0.49	17.2	56.4	55.3	3.3	55.18
4.82	0.50	17.7	59.5	55.4	3.4	55.25
4.83	0.51	18.3	61.9	56.3	3.4	56.18
4.84	0.52	18.8	64.4	57.3	3.4	57.11
4.85	0.53	19.4	67.0	58.2	3.5	58.04
4.86	0.54	20.0	69.7	59.1	3.5	58.97
4.87	0.55	20.6	72.4	60.1	3.5	59.90
4.88	0.56	21.2	75.2	61.0	3.5	60.83
4.89	0.57	21.8	78.1	61.9	3.6	61.76

$Q_{100} = 10.2$ CFS

$E = 0.29 + \frac{1.7^2}{2g} = 0.33'$ OK

CATCH BASINS: (IN SUMP CONDITION)

INSTALL A SINGLE GRATE TYPE "D" CATCH BASIN ON EACH SIDE OF CORTADERIA @ LOW POINT • STA 77+06.09

TOTAL Q TO LOW POINT = $Q_{100} = \frac{1}{2}(7.3) = 3.65$ (WEST)

$Q_{100} = 3.65 + 2.9 = 6.55$ (EAST)

SINGLE GRATE:

ORIFICE EQ'N:

$Q = 0.6 A_{NET} \sqrt{2gh}$ $\quad h = 0.33'$

$A_{NET} = \frac{31(18.5)}{144} = 3.98$ SF

$Q = 0.6(3.98)(2(32.2)(0.33))^{1/2}$

$= 11.0$ CFS

WEIR EQUATION:

$Q = 2.68 P_{NET} H^{1.5}$

$P_{NET} = [2(31) + 2(18.5)]/12$

$= 8.25$ FT

$Q = 4.2$ CFS

DOUBLE GRATE:

ORIFICE EQ'N:

$A_{NET} = 2(3.98) = 7.96$ SF

$Q = 22$ CFS

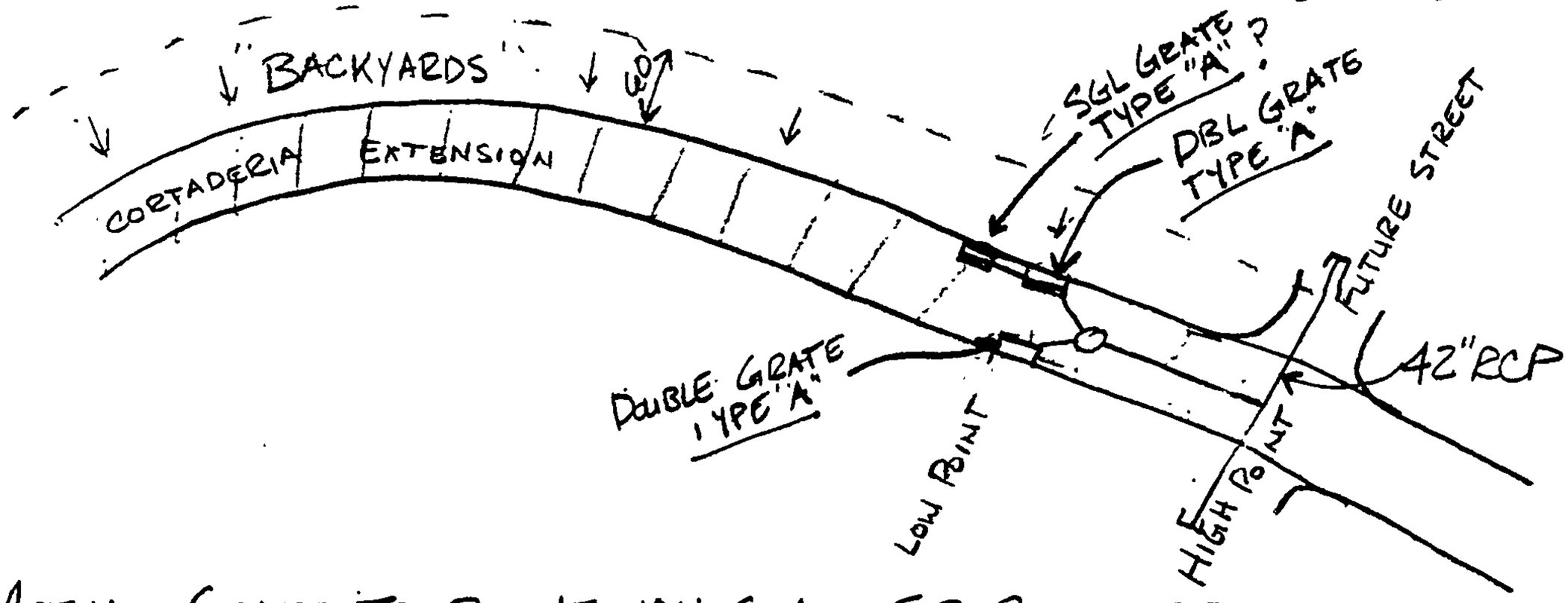
WEIR EQUATION:

$P_{NET} = [4(31) + 2(18.5)]/12$

$= 13.4$ FT

$Q = 6.81$ CFS

∴ NEED SINGLE GRATE "D" ON WEST SIDE AND DOUBLE GRATE "D" ON EAST SIDE OF CORTADERIA. TO ADD 50%, USE A DOUBLE "D" ON WEST AND A DOUBLE "D" AND SINGLE "D" ON EAST:



ACTUAL GRATE TO BE NEENAH GRATE FOR ROLL CURB

BOHANNAN-HUSTON INC.

PROJECT NAME CORTADERIA EXTENSION SHEET ____ OF ____

PROJECT NO. ____ BY PR DATE 10/30/95

SUBJECT DRAINAGE REPORT CH'D ____ DATE ____

SIZE STORM DRAIN PIPE UNDER CORTADERIA EXTENSION ALONG "FUTURE STREET" ALIGNMENT:

DESIGN FOR 2.5% SLOPE:

AS SHOWN ON PLATES 7 AND 8, WHICH GIVE THE ULTIMATE DEVELOPED CONDITIONS, THE SD LINE FROM THE CORTADERIA EXTENSION WILL CARRY THE RUNOFF FROM BASIN 14 (55 CFS) AND BASIN 15 (92 CFS).

THEREFORE: Q_{100} (BULKED) = 55+92 = 147 CFS

$S_f = 0.03$ $n = 0.013$

SOLVE FOR SIZE USING MANNING'S

→ MINIMUM DIAMETER = 3.4 FT

<u>USE 42" RCP</u>

BOHANNAN-HUSTON INC.

PROJECT NAME CORTADERIA EXTENSION SHEET _____ OF _____

PROJECT NO. _____ BY PR DATE 11/1/95

SUBJECT DRAINAGE REPORT CH'D _____ DATE _____

PARALLEL TO CORTADERIA EXTENSION:

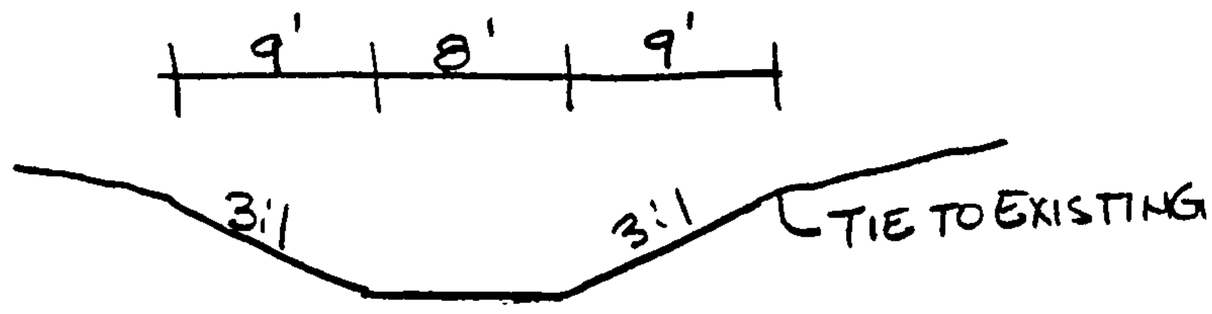
EARTH SWALE ALONG CORTADERIA EXTENSION
FROM STA 72+40 TO STA 76+50 (POND)

SWALE TO BE NON-EROSIVE ($V_{10} < 3$ FPS) IN 10-YEAR STORM.

Q_{10}(BULKED) = 29 CFS SLOPE = 0.5%

Q_{100}(BULKED) = 80 CFS

CHANNEL SECTION:



FROM RATING TABLE: V_{10} = 2.9 FPS < 3.0 FPS ✓

d_{100} = 1.80 FT V_{100} = 3.8 FPS

ADD FREEBOARD = $1 + 0.025 V\sqrt[3]{d}$ = 1.12'

PROVIDE 1.80 + 1.12 = 2.92' USE 3' DEPTH

BOHANNAN-HUSTON INC.

PROJECT NAME CORTADERIA EXTENSION SHEET _____ OF _____

PROJECT NO. _____ BY PR DATE 10/30/95

SUBJECT DRAINAGE REPORT CH'D _____ DATE _____

CORTADERIA EXTENSION CHANNEL

MANNING'S N = .0300 SLOPE = .0050

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	5.00	3	15.00	2.10			
2	9.00	2.00	4	24.00	5.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
2.05	0.05	0.1	0.0	3.2	0.3	3.15
2.10	0.10	0.3	0.1	6.3	0.5	6.30
2.15	0.15	0.6	0.5	6.6	0.7	6.61
2.20	0.20	1.0	0.9	7.0	0.9	6.91
2.25	0.25	1.3	1.5	7.3	1.1	7.22
2.30	0.30	1.7	2.2	7.6	1.3	7.52
2.35	0.35	2.1	3.0	7.9	1.4	7.83
2.40	0.40	2.5	3.9	8.2	1.6	8.13
2.45	0.45	2.9	4.9	8.6	1.7	8.44
2.50	0.50	3.3	6.0	8.9	1.8	8.74
2.55	0.55	3.8	7.3	9.2	1.9	9.05
2.60	0.60	4.2	8.6	9.5	2.0	9.35
2.65	0.65	4.7	10.1	9.8	2.1	9.66
2.70	0.70	5.2	11.6	10.2	2.2	9.96
2.75	0.75	5.7	13.3	10.5	2.3	10.27
2.80	0.80	6.2	15.1	10.8	2.4	10.57
2.85	0.85	6.8	17.0	11.1	2.5	10.88
2.90	0.90	7.3	19.0	11.5	2.6	11.18
2.95	0.95	7.9	21.1	11.8	2.7	11.49
3.00	1.00	8.5	23.3	12.1	2.8	11.79
3.05	1.05	9.1	25.7	12.4	2.8	12.10
3.10	1.10	9.7	28.2	12.7	2.9	12.40
3.15	1.15	10.3	30.8	13.1	3.0	12.71
3.20	1.20	10.9	33.5	13.4	3.1	13.01
3.25	1.25	11.6	36.3	13.7	3.1	13.32
3.30	1.30	12.3	39.3	14.0	3.2	13.62
3.35	1.35	13.0	42.4	14.3	3.3	13.93
3.40	1.40	13.7	45.6	14.7	3.3	14.23
3.45	1.45	14.4	49.0	15.0	3.4	14.54
3.50	1.50	15.1	52.5	15.3	3.5	14.84
3.55	1.55	15.9	56.1	15.6	3.5	15.15
3.60	1.60	16.6	59.9	16.0	3.6	15.46
3.65	1.65	17.4	63.8	16.3	3.7	15.76
3.70	1.70	18.2	67.8	16.6	3.7	16.07
3.75	1.75	19.0	72.0	16.9	3.8	16.37
3.80	1.80	19.8	76.4	17.2	3.8	16.68
3.85	1.85	20.7	80.8	17.6	3.9	16.98
3.90	1.90	21.5	85.4	17.9	4.0	17.29
3.95	1.95	22.4	90.2	18.2	4.0	17.59
4.00	2.00	23.3	95.1	18.5	4.1	17.90
4.05	2.05	24.2	100.2	18.8	4.1	18.20
4.10	2.10	25.1	105.4	19.2	4.2	18.51
4.15	2.15	26.1	110.8	19.5	4.3	18.81
4.20	2.20	27.0	116.3	19.8	4.3	19.12
4.25	2.25	28.0	122.0	20.1	4.4	19.42
4.30	2.30	28.9	127.8	20.4	4.4	19.73
4.35	2.35	29.9	133.8	20.8	4.5	20.03
4.40	2.40	30.9	140.0	21.1	4.5	20.34
4.45	2.45	32.0	146.3	21.4	4.6	20.64
4.50	2.50	33.0	152.8	21.7	4.6	20.95
4.55	2.55	34.1	159.5	22.1	4.7	21.25
4.60	2.60	35.1	166.3	22.4	4.7	21.56
4.65	2.65	36.2	173.3	22.7	4.8	21.86
4.70	2.70	37.3	180.4	23.0	4.8	22.17
4.75	2.75	38.4	187.8	23.3	4.9	22.47
4.80	2.80	39.6	195.3	23.7	4.9	22.78
4.85	2.85	40.7	203.0	24.0	5.0	23.08
4.90	2.90	41.9	210.9	24.3	5.0	23.39

Q_{10} (BULKED) = 29 CFS

Q_{100} (BULKED) = 80 CFS

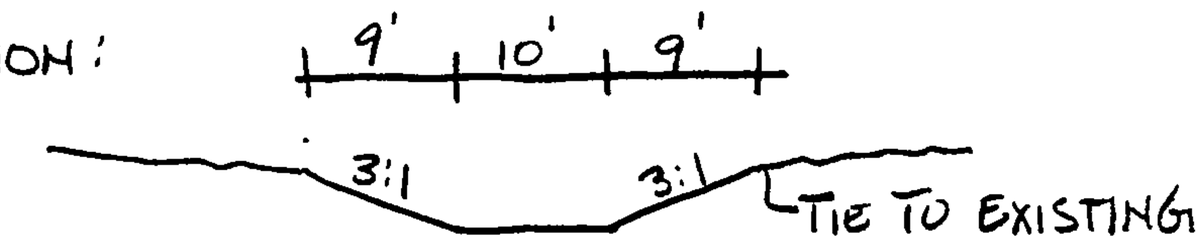
CHANNEL WEST OF CORTADERIA:

SWALE TO BE NON-EROSIVE ($V_{10} \leq 3$ FPS) IN 10 YR STORM

Q_{10} (BULKED) = 29 CFS SLOPE = 0.7%

Q_{100} (BULKED) = 80 CFS

CHANNEL SECTION:



FROM RATING TABLE: $V_{10} = 3.0$ FPS

$d_{100} = 1.35$ FT $V_{100} = 4.1$ FPS

ADD FREEBOARD $= 1 + 0.025\, V \sqrt[3]{d} = 1.11$ FT

PROVIDE $1.35 + 1.11 = 2.46'$ USE 3' DEPTH

BOHANNAN-HUSTON INC.

PROJECT NAME CORTADERIA EXTENSION SHEET ____ OF ____

PROJECT NO. ____ BY PR DATE 10/30/95

SUBJECT DRAINAGE REPORT CH'D ____ DATE ____

CHANNEL WEST OF CORTADERIA

MANNING'S N = .0300 SLOPE = .0070

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	5.00	3	19.00	2.10			
2	9.00	2.00	4	29.00	5.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID	
2.05	0.05	0.1	0.0	5.2	0.4	5.15	
2.10	0.10	0.5	0.3	10.3	0.6	10.30	
2.15	0.15	1.0	0.9	10.7	0.9	10.62	
2.20	0.20	1.6	1.8	11.0	1.1	10.94	
2.25	0.25	2.1	2.9	11.3	1.4	11.27	
2.30	0.30	2.7	4.2	11.7	1.6	11.59	
2.35	0.35	3.3	5.8	12.0	1.7	11.91	
2.40	0.40	3.9	7.5	12.3	1.9	12.23	
2.45	0.45	4.5	9.4	12.7	2.1	12.56	
2.50	0.50	5.2	11.5	13.0	2.2	12.88	
2.55	0.55	5.8	13.8	13.4	2.4	13.20	
2.60	0.60	6.5	16.3	13.7	2.5	13.52	
2.65	0.65	7.2	18.9	14.0	2.6	13.85	
2.70	0.70	7.9	21.8	14.4	2.8	14.17	
2.75	0.75	8.6	24.8	14.7	2.9	14.49	
2.80	0.80	9.3	28.0	15.0	3.0	14.81	Q_{10} (BULKED) = 29 CFS
2.85	0.85	10.1	31.4	15.4	3.1	15.14	
2.90	0.90	10.8	34.9	15.7	3.2	15.46	
2.95	0.95	11.6	38.7	16.1	3.3	15.78	
3.00	1.00	12.4	42.6	16.4	3.4	16.10	
3.05	1.05	13.2	46.8	16.7	3.5	16.43	
3.10	1.10	14.0	51.1	17.1	3.6	16.75	
3.15	1.15	14.9	55.6	17.4	3.7	17.07	
3.20	1.20	15.7	60.3	17.7	3.8	17.39	
3.25	1.25	16.6	65.1	18.1	3.9	17.72	
3.30	1.30	17.5	70.2	18.4	4.0	18.04	
3.35	1.35	18.4	75.5	18.8	4.1	18.36	Q_{100} (BULKED) = 80 CFS
3.40	1.40	19.4	80.9	19.1	4.2	18.68	
3.45	1.45	20.3	86.6	19.4	4.3	19.01	
3.50	1.50	21.3	92.4	19.8	4.3	19.33	
3.55	1.55	22.2	98.5	20.1	4.4	19.65	
3.60	1.60	23.2	104.7	20.4	4.5	19.97	
3.65	1.65	24.2	111.2	20.8	4.6	20.29	
3.70	1.70	25.2	117.9	21.1	4.7	20.62	
3.75	1.75	26.3	124.7	21.5	4.7	20.94	
3.80	1.80	27.3	131.8	21.8	4.8	21.26	
3.85	1.85	28.4	139.1	22.1	4.9	21.58	
3.90	1.90	29.5	146.6	22.5	5.0	21.91	
3.95	1.95	30.6	154.3	22.8	5.0	22.23	
4.00	2.00	31.7	162.2	23.1	5.1	22.55	
4.05	2.05	32.9	170.4	23.5	5.2	22.87	
4.10	2.10	34.0	178.7	23.8	5.3	23.20	
4.15	2.15	35.2	187.3	24.2	5.3	23.52	
4.20	2.20	36.4	196.1	24.5	5.4	23.84	
4.25	2.25	37.6	205.1	24.8	5.5	24.16	
4.30	2.30	38.8	214.4	25.2	5.5	24.49	
4.35	2.35	40.0	223.9	25.5	5.6	24.81	
4.40	2.40	41.3	233.6	25.8	5.7	25.13	
4.45	2.45	42.5	243.5	26.2	5.7	25.45	
4.50	2.50	43.8	253.7	26.5	5.8	25.78	
4.55	2.55	45.1	264.1	26.9	5.9	26.10	
4.60	2.60	46.4	274.7	27.2	5.9	26.42	
4.65	2.65	47.7	285.6	27.5	6.0	26.74	
4.70	2.70	49.1	296.7	27.9	6.0	27.07	
4.75	2.75	50.5	308.1	28.2	6.1	27.39	
4.80	2.80	51.8	319.7	28.5	6.2	27.71	
4.85	2.85	53.2	331.5	28.9	6.2	28.03	
4.90	2.90	54.6	343.6	29.2	6.3	28.36	
4.95	2.95	56.1	355.9	29.6	6.3	28.68	

SEDIMENT POND (NE CORNER OF CORTADERIA & FUTURE STREET)

1. SIZE POND BASED ON SETTLING VELOCITY (V_S)

POND RECEIVES 75% OF BASIN 14 RUNOFF
DESIGN PARTICLE = VERY FINE SAND, D = 0.06 MM
100% REMOVAL OF DESIGN PARTICLE - 2-YR EVENT
$V_S = 0.009$ FPS

$\therefore$ SURFACE AREA REQ'D = $SA = (1.2)Q_{2\text{-}YR} / V_S$

Q_2 FOR BASIN 14 = 1.6 CFS FROM APPENDIX E-PHASE I REPORT

$\Rightarrow Q_2(\text{POND}) = .75(1.6) = 1.2$ CFS

$SA = 1.2(1.2)/.009 = 160$ SF

ASSUME POND LENGTH = 3x WIDTH

$3W \cdot W = SA = 160$

$W \geq 7.3$ FT

$\longrightarrow$ USE 10' x 30' POND

2. POND SIZE BASED ON SEDIMENT STORAGE:

FROM USLE, THE AVERAGE ANNUAL SEDIMENT YIELD FROM BASIN 14 IS 1518 CF.

ASSUME: MIN SETTLING DEPTH = 2'
MAX SEDIMENT STORAGE DEPTH = 3'
MIN FREEBOARD = 2' (100-YR STORM)

ELEV	LENGTH(FT)	WIDTH(FT)	AREA (SF)	VOL(CF)	CUM VOL
0	30	10	300		0
1	36	16	576	438	438
2	42	22	924	750	1188
3	48	28	1344	1134	2322

1134

REQ'D SEDIMENT STORAGE = 1518 CF

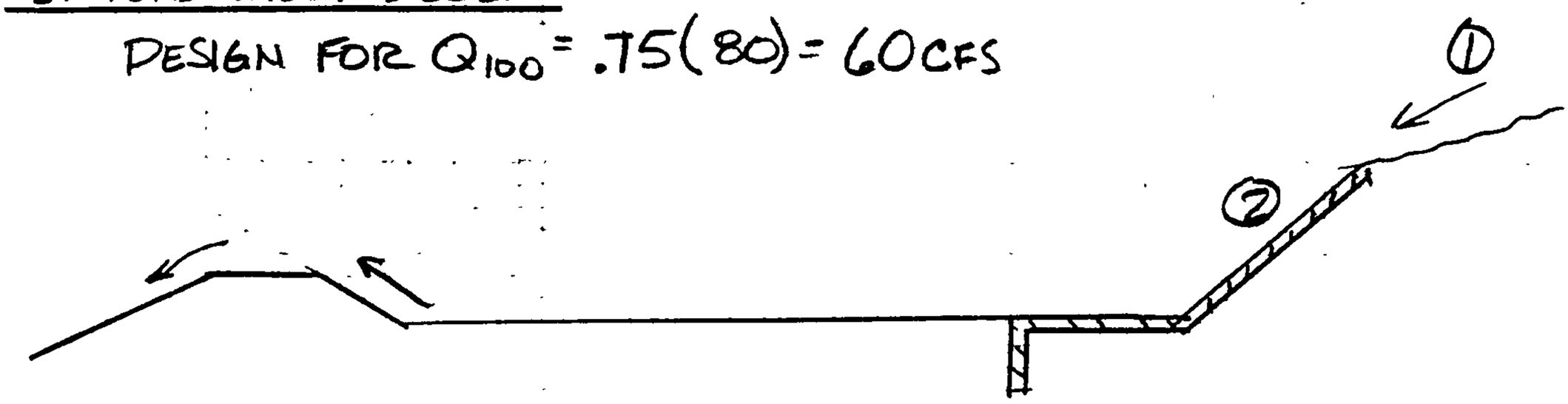
$\longrightarrow \therefore$ SEDIMENT STORAGE DEPTH = 2.3' USE 2.5' DEPTH

BOHANNAN-HUSTON INC.

PROJECT NAME CORTADERIA EXTENSION SHEET ____ OF ____
PROJECT NO. ____ BY PR DATE 11/2/95
SUBJECT DRAINAGE REPORT CH'D ____ DATE ____

3. POND INLET DESIGN

DESIGN FOR $Q_{100} = .75(80) = 60$ CFS

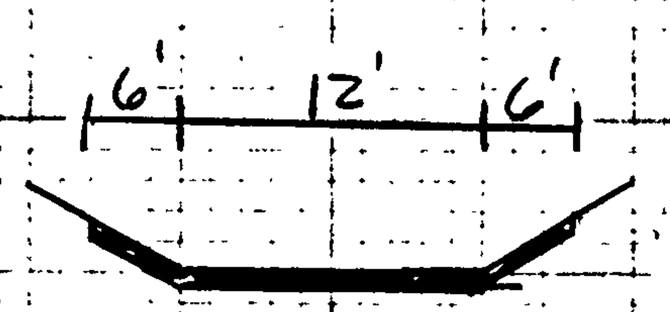


① UPSTREAM ARROYO

0	40
25	39
36	38
40	37.6
45	38
70	39
95	40

SLOPE = 2.67%
y_n = 0.97'
V = 4.6 FPS
T = 29.52
A_1 = 12.8 SF

② ASPHALT RUNDOWN



S = 20%
y_n = 0.35

V = 16.7
A = 3.9
T = 13.8

4. DETERMINE WATER SURFACE IN POND, MAX

CALCULATE SEQUENT DEPTH (JUMP @ POND BOTTOM)

AT BOTTOM OF RUNDOWN: $y_1 = 0.35$
$V_1 = 16.7$
$T = 13.8$
$A_1 = 3.9$

$$F_R = \frac{V_1}{\sqrt{g(A/T)}} = \frac{16.7}{\sqrt{32.2(3.9/13.8)}} = 5.5$$

HYDRAULIC JUMP EQ'N: $\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8F_1^2} - 1\right)$

$y_2 = 2.6'$

→ MAX SURFACE = 6026 + 2.6 = 6028.6

BOHANNAN-HUSTON INC.

PROJECT NAME CORTADERIA EXTENSION SHEET ____ OF ____
PROJECT NO. ____ BY PR DATE 11/2/95
SUBJECT DRAINAGE REPORT CH'D ____ DATE ____

HIGH DESERT - CORTADERIA EXTENSION
UNIVERSAL SOIL LOSS EQUATION

DESCRIPTION	VARIABLE	UNIT			
BASIN					
Drainage Area	DA	Sq. Mi.	0.041		
Slope	S	Ft/Ft	0.050		
Slope Angle	THETA	Radians	0.050		
	L	Feet	1500.000		
Rainfall	R		45.000		
Soil Erodability*	K		0.100		
Slope Length Factor	LS		1.531		
Cover*	C		0.140		
Support Practice Factor	P		1.000		
Sediment Yield	A	Tons/Acre	0.964		
		Tons	25.303		
		Cy	18.743		
			Total Annual Sediment Yield	18.743	Cy
Estimated Soil Unit Weight	100.000	Lbs/Cf	Adjustment Factor	3.000	

			Adjusted Sediment Yield	56.229	Cy
				1518.179	Cf

NOTE: The Universal Soil Loss Equation typically underestimates the actual sediment yield by 3 times so a factor of 4 is applied to the total annual sediment yield.

UPSTREAM OF POND

MANNING'S N = .0300 SLOPE = .0267

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	40.00	4	40.00	37.60	7	95.00	40.00
2	25.00	39.00	5	45.00	38.00			
3	36.00	38.00	6	70.00	39.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
38.20	0.60	4.3	14.5	16.2	3.3	16.20
38.21	0.61	4.5	15.2	16.6	3.4	16.56
38.22	0.62	4.7	15.9	17.0	3.4	16.92
38.23	0.63	4.8	16.6	17.3	3.4	17.28
38.24	0.64	5.0	17.4	17.7	3.5	17.64
38.25	0.65	5.2	18.2	18.1	3.5	18.00
38.26	0.66	5.4	19.0	18.4	3.6	18.36
38.27	0.67	5.5	19.9	18.8	3.6	18.72
38.28	0.68	5.7	20.8	19.1	3.6	19.08
38.29	0.69	5.9	21.7	19.5	3.7	19.44
38.30	0.70	6.1	22.6	19.9	3.7	19.80
38.31	0.71	6.3	23.6	20.2	3.7	20.16
38.32	0.72	6.5	24.5	20.6	3.8	20.52
38.33	0.73	6.7	25.6	20.9	3.8	20.88
38.34	0.74	6.9	26.6	21.3	3.8	21.24
38.35	0.75	7.2	27.7	21.7	3.9	21.60
38.36	0.76	7.4	28.8	22.0	3.9	21.96
38.37	0.77	7.6	29.9	22.4	3.9	22.32
38.38	0.78	7.8	31.1	22.7	4.0	22.68
38.39	0.79	8.0	32.2	23.1	4.0	23.04
38.40	0.80	8.3	33.5	23.5	4.0	23.40
38.41	0.81	8.5	34.7	23.8	4.1	23.76
38.42	0.82	8.8	36.0	24.2	4.1	24.12
38.43	0.83	9.0	37.3	24.5	4.1	24.48
38.44	0.84	9.2	38.6	24.9	4.2	24.84
38.45	0.85	9.5	40.0	25.3	4.2	25.20
38.46	0.86	9.7	41.4	25.6	4.2	25.56
38.47	0.87	10.0	42.9	26.0	4.3	25.92
38.48	0.88	10.3	44.3	26.3	4.3	26.28
38.49	0.89	10.5	45.8	26.7	4.4	26.64
38.50	0.90	10.8	47.4	27.1	4.4	27.00
38.51	0.91	11.1	48.9	27.4	4.4	27.36
38.52	0.92	11.3	50.5	27.8	4.5	27.72
38.53	0.93	11.6	52.2	28.2	4.5	28.08
38.54	0.94	11.9	53.9	28.5	4.5	28.44
38.55	0.95	12.2	55.6	28.9	4.6	28.80
38.56	0.96	12.5	57.3	29.2	4.6	29.16
38.57	0.97	12.8	59.1	29.6	4.6	29.52
38.58	0.98	13.1	60.9	30.0	4.7	29.88
38.59	0.99	13.4	62.7	30.3	4.7	30.24
38.60	1.00	13.7	64.6	30.7	4.7	30.60
38.61	1.01	14.0	66.6	31.0	4.8	30.96
38.62	1.02	14.3	68.5	31.4	4.8	31.32
38.63	1.03	14.6	70.5	31.8	4.8	31.68
38.64	1.04	14.9	72.5	32.1	4.9	32.04
38.65	1.05	15.3	74.6	32.5	4.9	32.40
38.66	1.06	15.6	76.7	32.8	4.9	32.76
38.67	1.07	15.9	78.9	33.2	5.0	33.12

$Q_{100} = 60$ CFS

ASPHALT RUNDOWN

MANNING'S N = .0170 SLOPE = .2000

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	5.00	3	18.00	3.10			
2	6.00	3.00	4	24.00	5.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
3.05	0.05	0.2	0.5	6.2	3.3	6.15
3.10	0.10	0.6	3.3	12.3	5.3	12.30
3.15	0.15	1.2	10.3	12.6	8.3	12.61
3.20	0.20	1.9	20.2	13.0	10.8	12.92
3.25	0.25	2.5	32.7	13.3	12.9	13.22
3.30	0.30	3.2	47.6	13.6	14.9	13.53
3.35	0.35	3.9	64.7	13.9	16.7	13.84
3.40	0.40	4.6	84.0	14.3	18.3	14.15
3.45	0.45	5.3	105.4	14.6	19.9	14.46
3.50	0.50	6.0	128.8	14.9	21.4	14.76
3.55	0.55	6.8	154.3	15.2	22.8	15.07
3.60	0.60	7.5	181.7	15.6	24.1	15.38
3.65	0.65	8.3	211.0	15.9	25.4	15.69
3.70	0.70	9.1	242.3	16.2	26.6	15.99
3.75	0.75	9.9	275.5	16.5	27.8	16.30
3.80	0.80	10.7	310.7	16.8	28.9	16.61
3.85	0.85	11.6	347.7	17.2	30.0	16.92
3.90	0.90	12.4	386.6	17.5	31.1	17.23
3.95	0.95	13.3	427.5	17.8	32.2	17.53
4.00	1.00	14.2	470.3	18.1	33.2	17.84
4.05	1.05	15.1	514.9	18.5	34.1	18.15
4.10	1.10	16.0	561.5	18.8	35.1	18.46
4.15	1.15	16.9	610.0	19.1	36.0	18.77
4.20	1.20	17.9	660.5	19.4	37.0	19.07
4.25	1.25	18.8	712.9	19.8	37.9	19.38
4.30	1.30	19.8	767.2	20.1	38.7	19.69
4.35	1.35	20.8	823.5	20.4	39.6	20.00
4.40	1.40	21.8	881.7	20.7	40.4	20.31
4.45	1.45	22.8	942.0	21.1	41.3	20.61
4.50	1.50	23.9	1004.2	21.4	42.1	20.92
4.55	1.55	24.9	1068.4	21.7	42.9	21.23
4.60	1.60	26.0	1134.6	22.0	43.7	21.54
4.65	1.65	27.1	1202.8	22.4	44.4	21.84
4.70	1.70	28.2	1273.1	22.7	45.2	22.15
4.75	1.75	29.3	1345.4	23.0	45.9	22.46
4.80	1.80	30.4	1419.8	23.3	46.7	22.77
4.85	1.85	31.6	1496.2	23.6	47.4	23.08
4.90	1.90	32.7	1574.8	24.0	48.1	23.38
4.95	1.95	33.9	1655.4	24.3	48.8	23.69
5.00	2.00	35.1	1738.2	24.6	49.5	24.00

$Q_{100} = 60$ CFS

CITY OF
Albuquerque

P.O. Box 1293 Albuquerque, NM 87103

August 23, 1996

Martin J. Chávez, Mayor

Kevin Patton
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

RE: ENGINEER'S CERTIFICATION FOR TIERRA DEL OSO SUBD (E-23/D3F)
FORMERLY HIGH DESERT TRACT 2A-1B-1
RECEIVED AUGUST 6, 1996 FOR FINANCIAL GUARANTY RELEASE
ENGINEER'S STAMP DATED 8/2/96

Dear Mr. Patton:

Based on the information included in the submittal referenced above, City Hydrology accepts the engineer's certification for financial guaranty release.

Contact Terri Martin to obtain the financial guaranty release for City Project Number 5330.90.

If I can be of further assistance, You may contact me at 768-2727.

Sincerely,

John P. Curtin, P.E.
Civil Engineer, Hydrology

c: Andrew Garcia
Fred Aguirre
Terri Martin, CPN 5330.90
Jack Eichorn, High Desert Investment Corp, 13000 Academy NE, 87111

CITY OF
Albuquerque
P.O. Box 1293 Albuquerque, NM 87103

June 13, 1996

Martin J. Chávez, Mayor

Kevin Patton
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

RE: AMENDED GRADING PLAN FOR TIERRA DEL OSO SUBD (E-23/D3F)
FORMERLY HIGH DESERT TRACT 2A-1B-1
RECEIVED MAY 21, 1996 FOR FINAL PLAT
ENGINEER'S STAMP DATED 12/14/95 REVISED 4-19-96

Dear Mr. Patton:

Based on the information included in the submittal referenced above, City Hydrology accepts the Amended Grading Plan for Final Plat. It is City Hydrology's understanding that DRB approved the Amended Grading Plan on May 21, 1996.

Engineer's Certification of grading & drainage per DPM checklist must be accepted by City Hydrology before the Financial Guaranty will be released.

If you have any questions about this project, You may contact me at 768-2727.

Sincerely,

John P. Curtin, P.E.
Civil Engineer, Hydrology

c: Andrew Garcia
Fred Aguirre, DRB 95-476
Jack Eichorn, High Desert Investment Corp, 13000 Academy NE, 87111

TIERRA DEL OSO SUB S LINE "C"

CULVERT RATING TABLE

30 INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.01040

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)	
1.00000	0.05020	0.08432	1.67950	
2.00000	0.14054	0.37068	2.63758	
3.00000	0.25547	0.87330	3.41841	
4.00000	0.38908	1.59316	4.09467	
5.00000	0.53776	2.52572	4.69679	
6.00000	0.69890	3.66304	5.24118	
7.00000	0.87048	4.99480	5.73796	
8.00000	1.05085	6.50883	6.19390	
9.00000	1.23855	8.19149	6.61377	
10.00000	1.43233	10.02781	7.00107	
11.00000	1.63102	12.00169	7.35840	
12.00000	1.83356	14.09598	7.68777	
13.00000	2.03894	16.29251	7.99068	
14.00000	2.24619	18.57213	8.26829	
15.00000	2.45437	20.91469	8.52142	
16.00000	2.66255	23.29902	8.75065	
17.00000	2.86980	25.70284	8.95633	
18.00000	3.07518	28.10267	9.13856	Q_{100} = 29.2 cfs
19.00000	3.27772	30.47365	9.29722	
20.00000	3.47641	32.78929	9.43194	
21.00000	3.67019	35.02116	9.54207	
22.00000	3.85789	37.13829	9.62658	
23.00000	4.03825	39.10647	9.68401	Q = 40.4 cfs
24.00000	4.20984	40.88686	9.71222	
25.00000	4.37098	42.43383	9.70808	
26.00000	4.51965	43.69081	9.66685	
27.00000	4.65327	44.58167	9.58073	
28.00000	4.76820	44.98848	9.43511	
29.00000	4.85853	44.67138	9.19442	
30.00000	4.90874	41.82941	8.52142	

26.3
+ 3.2 (5)
+ 2.1 (pA)
+ 8.8 (spain)
40.4 cfs

RECEIVED
MAY 21 1996

TIERRA DEL OSO SD LINE "C"

CULVERT RATING TABLE

24. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.02530

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.04479	0.11701	2.61256
2.00000	0.12504	0.51160	4.09144
3.00000	0.22665	1.19831	5.28696
4.00000	0.34416	2.17271	6.31303
5.00000	0.47417	3.42218	7.21727
6.00000	0.61418	4.92902	8.02531
7.00000	0.76224	6.67182	8.75285
8.00000	0.91669	8.62626	9.41025
9.00000	1.07605	10.76555	10.00466
10.00000	1.23901	13.06063	10.54117
11.00000	1.40432	15.48037	11.02338
12.00000	1.57079	17.99154	11.45378
13.00000	1.73727	20.55878	11.83397
14.00000	1.90258	23.14441	12.16476
15.00000	2.06554	25.70813	12.44622
16.00000	2.22490	28.20648	12.67763
17.00000	2.37935	30.59206	12.85734
18.00000	2.52741	32.81218	12.98255
19.00000	2.66742	34.80657	13.04875
20.00000	2.79743	36.50304	13.04879
21.00000	2.91494	37.80857	12.97064
22.00000	3.01655	38.58657	12.79163
23.00000	3.09680	38.57578	12.45665
24.00000	3.14159	35.98310	11.45378

Q_{100} = 13.5 cfs

Q = 26.3 cfs

13.5 P2+2+8
+ 12.8 P3
26.3 cfs

TIERRA DEL OSO SD LINE "C"

CULVERT RATING TABLE

18 INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.04740

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.03862	0.13750	3.56006
2.00000	0.10733	0.59553	5.54861
3.00000	0.19359	1.38090	7.13303
4.00000	0.29241	2.47670	8.47010
5.00000	0.40056	3.85540	9.62505
6.00000	0.51564	5.48254	10.63255
7.00000	0.63565	7.31836	11.51328
8.00000	0.75883	9.31860	12.28022
9.00000	0.88357	11.43476	12.94152
10.00000	1.00831	13.61411	13.50185
11.00000	1.13150	15.79922	13.96309
12.00000	1.25151	17.92700	14.32433
13.00000	1.36659	19.92699	14.58159
14.00000	1.47474	21.71784	14.72656
15.00000	1.57355	23.20000	14.74371
16.00000	1.65981	24.23746	14.60251
17.00000	1.72852	24.59350	14.22804
18.00000	1.76715	22.86955	12.94152

$Q_{100} = 13.5$ CFS

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

January 23, 1996

Kevin Patton
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

RE: GRADING PLAN FOR TIERRA DEL OSO SUBD (E-23/D3F)
FORMERLY HIGH DESERT TRACT 2A-1B-1
RECEIVED JANUARY 11, 1996 FOR FINAL PLAT
ENGINEER'S STAMP DATED 12/14/95

Dear Mr. Patton:

Based on the information included in the submittal referenced above, City Hydrology accepts the Grading Plan for Final Plat. Submit a copy of the Grading Plan, dated 12/14/95, to DRB for their approval.

Engineer's Certification of grading & drainage per DPM checklist must be accepted by City Hydrology before the Financial Guaranty will be released.

If you have any questions about this project, You may contact me at 768-2727.

Sincerely,

John P. Curtin

John P. Curtin, P.E.
Civil Engineer, Hydrology

c: Andrew Garcia
Fred Aguirre, DRB 95-476

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

December 1, 1995

Kevin Patton
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

RE: GRADING PLAN FOR CORTADERIA EXTENSION (E-23/D3F)
RECEIVED NOVEMBER 30, 1995 FOR ROUGH GRADING
ENGINEER'S STAMP DATED 11/3/95

Dear Mr. Patton:

Based on the information included in the submittal referenced above, City Hydrology accepts the Grading Plan for Rough Grading and approves a Grading Permit for this project.

The Contractor must include an erosion control plan when he applies for a topsoil disturbance permit. Do not grade adjacent property without the owner's permission.

If I can be of further assistance, You may contact me at 768-2727.

Sincerely,

John P. Curtin, P.E.
Civil Engineer, Hydrology

c: Andrew Garcia
Larry Caudill, Environmental Health

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

DRAINAGE REPORT
FOR
HIGH DESERT TRACT 2A-1B-1 SUBDIVISION

NOVEMBER 1995

Prepared by:

BOHANNAN-HUSTON INC.
COURTYARD I, 7500 JEFFERSON STREET N.E.
ALBUQUERQUE, NM 97109

Prepared for:

HIGH DESERT INVESTMENT CORP.
13000 ACADEMY ROAD NE
ALBUQUERQUE, NM 87111

JAMES R. TOPMILLER
NEW MEXICO
9354
REGISTERED PROFESSIONAL ENGINEER

PREPARED BY:		UNDER THE SUPERVISION OF:	
Bruce Stidworthy	11/3/95	James R. Topmiller	11/3/95
Bruce Stidworthy, E.I.	Date	James Topmiller, P.E.	Date

I. PURPOSE

The purpose of this report is to present historic and proposed drainage conditions for the proposed High Desert Tract 2A-1B-1 subdivision, and to obtain approval of the drainage report to support preliminary and final plat approval for this project.

II. METHODOLOGIES

Site conditions are 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.

Part A of the DPM, Section 22.2, Hydrology, January 1993, provides a simplified procedure for projects with sub-basins smaller than 40 acres. The Subdivision within Tract 2A-1B-1 at High Desert, referred to within the report as the "Site," is approximately 18.2 acres in size and utilizes the simplified method mentioned above. Three upland drainage basins enter the site along its north boundary.

This report will reference the following City of Albuquerque approved studies prepared for the High Desert Development: 1) the *High Desert Drainage Management Master Plan*, dated December 1993, and 2) the *Final High Desert Phase I Hydrology & Design Drainage Report*, dated March 1994.

The *High Desert Drainage Management Master Plan*, dated December 1993, was prepared to support future drainage plans submitted for the development of individual land parcels within High Desert, and to provide design guidance to the installation of major drainage infrastructure to be constructed by High Desert in advance of, or simultaneously with individual parcel development.

In addition, it provides fully developed flow rates for basins that influence Tracts within the High Desert Development infrastructure.

The *Final High Desert Phase I Hydrology & Design Drainage Report*, dated March 1994, was prepared to provide the hydrologic and hydraulic information for the design of drainage infrastructure necessary for the development of Phase I of the High Desert Subdivision. That report was intended to supplement the information provided in the *High Desert Drainage Management Master Plan*. The proposed conditions described in the *Final High Desert Phase I Hydrology & Design Drainage Report* are identical with the current existing conditions in the vicinity of Tract 2A-1B-1.

III. SITE LOCATION AND CHARACTERISTICS

Please refer to the existing drainage conditions map enclosed with this report.

The site, Tract 2A-1B-1, is on the southeast corner of Tramway Boulevard and Spain Road. It is proposed that the 18.2 acre site be developed into 45 lots containing single family detached dwelling units. The entrance to the site is oriented north/south. In order to provide access to the site, Cortaderia Street is to be extended from the existing intersection at Spain Road to the north boundary of the site. This work is to be done under a separate work order. 2.5 DU/Ac

Vegetation consists primarily of prairie grasses and a few juniper trees. Slopes in the project site range from 4% to a maximum slope of 25% near the southern border of the site. The majority of the project slopes at 5% to the west. The south edge of the site contains an arroyo which drains to the Bear Arroyo. The Soil Conservation Service has classified the soils in this site area as Embudo-Tijeras complex, Embudo gravelly fine sandy loam and Tijeras gravelly fine sandy

loam, all of which correspond to a common hydrological soil group classification of B.

IV. EXISTING HYDROLOGIC AND SITE DRAINAGE CONDITIONS

Please refer to the existing drainage conditions map enclosed with this report.

Approximately 6.82 acres (in basins E1 and E2), of the 18.2 acre site drain to the Bear Arroyo immediately south of the site. These flows leave the site via sheet flow and shallow concentrated flows in existing natural arroyos.

The remaining three existing basins, (E3, E4, and E5) drain to the west. These basins drain via sheet flow and shallow concentrated flow in existing natural arroyos. Basin E3 flows into an existing pond which is lined with wire tied rip-rap and located near the northwest corner of the site. The pond was originally designed and built with the construction of the Tramway Boulevard Project for the purpose of capturing flows so that they could be transported to the west side of Tramway. Flows leave the pond and pass under Tramway through a 36" RCP culvert. Basins E4 and E5 drain to inlets on the east side of the Tramway pedestrian path. These inlets are connected to 36" and 30" RCP culverts respectively. The culverts convey the flow under Tramway Boulevard.

Maximum allowable flows for the culverts described above where determined in the *High Desert Drainage Management Master Plan*. These flows were found using non-pressure, mannings analysis, and a mannings n of 0.014. A table which compares the maximum allowable flows with those proposed by this report can be found in the *Proposed Site Conditions Hydrology* section of the appendix of this report.

FEMA Floodplain

According to the latest FEMA floodplain maps, there are no existing floodplains within the site boundaries. The closest FEMA floodplains are in the Bear Arroyo floodplain immediately south of the site, and in the High Desert Open Space east of the site.

V. PROPOSED (DEVELOPED) HYDROLOGIC AND HYDRAULIC CONDITIONS

Please refer to the Grading Plan as well as the Proposed Basins/Drainage Map enclosed with this report.

The proposed subdivision is broken into nine onsite basins, labeled 1 through 9, and five offsite basins labeled P1 through P5. The Hydrologic and Hydraulic conditions for each basin as well as general drainage concepts are explained in the following paragraphs. Exact sizes flows, velocities, etc. are shown on the Proposed Basins/Drainage Map, and detailed calculations verifying the capacity of each element of the storm drain system for the site are included in the appendix of this report.

Basin 1 contains Cortaderia Street, as well as many of the lots which will front Cortaderia. Preliminarily, the percentage of treatment 'D' within Basin 1 was determined using Table A-5 in Section 22.2 of the Development Process Manual. In order to ensure a conservative design, the percentage of D was increased slightly from the figure determined using Table A-5. Engineering judgement was then used to determine the remaining treatment percentages. A summary table of all of the basins along with their treatment percentages is contained within the Appendices of this report. Offsite Basin P1 (8.8cfs) drains to Basin 1(21.0 cfs), the combined flow then drains to the south end of Cortaderia Street, where it is collected by a number of inlets. The first inlet to collect flows from Cortaderia is a

single 'A' inlet (capacity = 7.4 cfs). The second inlet which collects storm water runoff from Cortaderia Street is a singe 'C' inlet (capacity = 7.1 cfs). The last inlet in the system is a double 'A' inlet with double wings (capacity > 30.6 cfs). The double 'A' inlet is in sump condition, and is sized for two times the 100yr - 6hr storm event ($2xQ_{100}$), as is required for inlets which do not have an emergency overflow. The above inlets are connected with reinforced concrete storm drain pipes to the storm drain manhole in the cul-de-sac at the end of Cortaderia Street. This storm drain system then ties to an existing manhole just to the east of the Tramway pedestrian path.

Basin 2 contains Street 'A', and most of the lots which will front Street 'A'. Basin 'A' (11.7 cfs) accepts flow from offsite Basin P2 (1.3 cfs) and onsite Basin 8 (0.5 cfs). The relative percentages of land treatment for Basin 2 were determined in the same manner as Basin 1. Flows from Basin 2 drain to the cul-de-sac at the west end of Street 'A' where they are collected by a double 'A' inlet with double wings (capacity > 27.0 cfs). Like Basin 1, the double 'A' inlet described above is in sump condition, and is sized for two times the 100yr - 6hr storm event ($2xQ_{100}$). These flows are then conveyed by underground RCP to the existing pond at the southeast corner of Tramway Boulevard and Spain Road.

Basin 3 consists of the center portion of the subdivision. It is approximately 2.67 acres in size and yields a 100-year storm water runoff of 10.8 cfs to the proposed street 'B'. The street will transport this runoff, as well as the runoff from Basins 8, 9, and P2 (Q_{100}= 0.5cfs, 0.7cfs, and 1.3cfs respectively) to a type 'D' double grate inlet located at the west end of the cul-de-sac. That inlet will collect 10.8 cfs. A second double 'D' inlet located in the emergency access easement, will collect the remaining 2.5 cfs. The emergency access easement which proceeds from the west end of the cul-de-sac to the west boundary of the site will also serve as an emergency overflow for the double 'D' inlets described above. An underground RCP will be connected to the inlets, and will convey the storm water runoff to the existing 36" RCP culvert under Tramway Boulevard.

Basin 4 encompasses the southern and eastern portions of the subdivision, it is 4.83 acres in size, and produces a 100-year storm water runoff of 17.9 cfs. This basin will convey the runoff from individual lots immediately adjacent to the southern and eastern boundaries of the subdivision to the Open Space which borders the subdivision along its south and east sides. Since lots 31 through 40 will not have retaining or privacy walls in the back, flows from Basin 4 will be conveyed to the Open Space by sheet flow and by small, natural, existing, arroyos. Basin 4 does not accept flow from any upstream basins.

Basins 5, 6, and 7 consist of an isolated number of lots that lie along the western boundary of the site. These basins total 2.42 acres in size and in the 100yr storm event, generate 3.2 cfs 3.5 cfs, and 2.8 cfs respectively. These lots will drain onto the proposed utility easement through inverted blocks in the privacy wall along the western boundary. The flows from 6 and 7 will then be conveyed in a historic manner to the existing inlets along the east side of the Tramway Pedestrian Path, while the flows from basin 5 will be conveyed in a historic manner to the existing pond at the southeast corner of Tramway Boulevard and Spain Road.

Basins 8 and 9 as well as offsite basin P2 consist of half of Cortaderia Street for their respective reaches. Basin P2 (Q_{100} = 1.3 cfs) reaches from a high point in the proposed Cortaderia Extension, to the site boundary, it drains to Basin 8. Basin 8 reaches from the site boundary to the centerline of Street 'A'. Mathematically determining the amount of flow from the west side of Cortaderia (Basins P2, and 8) which would turn and go down Street 'A', and how much would continue in Cortaderia, is quite complex. For this reason, and to ensure a conservative design, flows from Basins 8 and P2 have been considered to drain to Basins 9 AND 2. Basin 9 consists of the west side of Cortaderia Street from the centerline of Street 'A' to the centerline of Street 'B'. Basin 9, as well as upstream basins 8 and P2, have been considered to drain to Basin 3. There are two reasons why this is a good assumption, first, because their is a fairly large

difference in slope (about 3%) between Street 'B' and Cortaderia and second, because flows from Basins 8, 9, and P2 are already on the west side of Cortaderia.

Offsite Basins P1 through P3 lie to the north of the site. Basin P1 contains 3.70ac., and generates approximately 8.8cfs in the 100yr storm. Drainage from Basin P1 sheet flows to the east onto Cortaderia, then drains southward to onsite Basin 1. Basin P1 consists primarily of treatment 'A', and accepts no flow from upstream basins. Basin P2 was discussed in the proceeding paragraph. Basin P3 consists of 3.16ac., and produces 6.9cfs in the 100yr storm event. Flows from Basin P3 will sheet flow onto Spain Road.

Basins P4, P5, and P6 are offsite downstream basins which accept surface flows from onsite basins 5,6 and 7 respectively. With the exception of the installation of underground utilities, Basins P4, P5 and P6 will not be altered. Flows from these basins will continue to drain in a historic manner as was described in the existing conditions section for Basins E3, E4, and E5 respectively. The *High Desert Drainage Management Master Plan* gives peak allowable flows for all three of the existing culverts which convey flow under Tramway Boulevard. Comparisons of the proposed and allowable flows show that the development of Tract 2A-1B-1, as described in this report, will not exceed the flows anticipated by the *High Desert Drainage Management Master Plan*. This comparison can be found in the appendix of this report.

VI. CONCLUSION

This report has presented a comprehensive drainage management plan for the proposed High Desert Tract 2A-1B-1 Subdivision. The plan provides safe and adequate drainage protection for the proposed development. It is recommended that this plan be approved as presented.

Existing Drainage Basin Calculations for High Desert Tract 2A-1B-1							
Basin	Area	Land Treatment Percentages				Q	
I.D.	(acres)	A	B	C	D	cfs./ac.	cfs
E1	3.41	50%	45%	5%	0%	2.60	8.9
E2	3.41	50%	35%	15%	0%	2.68	9.1
E3	9.38	95%	0%	5%	0%	2.28	21.4
E4	8.38	95%	0%	5%	0%	2.28	19.1
E5	4.62	93%	2%	5%	0%	2.29	10.6

Proposed Drainage Basin Calculations for High Desert Tract 2A-1B-1

Basin	Area	Land Treatment Percentages				Q	
I.D.	(acres)	A	B	C	D	cfs./ac.	cfs
1	5.12	0%	30% 1.54	30% 1.54	40% 2.05	4.10	21.0
2	2.89	0%	31% .90	31% .90	38% 1.16	4.06	11.7
3	2.67	0%	31% .83	31% .83	38% 1.01	4.06	10.8
4	4.83	10% .48	30% 1.45	35% 1.69	25% 1.21	3.71	17.9
5	0.82	0%	35% .29	35% .29	30% .25	3.90	3.2
6	0.89	0%	35% .31	35% .31	30% .27	3.90	3.5
7	0.71	0%	35% .25	35% .25	30% .21	3.90	2.8
8	0.11	0%	5% .01	15% .02	80% .09	4.91	0.5
9	0.14	0%	5% .01	15% .02	80% .11	4.91	0.7
P1	3.70	92%	2%	1%	5%	2.38	8.8
P2	0.27	0%	20%	5%	75%	4.71	1.3
P3	3.16	100%	0%	0%	0%	2.20	7.0
P4	0.82	85%	0%	10%	5%	2.51	2.1
P5	1.14	95%	0%	0%	5%	2.35	2.7
P6	1.93	90%	5%	0%	5%	2.39	4.6

DMMP

Proposed Discharge Flows

Tables showing that proposed discharges do not exceed those anticipated by the *High Desert Drainage Management Master Plan*

Northern Culvert (36" RCP)

Contributing Basins and flows						Ex. Spain Rd. Flow	Total Q (cfs)	Anticipated Flow (cfs)
P2	P3 Dev	P4	2	5	8			
1.3	6.9 12.8	2.1	11.7	3.2	0.5	8.8	34.5	42

AP 15

Middle Culvert (36" RCP)

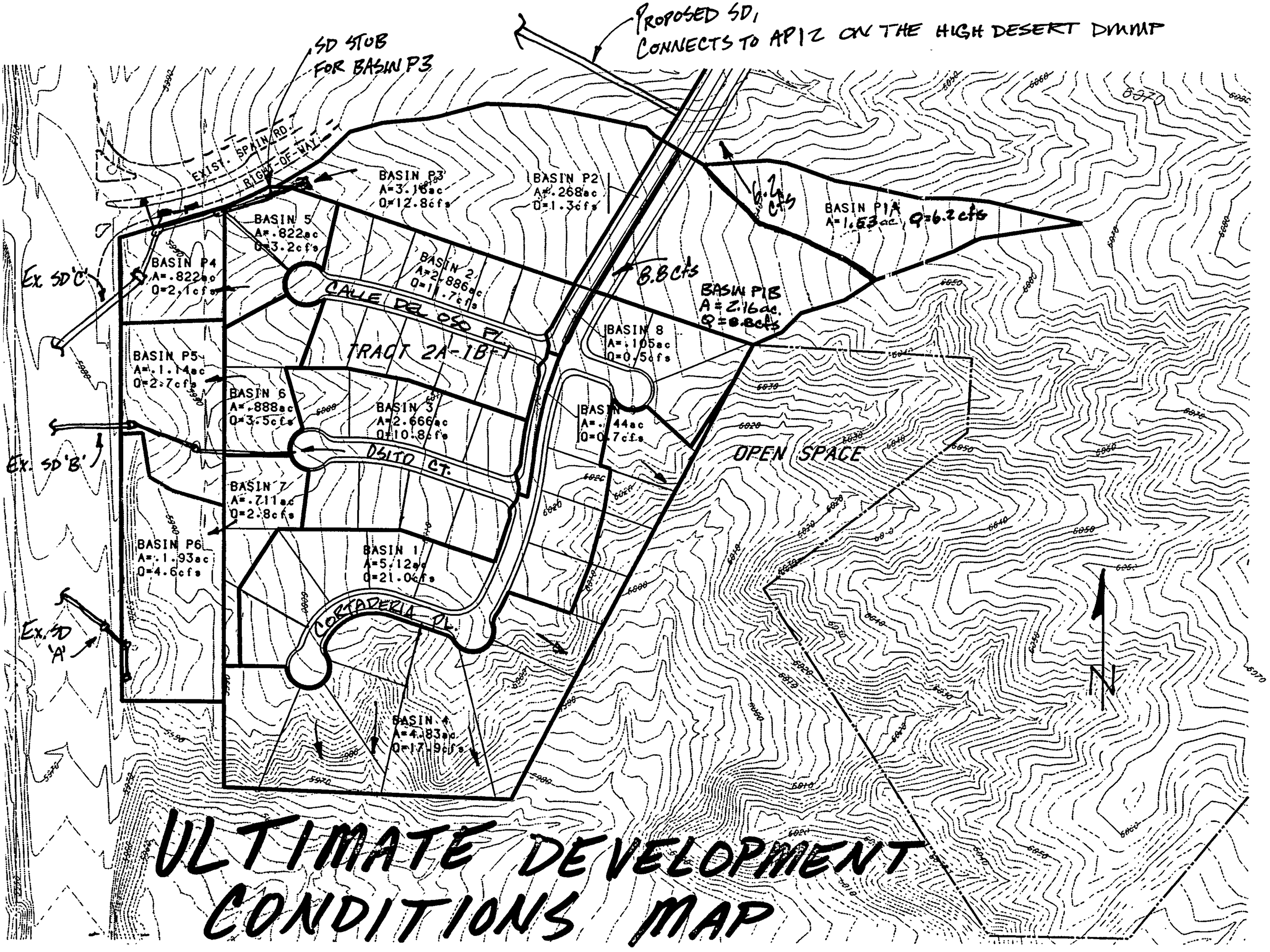
Contributing Basins and flows						Total Q (cfs)	Anticipated Flow (cfs)
P2	P5	3	6	8	9		
1.3	2.7	10.8	3.5	0.5	0.7	19.5	24

AP 16

Southern Culvert (30" RCP)

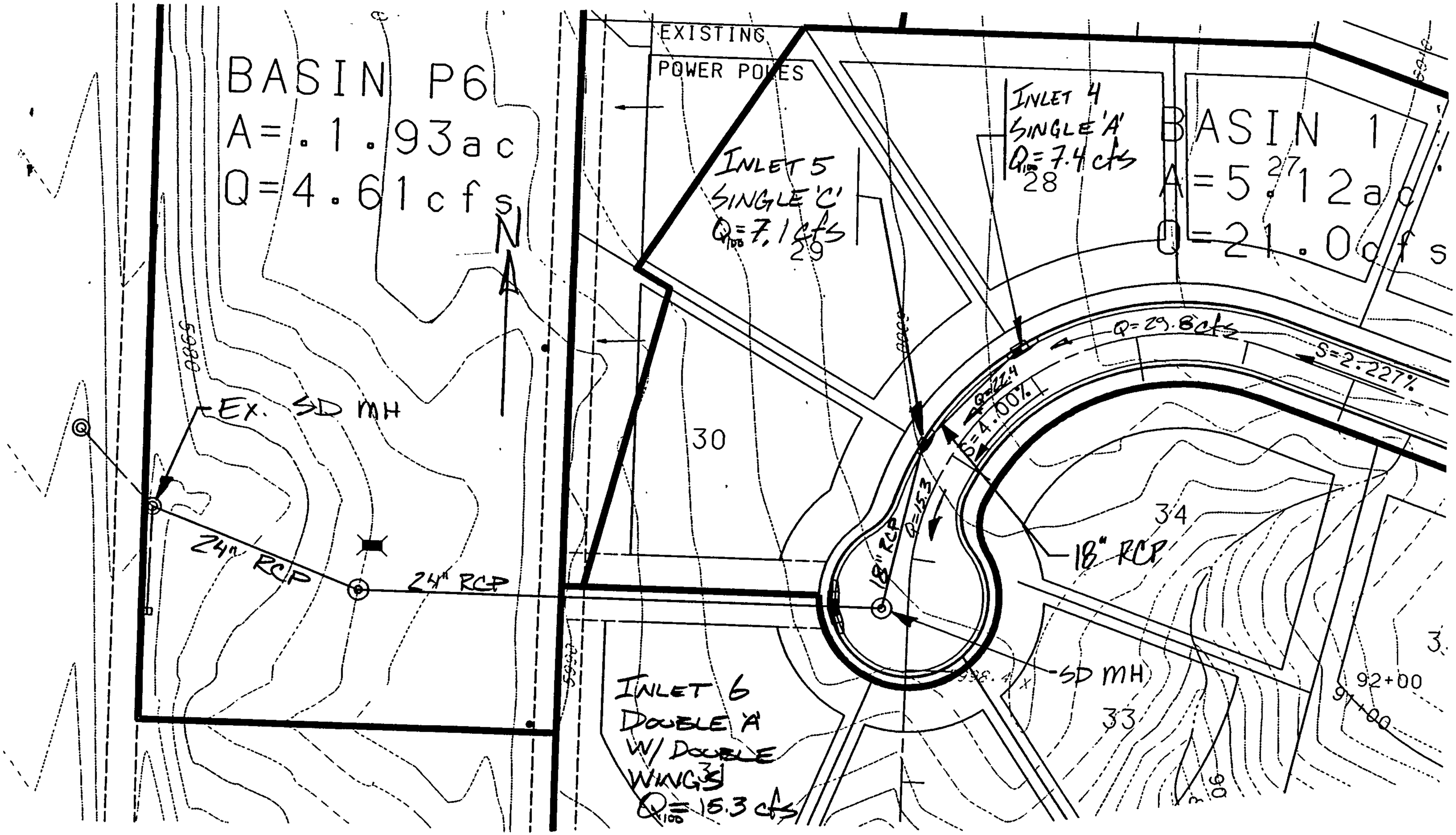
Contributing Basins and flows				Total Q (cfs)	Anticipated Flow (cfs)
P1 Dev	P6	1	7		
8.8	4.6	21	2.8	37.2	37

AP 17

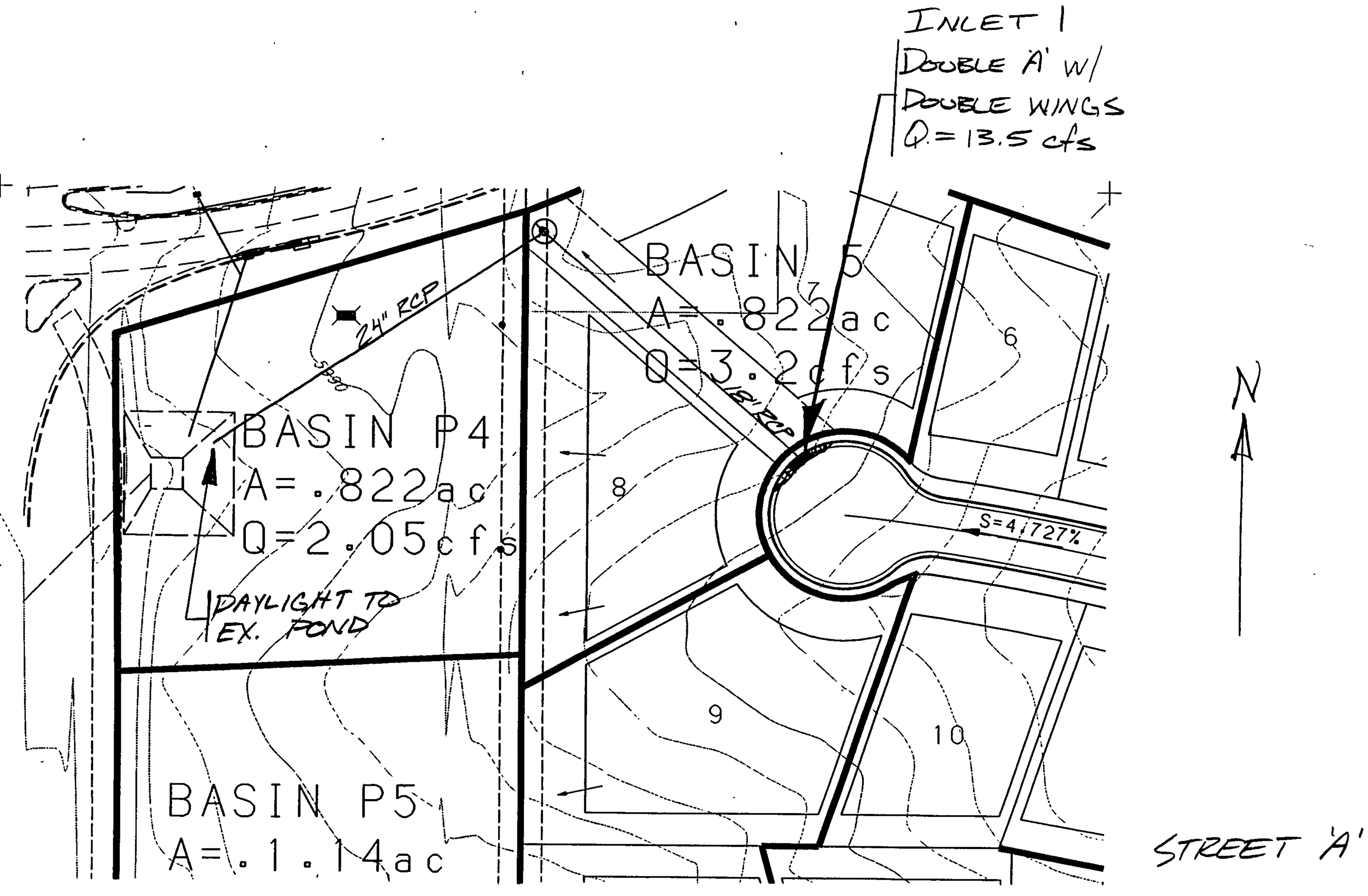


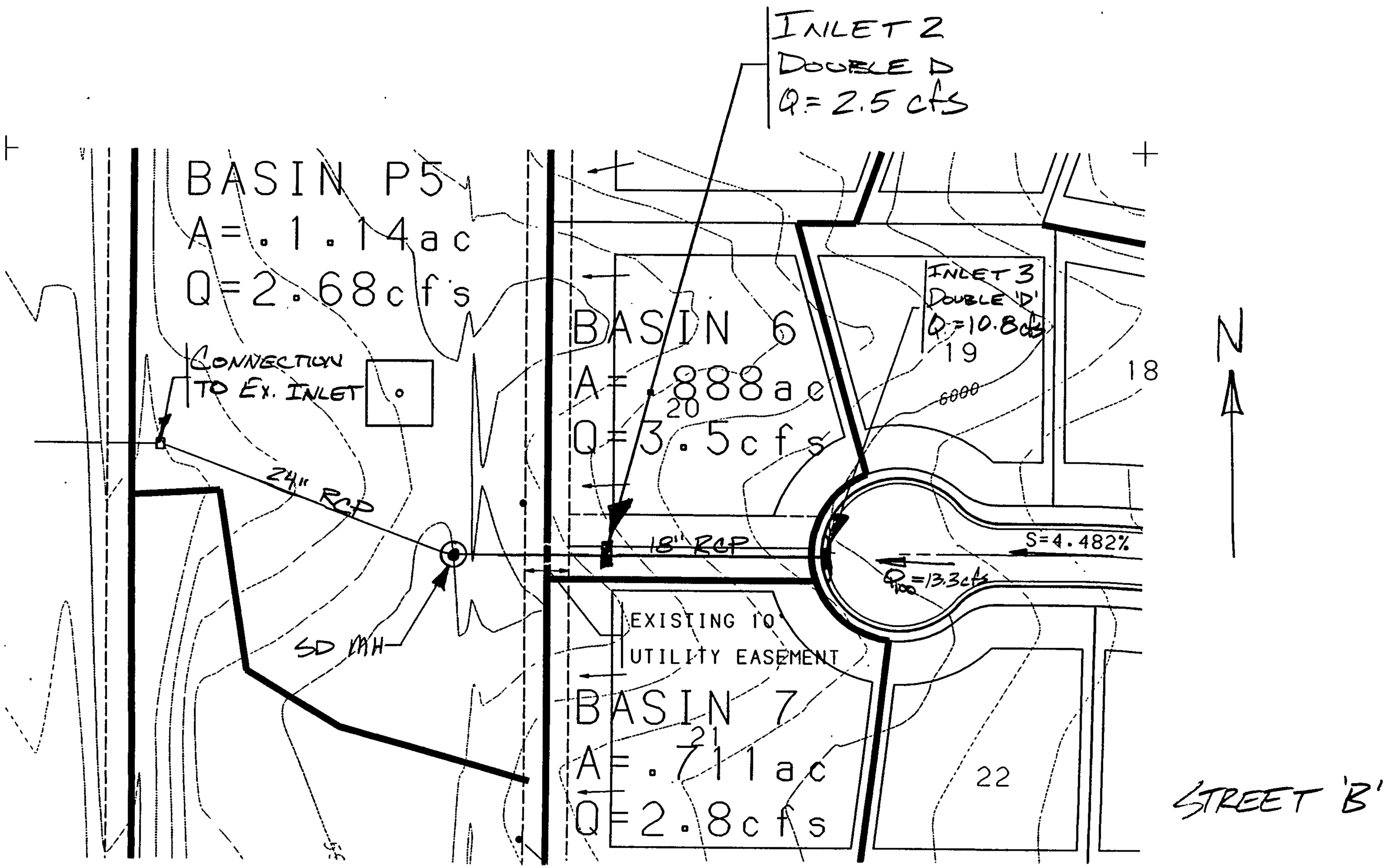
ULTIMATE DEVELOPMENT CONDITIONS MAP

EXIST. SD	CONTRIBUTING BASINS	TOTAL Q (cfs)
A	P1 (8.8cfs), 1, 7, P6	37.2
B	9 3 6 P5 8 P2	19.5
C	P2, P3, P4, 2, 5, 8, SPAIN RD.	40.4


BASIN P6
A=1.93ac
Q=4.61cfs
N
EXISTING
POWER POLES
INLET 5
SINGLE 'C'
Q100=7.1cfs
29
INLET 4
SINGLE 'A'
Q100=7.4cfs
28
BASIN 1
A=5.12ac
Q=21.0cfs
27
Q=29.8cfs
S=2.227%
Q=22.4
S=4.00%
Q=15.3
18" RCP
18" RCP
EX. SD MH
24" RCP
24" RCP
30
34
SD MH
33
92+00
91+00
INLET 6
DOUBLE 'A'
W/ DOUBLE
WING
Q100=15.3cfs

CORTADERIA


INLET 1
DOUBLE 'A' W/
DOUBLE WINGS
Q.=13.5 cfs
BASIN 5
A=.822ac
Q=3.2cfs
18" RCP
24" RCP
BASIN P4
A=.822ac
Q=2.05cfs
DAYLIGHT TO
EX. POND
BASIN P5
A=.1.14ac
S=4.727%
6
7
8
9
10
N
STREET 'A'


INLET 2
DOUBLE D
Q=2.5 cfs
BASIN P5
A=1.14ac
Q=2.68cfs
CONNECTION
TO EX. INLET
24" RCP
SD MH
BASIN 6
A=.888ac
Q=3.5cfs
20
18" RCP
INLET 3
DOUBLE 'D'
Q=10.8cfs
19
18
6000
S=4.482%
Q100=13.3cfs
EXISTING 10'
UTILITY EASEMENT
BASIN 7
21
A=.711ac
Q=2.8cfs
22
N
STREET 'B'

SUMMARY TABLE

Appendix C, Street Capacity

Street	Slope	Q (CFS)	Vel (FPS)	Water Surf. (ft' above FL)	Curb Type	EGL (ft' above FL)	Right of Way (ft' above FL)
Cortaderia Place	0.0283	8.8	4.1	0.33	Rolled	0.59	0.67
Cortaderia Place	0.0141	22.9	3.7	0.46	Std.	0.67	1.00
Cortaderia Place	0.059	24.6	6.2	0.39	Std.	0.99	1.00
Cortaderia Place	0.04	29.8	5.9	0.44	Std.	0.98	1.00
Street 'A'	0.0473	13.5	4.7	0.32	Rolled	0.66	0.67
Street 'B'	0.0448	13.3	4.5	0.28	Rolled	0.59	0.67

Cortaderia St. - NB SIDE OF STREET — NEAR SUBD ENTRANCE

MANNING'S N = .0170 SLOPE = .0283

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	1.02	4	6.83	0.41	7	26.00	0.33
2	6.00	0.91	5	24.00	0.06	8	35.00	0.67
3	6.00	0.41	6	26.00	0.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID	
0.03	0.03	0.0	0.0	0.8	0.8	0.80	
0.05	0.05	0.0	0.0	1.7	1.2	1.60	
0.08	0.08	0.1	0.1	2.7	1.5	2.63	
0.10	0.10	0.2	0.3	4.0	1.8	3.88	
0.13	0.13	0.3	0.6	5.3	2.1	5.13	
0.15	0.15	0.4	1.0	6.5	2.4	6.38	
0.18	0.18	0.6	1.6	7.8	2.7	7.63	
0.20	0.20	0.8	2.4	9.1	2.9	8.88	
0.23	0.23	1.0	3.3	10.4	3.2	10.13	
0.25	0.25	1.3	4.5	11.6	3.4	11.38	
0.28	0.28	1.6	5.9	12.9	3.7	12.63	
0.30	0.30	1.9	7.6	14.2	3.9	13.88	Q_{100} = 8.8 cfs
0.33	0.33	2.3	9.6	15.5	4.1	15.13	
0.35	0.35	2.7	11.6	17.2	4.3	16.83	(BASIN P1)
0.38	0.38	3.2	13.9	19.1	4.4	18.76	
0.40	0.40	3.6	16.6	21.1	4.6	21.52	
0.43	0.43	4.2	20.2	22.1	4.8	22.48	
0.45	0.45	4.8	24.1	23.7	5.0	23.15	
0.48	0.48	5.4	28.6	24.4	5.3	23.83	
0.50	0.50	6.0	33.5	25.1	5.6	24.50	
0.53	0.53	6.6	38.8	25.8	5.9	25.17	
0.55	0.55	7.2	44.5	26.5	6.2	25.85	
0.57	0.57	7.9	50.5	27.3	6.4	26.52	
0.60	0.60	8.5	56.9	28.0	6.7	27.19	
0.62	0.62	9.2	63.6	28.7	6.9	27.87	
0.65	0.65	9.9	70.7	29.4	7.1	28.54	
0.67	0.67	10.4	75.8	29.9	7.3	29.00	

R.O.W. = 0.67' ABOVE GUTTER (ROLLED CURB)

WSEL = 0.33'

VEL. HEAD = $4.1^2/64.4$ = 0.26'

EGL = 0.59 < 0.67'

Cortaderia St. with 1.41% slope

Std Curb

MANNING'S N = .0170 SLOPE = .0141

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	1.00	4	12.00	0.13	7	38.00	0.00
2	10.00	0.67	5	24.00	0.41	8	38.00	0.67
3	10.00	0.00	6	36.00	0.13	9	48.00	1.00

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
0.02	0.02	0.0	0.0	0.7	0.5	0.64
0.04	0.04	0.0	0.0	1.4	0.7	1.28
0.06	0.06	0.1	0.1	2.0	1.0	1.92
0.08	0.08	0.1	0.1	2.7	1.2	2.56
0.10	0.10	0.2	0.2	3.4	1.4	3.20
0.12	0.12	0.2	0.4	4.1	1.5	3.84
0.14	0.14	0.3	0.5	5.6	1.5	5.29
0.16	0.16	0.4	0.7	7.3	1.6	7.00
0.18	0.18	0.6	1.0	9.1	1.7	8.71
0.20	0.20	0.8	1.4	10.8	1.8	10.43
0.22	0.22	1.0	2.0	12.6	1.9	12.14
0.24	0.24	1.3	2.6	14.3	2.1	13.86
0.26	0.26	1.6	3.5	16.1	2.2	15.57
0.28	0.28	1.9	4.4	17.9	2.3	17.29
0.30	0.30	2.3	5.6	19.6	2.5	19.00
0.32	0.32	2.7	6.9	21.4	2.6	20.71
0.34	0.34	3.1	8.4	23.1	2.7	22.43
0.36	0.36	3.6	10.1	24.9	2.8	24.14
0.38	0.38	4.1	12.0	26.6	3.0	25.86
0.40	0.40	4.6	14.1	28.4	3.1	27.57
0.42	0.42	5.2	16.9	28.9	3.3	28.00
0.44	0.44	5.7	20.1	28.9	3.5	28.00
0.46	0.46	6.3	23.5	28.9	3.7	28.00
0.48	0.48	6.8	27.1	29.0	4.0	28.00
0.50	0.50	7.4	30.8	29.0	4.2	28.00
0.52	0.52	8.0	34.8	29.1	4.4	28.00
0.54	0.54	8.5	38.9	29.1	4.6	28.00
0.56	0.56	9.1	43.2	29.1	4.8	28.00
0.58	0.58	9.6	47.7	29.2	5.0	28.00
0.60	0.60	10.2	52.4	29.2	5.1	28.00
0.62	0.62	10.8	57.2	29.3	5.3	28.00
0.64	0.64	11.3	62.2	29.3	5.5	28.00
0.66	0.66	11.9	67.4	29.3	5.7	28.00
0.68	0.68	12.4	71.5	30.2	5.8	28.78
0.70	0.70	13.0	75.2	31.4	5.8	29.98

Q_{100} = 22.9 cfs

Q_{100} = BASIN P1 + 2/3(BASIN 1) = 22.9 cfs

Portion of basin 1 upstream of 1.41% slope in Cortaderia St.

R.OW = 1.0'

WSEL = 0.46'

VEL. HEAD = $3.7^2/64.4$ = 0.21

EGL = 0.67 < 1.0

Cortaderia Street with 5.9% slope

MANNING'S N = .0170 SLOPE = .0590

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	1.00	4	12.00	0.13	7	38.00	0.00
2	10.00	0.67	5	24.00	0.41	8	38.00	0.67
3	10.00	0.00	6	36.00	0.13	9	48.00	1.00

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
0.03	0.03	0.0	0.0	0.9	1.1	0.80
0.05	0.05	0.0	0.1	1.7	1.7	1.60
0.08	0.08	0.1	0.2	2.6	2.3	2.40
0.10	0.10	0.2	0.4	3.4	2.8	3.20
0.13	0.13	0.3	0.8	4.3	3.2	4.00
0.15	0.15	0.4	1.2	6.5	3.2	6.14
0.18	0.18	0.6	1.9	8.6	3.4	8.29
0.20	0.20	0.8	2.9	10.8	3.7	10.43
0.23	0.23	1.1	4.3	13.0	4.0	12.57
0.25	0.25	1.4	6.2	15.2	4.4	14.71
0.28	0.28	1.8	8.5	17.4	4.7	16.86
0.30	0.30	2.3	11.4	19.6	5.0	19.00
0.33	0.33	2.8	14.8	21.8	5.4	21.14
0.35	0.35	3.3	18.9	24.0	5.7	23.29
0.38	0.38	3.9	23.5	26.2	6.0	25.43
0.40	0.40	4.6	28.9	28.4	6.3	27.57
0.43	0.43	5.3	36.2	28.9	6.9	28.00
0.45	0.45	6.0	44.5	28.9	7.4	28.00
0.48	0.48	6.7	53.5	29.0	8.0	28.00
0.50	0.50	7.4	63.0	29.0	8.5	28.00
0.53	0.53	8.1	73.2	29.1	9.1	28.00
0.55	0.55	8.8	84.0	29.1	9.6	28.00
0.57	0.57	9.5	95.3	29.2	10.0	28.00
0.60	0.60	10.2	107.2	29.2	10.5	28.00
0.62	0.62	10.9	119.6	29.3	11.0	28.00
0.65	0.65	11.6	132.6	29.3	11.4	28.00
0.67	0.67	12.3	144.5	29.8	11.8	28.48
0.70	0.70	13.0	153.8	31.4	11.8	29.98
0.72	0.72	13.8	163.8	32.9	11.9	31.48
0.75	0.75	14.6	174.7	34.5	12.0	32.98
0.77	0.77	15.4	186.3	36.1	12.1	34.49
0.80	0.80	16.3	198.6	37.6	12.2	35.99
0.82	0.82	17.2	211.8	39.2	12.3	37.49
0.85	0.85	18.2	225.8	40.7	12.4	38.99
0.87	0.87	19.2	240.7	42.3	12.5	40.49
0.90	0.90	20.2	256.4	43.8	12.7	41.99
0.92	0.92	21.3	272.9	45.4	12.8	43.50
0.95	0.95	22.4	290.4	46.9	13.0	45.00
0.97	0.97	23.5	308.8	48.5	13.1	46.50
1.00	1.00	24.7	328.1	50.0	13.3	48.00

$Q_{100} = 24.6$ cfs

Q_{100} = BASIN P1 + 0.75(BASIN 1)

PORTION of basin 1 upstream of 5.9% slope in Cortaderia St.

R.O.W. = 1.0

WSEL = 0.39

VEL HEAD = $6.2^2/64.4$ = 0.60

EGL = 0.99 < 1.0

Cortaderia Street with 4% slope

MANNING'S N = .0170 SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	1.00	4	12.00	0.13	7	38.00	0.00
2	10.00	0.67	5	24.00	0.41	8	38.00	0.67
3	10.00	0.00	6	36.00	0.13	9	48.00	1.00

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
0.02	0.02	0.0	0.0	0.7	0.8	0.64
0.04	0.04	0.0	0.0	1.4	1.2	1.28
0.06	0.06	0.1	0.1	2.0	1.6	1.92
0.08	0.08	0.1	0.2	2.7	2.0	2.56
0.10	0.10	0.2	0.4	3.4	2.3	3.20
0.12	0.12	0.2	0.6	4.1	2.6	3.84
0.14	0.14	0.3	0.8	5.6	2.6	5.29
0.16	0.16	0.4	1.2	7.3	2.7	7.00
0.18	0.18	0.6	1.7	9.1	2.9	8.71
0.20	0.20	0.8	2.4	10.8	3.1	10.43
0.22	0.22	1.0	3.3	12.6	3.3	12.14
0.24	0.24	1.3	4.4	14.3	3.5	13.86
0.26	0.26	1.6	5.8	16.1	3.7	15.57
0.28	0.28	1.9	7.5	17.9	3.9	17.29
0.30	0.30	2.3	9.4	19.6	4.1	19.00
0.32	0.32	2.7	11.6	21.4	4.4	20.71
0.34	0.34	3.1	14.1	23.1	4.6	22.43
0.36	0.36	3.6	17.0	24.9	4.8	24.14
0.38	0.38	4.1	20.2	26.6	5.0	25.86
0.40	0.40	4.6	23.8	28.4	5.2	27.57
0.42	0.42	5.2	28.5	28.9	5.5	28.00
0.44	0.44	5.7	33.9	28.9	5.9	28.00 $Q_{100} = 29.8c$
0.46	0.46	6.3	39.5	28.9	6.3	28.00
0.48	0.48	6.8	45.6	29.0	6.7	28.00
0.50	0.50	7.4	51.9	29.0	7.0	28.00
0.52	0.52	8.0	58.6	29.1	7.4	28.00
0.54	0.54	8.5	65.6	29.1	7.7	28.00
0.56	0.56	9.1	72.8	29.1	8.0	28.00
0.58	0.58	9.6	80.4	29.2	8.3	28.00
0.60	0.60	10.2	88.3	29.2	8.7	28.00
0.62	0.62	10.8	96.4	29.3	9.0	28.00
0.64	0.64	11.3	104.8	29.3	9.3	28.00
0.66	0.66	11.9	113.5	29.3	9.6	28.00
0.68	0.68	12.4	120.4	30.2	9.7	28.78
0.70	0.70	13.0	126.6	31.4	9.7	29.98
0.72	0.72	13.6	133.2	32.6	9.8	31.18
0.74	0.74	14.3	140.2	33.9	9.8	32.38
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

R.O.W = 1.0' ABOVE GUTTER

WSEL = 0.44

VEL. HEAD = $5.9^2/64.4 = 0.54$

EGL = 0.98 < 1.0

TRACT 2A-1B-1 STREET "A"

STANDARD CURB & GUTTER

MANNING'S N = .0170 SLOPE = .0473

28' F-F STREET SECTION

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.67	4	14.00	0.37	7	28.00	0.67
2	0.17	0.00	5	26.00	0.13			
3	2.00	0.13	6	27.83	0.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID	
0.01	0.01	0.0	0.0	0.3	0.5	0.30	
0.02	0.02	0.0	0.0	0.6	0.9	0.60	
0.03	0.03	0.0	0.0	0.9	1.1	0.89	
0.04	0.04	0.0	0.0	1.3	1.4	1.19	
0.05	0.05	0.0	0.1	1.6	1.6	1.49	
0.06	0.06	0.1	0.1	1.9	1.8	1.79	
0.07	0.07	0.1	0.1	2.2	2.0	2.09	
0.08	0.08	0.1	0.2	2.5	2.1	2.38	
0.09	0.09	0.1	0.3	2.8	2.3	2.68	
0.10	0.10	0.1	0.4	3.1	2.5	2.98	
0.11	0.11	0.2	0.5	3.5	2.7	3.28	
0.12	0.12	0.2	0.6	3.8	2.8	3.57	
0.13	0.13	0.3	0.7	4.4	2.8	4.23	
0.14	0.14	0.3	0.8	5.5	2.7	5.23	
0.15	0.15	0.4	1.0	6.5	2.8	6.24	
0.16	0.16	0.4	1.2	7.5	2.8	7.24	
0.17	0.17	0.5	1.4	8.5	2.9	8.25	
0.18	0.18	0.6	1.8	9.5	3.0	9.25	
0.19	0.19	0.7	2.1	10.6	3.1	10.26	
0.20	0.20	0.8	2.5	11.6	3.2	11.26	
0.21	0.21	0.9	3.0	12.6	3.3	12.27	
0.22	0.22	1.0	3.6	13.6	3.4	13.27	
0.23	0.23	1.2	4.2	14.6	3.5	14.28	
0.24	0.24	1.3	4.9	15.7	3.7	15.28	
0.25	0.25	1.5	5.6	16.7	3.8	16.29	
0.26	0.26	1.7	6.5	17.7	3.9	17.29	
0.27	0.27	1.8	7.4	18.7	4.0	18.30	
0.28	0.28	2.0	8.4	19.7	4.2	19.30	
0.29	0.29	2.2	9.5	20.8	4.3	20.31	
0.30	0.30	2.4	10.7	21.8	4.4	21.31	13.5 CFS
0.31	0.31	2.6	11.9	22.8	4.5	22.32	
0.32	0.32	2.9	13.3	23.8	4.6	23.32	100 YR-6 hr STORM
0.33	0.33	3.1	14.8	24.9	4.8	24.33	
0.34	0.34	3.4	16.3	25.9	4.9	25.33	
0.35	0.35	3.6	18.0	26.9	5.0	26.34	
0.36	0.36	3.9	19.8	27.9	5.1	27.34	
0.37	0.37	4.2	22.0	28.4	5.3	27.85	
0.38	0.38	4.4	24.4	28.5	5.5	27.85	
0.39	0.39	4.7	27.0	28.5	5.7	27.86	
0.40	0.40	5.0	29.7	28.5	6.0	27.86	
0.41	0.41	5.3	32.5	28.5	6.2	27.87	
0.42	0.42	5.6	35.4	28.5	6.4	27.87	
0.43	0.43	5.8	38.4	28.6	6.6	27.88	
0.44	0.44	6.1	41.5	28.6	6.8	27.88	
0.45	0.45	6.4	44.7	28.6	7.0	27.89	
0.46	0.46	6.7	48.0	28.6	7.2	27.89	
0.47	0.47	6.9	51.4	28.6	7.4	27.90	
0.48	0.48	7.2	54.8	28.7	7.6	27.90	
0.49	0.49	7.5	58.4	28.7	7.8	27.91	
0.50	0.50	7.8	62.0	28.7	8.0	27.91	
0.51	0.51	8.1	65.7	28.7	8.1	27.92	
0.52	0.52	8.3	69.5	28.7	8.3	27.92	
0.53	0.53	8.6	73.4	28.8	8.5	27.93	

0.54	0.54	8.9	77.4	28.8	8.7	27.93
0.55	0.55	9.2	81.4	28.8	8.9	27.94
0.56	0.56	9.5	85.5	28.8	9.0	27.94
0.57	0.57	9.7	89.7	28.8	9.2	27.95
0.58	0.58	10.0	94.0	28.9	9.4	27.95
0.59	0.59	10.3	98.4	28.9	9.6	27.96
0.60	0.60	10.6	102.8	28.9	9.7	27.96
0.61	0.61	10.9	107.4	28.9	9.9	27.97
0.62	0.62	11.1	112.0	29.0	10.1	27.97
0.63	0.63	11.4	116.6	29.0	10.2	27.98
0.64	0.64	11.7	121.4	29.0	10.4	27.98
0.65	0.65	12.0	126.2	29.0	10.5	27.99
0.66	0.66	12.3	131.1	29.0	10.7	27.99
0.67	0.67	12.5	136.1	29.1	10.9	28.00

13.5 CFS

DEPTH 0.32 FT

VELOCITY 4.7 FPS

$$\frac{V^2}{2G} = \frac{(4.7)^2}{64.4} = 0.34$$

EGL = 0.67 < TOP OF CURB

OK

TRACT 2A-1B-1 STREET "B"

ROL CURB & GUTTER

MANNING'S N = .0170 SLOPE = .0448

28'-F/F

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.33	4	14.00	0.30	7	28.00	0.33
2	1.00	0.00	5	26.00	0.06			
3	2.00	0.06	6	27.00	0.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID	
0.01	0.01	0.0	0.0	0.4	0.5	0.38	
0.02	0.02	0.0	0.0	0.8	0.9	0.76	
0.03	0.03	0.0	0.0	1.1	1.1	1.13	
0.04	0.04	0.0	0.0	1.5	1.4	1.51	
0.05	0.05	0.0	0.1	1.9	1.6	1.89	
0.06	0.06	0.1	0.1	2.3	1.8	2.27	
0.07	0.07	0.1	0.2	3.2	1.8	3.12	
0.08	0.08	0.1	0.2	4.2	1.8	4.18	
0.09	0.09	0.2	0.3	5.3	1.9	5.25	
0.10	0.10	0.2	0.5	6.3	2.1	6.31	
0.11	0.11	0.3	0.7	7.4	2.2	7.37	
0.12	0.12	0.4	0.9	8.5	2.3	8.43	
0.13	0.13	0.5	1.2	9.5	2.5	9.49	
0.14	0.14	0.6	1.5	10.6	2.6	10.55	
0.15	0.15	0.7	1.9	11.7	2.8	11.61	
0.16	0.16	0.8	2.4	12.7	2.9	12.67	
0.17	0.17	0.9	2.9	13.8	3.1	13.73	
0.18	0.18	1.1	3.5	14.9	3.2	14.79	
0.19	0.19	1.2	4.1	15.9	3.4	15.85	
0.20	0.20	1.4	4.9	17.0	3.5	16.91	
0.21	0.21	1.6	5.7	18.0	3.6	17.97	
0.22	0.22	1.8	6.6	19.1	3.8	19.03	
0.23	0.23	2.0	7.6	20.2	3.9	20.09	
0.24	0.24	2.2	8.7	21.2	4.0	21.15	
0.25	0.25	2.4	9.9	22.3	4.2	22.22	13.3 CFS
0.26	0.26	2.6	11.1	23.4	4.3	23.28	
0.27	0.27	2.8	12.5	24.4	4.4	24.34	100 YR-6 HR
0.28	0.28	3.1	14.0	25.5	4.5	25.40	STORM
0.29	0.29	3.3	15.6	26.6	4.7	26.46	
0.30	0.30	3.6	17.3	27.6	4.8	27.52	
0.31	0.31	3.9	19.4	28.0	5.0	27.88	
0.32	0.32	4.2	21.7	28.1	5.2	27.94	
0.33	0.33	4.5	24.1	28.1	5.4	28.00	

DEPTH = 0.28 FT

ROW = 0.67'

VELOCITY = 4.5 FPS

EGL = 0.28 + 0.31 = 0.59' BELOW ROW

$$\frac{V^2}{2G} = \frac{(4.5)^2}{64.4} = 0.31$$

OK

Q = 13.3 CFS

SUMMARY TABLE

Appendix D, Inlet & Storm Drain Capacity

Inlet	Type	Capacity (CFS)	Actual Q (CFS)
1	Dbl A, Dbl wing	29.76	13.3
2	*Single D	3.5	2.5
3	Double D	10.8	10.8
4	Single A	7.4	7.4
5	Single C	7.1	7.1
6	Dbl A, Dbl wing	30.6	15.3

*This inlet was a Double D in the drainage report. Because a Single grate is capable of carrying the required flows, Inlet 2 has been changed.

Note: Due to the steep slopes of the storm drain lines, all of the proposed lines opperate under non-pressure flow, and have significant excess capacity, for this reason a summary table has not been provided - HGL's are shown on the construction plans.

HGL ANALYSIS FOR 'SOUTHERN' STORM DRAIN UNDER TRAMWAY BLVD. (EXISTING 30" RCP)

Structure	Diam.	Q	Area	Vel.	K	Sf	Length	D.	Angle	Hf	Hb	Hj	Hmh	Ht	Total Losses	HGL(dn)	HGL(up)	Pipe Soffit	Low Point #	HV	EGL(dn)	EGL(up)
OUTLET											0.00	0.00	0.00	0.00	0.00		66.10	66.10	66.10	1.74	66.10	67.84
	30	52.0	4.91	10.59	410	0.0161	146.00			2.35												
MH 1								6	45		0.21	0.00	0.08	0.00	0.29	68.45	69.17	67.30	72.04	1.3	70.19	70.48
	30	45.0	4.91	9.17	410	0.0120	94.00			1.13												
MH 2								6	0		0.00	0.41	0.05	0.00	0.47	70.31	71.19	67.80	71.42	0.89	71.61	72.08
	30	37.2	4.91	7.58	410	0.0082	40.00			0.33												
MH 3								6	0		0.00	1.24	0.02	0.00	1.26	71.52	73.59	68.50	73.70	0.08	72.41	73.67
	24	7.0	3.14	2.23	226	0.0010	52.00			0.05												
INLET																						

ANALYSIS OF AN INLET IN A SUMP CONDITION

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

WEIR: Q=C*L*H^1.5

Wing opening
C= 3.0
L= 4.0
Q=3.0(4.0')H**1.5= 12.0H**1.5

Grate opeining
C=3.0
L(double grate)=[2(2.67')+2(1.8')]=8.94'
Q=3.0(8.94)H^1.5=26.82*H^1.5

ORIFICE: Q=C*A*(2*G*H)**0.5

Grate opening
C=0.6
A(double grate)=8.19 sf
Q=4.194*(64.4*H)^0.5

Wing opening
C=0.6
A=2.0 sf
Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WING ~~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	
	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 cul-de-sac 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 = 15.3 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 30.6 CFS at the sump condition

The total runoff in Cortaderia is 29.8 cfs; of which 14.5 cfs is diverted into the two inlets upstream of the type "A".

CORTADERIA ST.

24" RCP Storm Drain @ Slope = 4% PIPE CONECTING MH IN

CULVERT RATING TABLE CORTADERIA CUL-DE-SAC TO

24. INCH DIAMETER PIPE SOUTHERN CULVERT UNDER

N = 0.01300 INCREMENT = 1.50 SLOPE = 0.04000 TRAMWAY.

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.50000	0.08175	0.34955	4.27578
3.00000	0.22665	1.50675	6.64777
4.50000	0.40777	3.47552	8.52316
6.00000	0.61418	6.19769	10.09094
7.50000	0.83876	9.58659	11.42943
9.00000	1.07605	13.53649	12.57975
10.50000	1.32145	17.92653	13.56583
12.00000	1.57080	22.62237	14.40186
13.50000	1.82014	27.47616	15.09561
15.00000	2.06554	32.32513	15.64975
16.50000	2.30283	36.98801	16.06201
18.00000	2.52741	41.25769	16.32412
19.50000	2.73382	44.88528	16.41854
21.00000	2.91494	47.54010	16.30914
22.50000	3.05984	48.66991	15.90604
24.00000	3.14159	45.24477	14.40186

Q_{100} = 29.8 cfs

NOTE: THIS PIPE HAS EXCESS CAPACITY.

18" RCP Storm Drain @ Slope = 3.5% — PIPE CONNECTING INLETS 4 & 5 & CONNECTING W/ SD MH IN CORTADERIA CUL-DE-SAC

CULVERT RATING TABLE

18. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.03500

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.03862	0.11815	3.05916
2.00000	0.10733	0.51174	4.76792
3.00000	0.19359	1.18660	6.12941
4.00000	0.29241	2.12823	7.27836
5.00000	0.40056	3.31295	8.27080
6.00000	0.51564	4.71115	9.13655
7.00000	0.63565	6.28867	9.89336
8.00000	0.75883	8.00747	10.55239
9.00000	0.88357	9.82589	11.12065
10.00000	1.00831	11.69861	11.60215
11.00000	1.13150	13.57627	11.99848
12.00000	1.25151	15.40468	12.30890
13.00000	1.36659	17.12327	12.52997
14.00000	1.47474	18.66214	12.65453
15.00000	1.57355	19.93576	12.66927
16.00000	1.65981	20.82725	12.54794
17.00000	1.72852	21.13320	12.22616
18.00000	1.76715	19.65180	11.12065

$Q_{100} = 14.4$ cfs

ANALYSIS OF AN INLET IN A SUMP CONDITION

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

WEIR: Q=C*L*H^1.5

Wing opening
C= 3.0
L= 4.0
Q=3.0(4.0')H**1.5= 12.0H**1.5

Grate opeining
C=3.0
L(double grate)=[2(2.67')+2(1.8')]=8.94'
Q=3.0(8.94)H^1.5=26.82*H^1.5

ORIFICE: Q=C*A*(2*G*H)**0.5

Grate opening
C=0.6
A(double grate)=8.19 sf
Q=4.194*(64.4*H)^0.5

Wing opening
C=0.6
A=2.0 sf
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	
	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 cul-de-sac 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 = 13.5 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 27.0 CFS at the sump condition

STREET 'A'

18" RCP Storm Drain @ Slope = 3.5% - Street 'B' — FOR RCP SD FROM CUL-DE-SAC AT W. END OF STREET 'B' TO MIDDLE EXIST. CULVERT UNDER TRAMWAY.

CULVERT RATING TABLE

18. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.03500

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.03862	0.11815	3.05916
2.00000	0.10733	0.51174	4.76792
3.00000	0.19359	1.18660	6.12941
4.00000	0.29241	2.12823	7.27836
5.00000	0.40056	3.31295	8.27080
6.00000	0.51564	4.71115	9.13655
7.00000	0.63565	6.28867	9.89336
8.00000	0.75883	8.00747	10.55239
9.00000	0.88357	9.82589	11.12065
10.00000	1.00831	11.69861	11.60215
11.00000	1.13150	13.57627	11.99848
12.00000	1.25151	15.40468	12.30890
13.00000	1.36659	17.12327	12.52997
14.00000	1.47474	18.66214	12.65453
15.00000	1.57355	19.93576	12.66927
16.00000	1.65981	20.82725	12.54794
17.00000	1.72852	21.13320	12.22616
18.00000	1.76715	19.65180	11.12065

$Q_{100} = 13.3$ cfs

THIS CAPACITY ANALYSIS ALSO SERVES FOR STREET 'A' — SINCE Q_{100} FOR THE INLET IN STREET 'A' IS 13.5 cfs, & THE SLOPE OF THE STORM DRAIN IS $\geq 3.5\%$.

NOTE: THESE PIPES HAVE EXCESS CAPACITY.

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Double Grate Type "D"

WEIR: Q=C*L*H^1.5

Grate opening

C=3.0

L(double grate)=[4(2.67')+2(1.8')]=14.28'

Q=3.0(14.28)H^1.5=42.84*H^1.5

ORIFICE:

Grate opening

C=0.6

A(double grate)=8.19 sf

Q=4.194*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	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	Flow at double "d" inlet at cul-del-sac low point
	0.10	0.10	1.35	12.47	1.35	Weir controls on grate analysis
	0.20	0.20	3.83	17.64	3.83	
	0.30	0.30	7.04	21.60	7.04	Residual flows to next inlet in emergency access rd
TOP OF CURB	0.40	0.40	10.84	24.94	10.84	
	0.50	0.50	15.15	27.88	15.15	
	0.60	0.60	19.91	30.55	19.91	
ROW LIMIT	0.70	0.70	25.09	32.99	25.09	
	0.80	0.80	30.65	35.27	30.65	
	0.90	0.90	36.58	37.41	36.58	
	1.00	1.00	42.84	39.43	39.43	Orifice controls on grate analysis

NOTE: The total runoff intercepted by the inlet at the low point in the cul-de-sac is:

THE 100 YR STORM EVENT = 13.3 CFS

The remaining flow not intercepted by the inlet in the cul-de-sac is picked-up by the inlet located in the emergency access road between the lots.

STREET 'B'