DRAINAGE INFORMATION SHEET

PROJECT TITLE: PARKWEST SUBDIVISION UNIT B1 ZONE ATLAS/DRNG. FILE #: ~~G9~~ H9/D1D

LEGAL DESCRIPTION: TRACTS I, II-A, II-B, III, AND IV LAURELWOOD II SUBDIVISION

CITY ADDRESS: UNSER BOULEVARD AND 98TH STREET

ENGINEERING FIRM: COMMUNITY SCIENCES CORPORATION CONTACT: STEPHEN L. CRAWFORD

ADDRESS: P.O. BOX 1328, CORRALES, NM 87048 PHONE: 897-0000

OWNER: SIVAGE THOMAS HOMES CONTACT: W. DAVID SIVAGE

ADDRESS: 5141 MASTHEAD NE PHONE: 821-3511

ARCHITECT: N/A CONTACT:

ADDRESS: PHONE:

SURVEYOR: N/A CONTACT:

ADDRESS: PHONE:

CONTRACTOR: N/A CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

___YES

_X_NO

___COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO: 93-303

EPC NO.

PROJ. NO.

TYPE OF SUBMITTAL:

___DRAINAGE REPORT

___DRAINAGE PLAN

___CONCEPTUAL GRADING/DRAINAGE PLAN

___GRADING PLAN

___EROSION CONTROL PLAN

_X_ENGINEER'S CERTIFICATION

TYPE OF APPROVAL SOUGHT:

___SKETCH PLAT APPROVAL

___PRELIMINARY PLAT APPROVAL

___SITE DEVELOPMENT PLAN APPROVAL

___FINAL PLAT APPROVAL

___BUILDING PERMIT APPROVAL

___FOUNDATION PERMIT APPROVAL

___CERT. OF OCCUPANCY APPROVAL

___ROUGH GRADING PERMIT APPROVAL

___GRADING/PAVING PERMIT APPROVAL

_X_OTHER: BOND RELEASE (SPECIFY)

MAR 14

SUBMITTED:

BY:

CSC#143-22-635/143-22AM.REP

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Laurelwood II Subdivision ZONE ATLAS/DRNG. FILE #: H-9 D1D

LEGAL DESCRIPTION: Laurelwood II Subdivision

CITY ADDRESS:

ENGINEERING FIRM: FRED DENNEY & ASSOCIATES, INC. CONTACT: Joe Jones

ADDRESS: 2400 Comanche NE, Albuquerque, NM 87107 PHONE: 884-0696

OWNER: Laurelwood II Joint Venture CONTACT: Skip Buchanan

ADDRESS: 2400 Comanche NE, Albuquerque, NM 87107 PHONE: 884-0696

ARCHITECT: N/A CONTACT: N/A

ADDRESS: PHONE:

SURVEYOR: FRED DENNEY & ASSOCIATES, INC. CONTACT: Kevin Daly

ADDRESS: 2400 Comanche NE, Albuquerque, NM 87107 PHONE: 884-0696

CONTRACTOR: CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

__X__ YES
_____ NO
_____ COPY OF CONFERENCE RECAP SHEET PROVIDED

RECEIVED
SEP 03 1987
HYDROLOGY SECTION

DRB No. 87-431
EPC No.
PROJ. No.

TYPE OF SUBMITTAL:

_____ DRAINAGE REPORT
__X__ DRAINAGE PLAN
_____ CONCEPTUAL GRADING & DRAINAGE PLAN
_____ GRADING PLAN
_____ EROSION CONTROL PLAN
_____ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

_____ SECTOR PLAN APPROVAL
_____ SKETCH PLAT APPROVAL
__X__ PRELIMINARY PLAT APPROVAL
_____ SITE DEVELOPMENT PLAN APPROVAL
_____ FINAL PLAT APPROVAL
_____ BUILDING PERMIT APPROVAL
_____ FOUNDATION PERMIT APPROVAL
_____ CERTIFICATE OF OCCUPANCY APPROVAL
_____ ROUGH GRADING PERMIT APPROVAL
_____ GRADING/PAVING PERMIT APPROVAL

_____ OTHER _____ (SPECIFY)

DATE SUBMITTED: September 3, 1987

BY: Joe Jones
Joe Jones

REV. 10/85

FILE COPY

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

Ken Schultz
Mayor

UTILITY DEVELOPMENT DIVISION
HYDROLOGY SECTION
(505) 768-2650

September 8, 1987

Joe Jones
Fred Denney & Associates, Inc.
2400 Comanche Road, NE
Albuquerque, New Mexico 87107

RE: DRAINAGE PLAN FOR LAURELWOOD II SUBDIVISION, SUBMITTED FOR PRELIMINARY PLAT APPROVAL (H-9/D1D)

Dear Joe:

Your submittal, referred to above, with an engineer's stamp date of September 3, 1987, and received by us on that date, is approved for preliminary plat sign-off by the City Engineer.

If you have any questions, please call me at 768-2650.

Cordially,

Stuart Reeder

G. Stuart Reeder, P.E.
C.E./Hydrology Section

xc: Owner

GSR/bsj

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

April 6, 1995

Stephen L. Crawford, P.E.
Community Science Corp.
P.O. Box 1328
Corrales, NM 87048

RE: ENGINEER'S CERTIFICATION FOR PARKWEST UNIT 1 (H-9/D1D)
RECEIVED MARCH 14, 1995 FOR FINANCIAL GUARANTY RELEASE
ENGINEER'S STAMP DATED 3-10-95

Dear Mr. Crawford:

Based on the information included in the submittal referenced above, City Hydrology accepts the Engineer's Certification of grading & drainage for Financial Guaranty Release. Contact the DRC Chairman, Billy Goolsby, to receive the actual release.

Comment #2 was backwards. Rear yard ponds are designed to contain the volume of runoff from the rear yard only. All other areas must drain to the street. Therefore the side yard swales drain to the street instead the rear yard ponds.

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

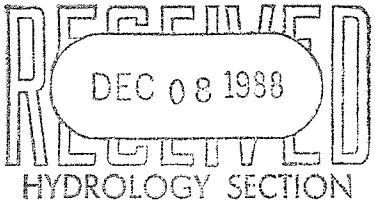
Sincerely,

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

c: Andrew Garcia
Billy Goolsby, CPN 4886.91
W. David Sivage, Sivage Thomas Homes,5141 Masthead NE 87109

AMENDED
MASTER DRAINAGE PLAN
FOR
LAURELWOOD II SUBDIVISION

DECEMBER, 1988



PREPARED BY:
FRED DENNEY & ASSOCIATES, INC.
CONSULTING ENGINEERS AND LAND SURVEYORS
2400 COMANCE ROAD NE
ALBUQUERQUE, NM 87107
(505) 884-0696

I, Richard L. Beltramo, hereby certify that the enclosed documents and drawings were prepared under my supervision and are true and correct to the best of my knowledge and belief.

Richard L. Beltramo

New Mexico Registered Professional Engineer No. 10596

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Master Drainage Plan Laurelwood II ZONE ATLAS/DRNG. FILE #: H9/D1D

LEGAL DESCRIPTION: Laurelwood II Subdivision

CITY ADDRESS:

ENGINEERING FIRM: FRED DENNEY & ASSOCIATES, INC. CONTACT: Rick Beltramo, P.E.

ADDRESS: 2400 Comanche NE, Albuquerque, NM 87107 PHONE: 884-0696

OWNER: Laurelwood II Joint Venture CONTACT: Skip Buchanan

ADDRESS: PHONE: 883-9393

ARCHITECT: N/A CONTACT: N/A

ADDRESS: PHONE:

SURVEYOR: FRED DENNEY & ASSOCIATES, INC. CONTACT: Kevin Daly

ADDRESS: 2400 Comanche NE, Albuquerque, NM 87107 PHONE: 884-0696

CONTRACTOR: CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

_____ YES
_X_ NO
_____ COPY OF CONFERENCE RECAP SHEET PROVIDED

RECEIVED
DEC 08 1988
HYDROLOGY SECTION

DRB No.
EPC No.
PROJ. No. W.O. 3411

TYPE OF SUBMITTAL:

_____ DRAINAGE REPORT
_X_ DRAINAGE PLAN
_____ CONCEPTUAL GRADING & DRAINAGE PLAN
_____ GRADING PLAN
_____ EROSION CONTROL PLAN
_____ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

_____ SECTOR PLAN APPROVAL
_____ SKETCH PLAT APPROVAL
_____ PRELIMINARY PLAT APPROVAL
_____ SITE DEVELOPMENT PLAN APPROVAL
_____ FINAL PLAT APPROVAL
_____ BUILDING PERMIT APPROVAL
_____ FOUNDATION PERMIT APPROVAL
_____ CERTIFICATE OF OCCUPANCY APPROVAL
_____ ROUGH GRADING PERMIT APPROVAL
_____ GRADING/PAVING PERMIT APPROVAL

_____ OTHER Work Order Approval (SPECIFY)

DATE SUBMITTED: 12/7/88

BY: Rick Beltramo
RICK BELTRAMO

REV. 10/85

TABLE OF CONTENTS

AMENDED MASTER DRAINAGE PLAN FOR LAURELWOOD II SUBDIVISION

I. PURPOSE

This report addresses and presents a drainage management plan necessary for the development of Laurelwood II Subdivision. During the course of design of Lava Bluff Drive, alternative drainage methods were established.

Additional analysis of the hydrology associated with the Ouray Storm Drain system was also found to be needed. The original report proposed building the channel and the roadway in conjunction with Phase I of Tract III. The current scenario is to build Phase I of Tract IV. For the reasons stated above, it was necessary to amend the original Master Drainage Plan.

II. GENERAL

The proposed development site consists of approximately 116 acres and is located on Unser Boulevard between 98th Street and Ouray Road. The site has been initially subdivided into four tracts via Bulk Land Platting. Each tract is zoned for residential use and will be developed accordingly. The four tracts will establish the future platting phases of the development; however, the platting phases will not necessarily be in sequential order. No development is proposed for Tract II at this time.

The original Master Drainage Plan utilized the major local street, Lava Bluff Drive, to carry the majority of the onsite runoff to three outfall locations. These outfall points are the Ladera Channel, the existing storm drain at Ouray Road, and the

existing storm drain at 98th street. During the design of this roadway, alternatiave drainage patterns were considered which we feel will improve the overall drainage of the subdivision and better meet the requirements of the City of Albuquerque Drainage Ordinance. In addition, a more detailed analysis of the Ouray Storm Drain was performed to ensure that adequate downstream capacity is available for this development.

III. DRAINAGE

At present, the proposed infrastructure improvements consist of the construction of the Ladera Channel and Lava Bluff Drive. The remainder of the site will be developed in phases at some time in the future. This master plan addresses the ultimate condition with fully developed tracts.

As individual tracts are developed, a detailed grading and drainage plan will be submitted which presents both interim and ultimate drainage plans. It is anticipated that temporary drainage swales and ponds will be constructed which facilitate interim drainage conditions. Upon development of individual phases, the interim ponds and channels will be removed or relocated until the permanent facilities are constructed.

Analysis of the drainage has been accomplished using two methods. Hymo was used for analysis of the Ouray Storm Drain outfall. Due to the varying types of basins and the large offsite basins contributing, it was necessary to use a Unit Hydrograph type model such as Hymo. This enabled modeling the effects due to the

routing of hydrographs. Curve numbers were input in the program in order to model infiltration and abstraction parameters.

Basins were divided into three types of basins or treatments:

Treatment #1 - Pervious Area, Undeveloped Land, CN = 69.

Treatment #2 - Pervious Area, Developed Land, CN = 85. Represents lawns, etc., all areas which are not considered as impervious.

Treatment #3 - Impervious Area, Developed Land, CN = 98. Represents paved areas and other impervious areas such as buildings.

Applied rainfall for this area is 2.2 inches per six hours for the 100-year design storm. A rainfall hyetograph was developed using the City of Albuquerque mass curve distribution. Computer printouts of the Hymo analysis are located in the Appendix.

Smaller basins such as onsite areas were analyzed using the DPM Rational Method. The Ouray Storm Drain was evaluated using both methods with the major system being analyzed using Hymo, and the collector system analyzed using Rational. Basins 6A through 6D were analyzed with Rational using the area below the escarpment as the contributing area. It was felt that this area would see a relatively large flow from areas adjacent to the soil cement channel. Evaluations using Hymo for the offsite areas of Basins 6A through 6C indicate much smaller flow rates. This is due to the large gentle sloping areas on top of the escarpment. Offsite basins are shown in Exhibit A.

Two offsite drainage easements are shown. One is associated with the Ladera Channel and contains trainer dikes which divert flow into the channel. The second easement is located in Basin 3A and is for a desilting pond. Once areas to the west are developed, the pond could then be removed. This pond is not designed to detain and reduce flow rates but rather to remove sediment from the storm water before discharging onto the development. The pond would be removed when the upstream area is developed.

IV. OURAY STORM DRAIN

As stated in the drainage report for SAD 215, a total of 256 cfs is accepted by the storm drain at the intersection of Ouray and Unser Boulevards. A total of 111 cfs was allotted from Basin E. Based on the Hymo analysis, Basin E is contributing 109 cfs, and the total peak flow is 184 cfs. Based on this, it can be concluded that the Ouray Storm Drain does indeed have adequate capacity for the proposed development.

Intermediate storm drain facilities are analyzed and designed using flow rates generated by the Rational Method. Examples of these systems would be the local street flows, 10' channel structures, rundowns, and miscellaneous standard drains. During the development of detailed drainage and grading plans, hydraulic analysis will be presented for the Ouray Storm Drain facility. This analysis will be based on using hydrology generated from the Hymo Analysis.

V. TRACT IV

An interim drainage plan is presented for the development of Phase I, Tract IV. Exhibit II shows such a plan. This represents the first tract to be built and therefore is tied to the construction of Lava Bluff Drive and the Ladera Channel (W.O. 3411). Included in the Appendix is the Infrastructure Listing for Tract IV, Phase I, the channel, and Lava Bluff Drive.

Several ponds are shown intercepting offsite flows. These ponds are intended to remove sediment then discharge to various facilities. Four areas discharge directly to the Ladera Channel. Area 1 outfalls to 98th Street and Lava Bluff Drive. Once this area is developed, the drainage will be conveyed north to the channel.

Area 8 represents the portions of Tract IV which drain to the Ouray Storm Drain. This pond is designed to reduce the developed peak flow rates to that of historic flow rates. Two diversion swales are shown upstream of the pond. These swales divert offsite flows from entering Pond 8 as well as protecting Lava Bluff Drive. Note that the pond is located at the end of Lava Bluff Drive. These swales are set on grades (.3%), which produce velocities of less than 3 ft/sec.

A soil cement channel is shown in Basin 7, and transmits approximately 45 cfs to Pond 7.

During the design process, a drainage report will be prepared which presents detailed design information. A grading plan will be submitted along with pond and channel details. Also included will be engineering computations for the Ladera Channel.

Hydrologic data for the Tract IV interim drainage plan can be found on Exhibit B.

+ TRAINER DYKES & PONDING AREAS @ (2) FE

VI. CONCLUSION

The proposed onsite development consists of construction of Tract IV, Lava Bluff Drive, and the concrete lining of the Ladera Channel. During the course of design, the internal routing of stormwater was changed, thus requiring an amendment to the Master Drainage Plan. This report identifies those changes and how they will be addressed in interim and future conditions. Onsite drainage easements are already in place, and additional offsite easements will be in place prior to final plat approval. If any additional easements or covenants are required, they will be provided prior to final plat.

CALCULATIONS

Exhibit A - Offsite Basins

Exhibit B - Summary Table

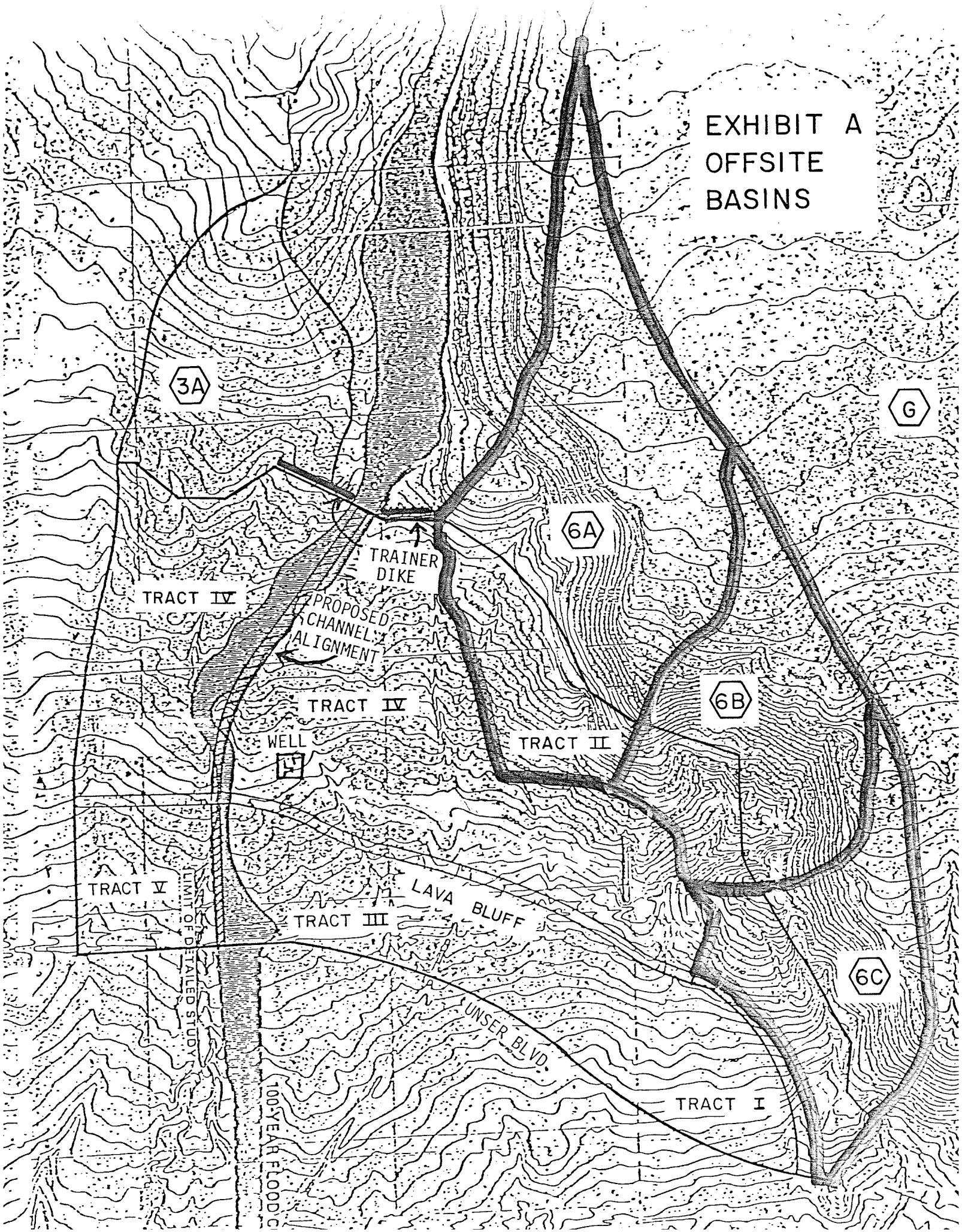


EXHIBIT A
OFFSITE
BASINS
3A
G
6A
6B
6C
TRAINER
DIKE
TRACT IV
PROPOSED
CHANNEL
ALIGNMENT
TRACT IV
WELL
TRACT II
TRACT V
LIMIT OF DETAILED STUDY
LAVA BLUFF
TRACT III
UNSER BLVD.
TRACT I
100-YEAR FLOODPLAIN

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2400 Comanche Road, NE
Albuquerque, New Mexico 87107

LOCATION _____

PROJ. NO. _____

DATE _____

DESIGNER _____

PAGE _____

ULTIMATE DEVELOPED CONDITIONS

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Albuquerque, New Mexico 87107

LOCATION _____

PROJ. NO. _____

DATE 12/88

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PAGE _____

DURAY SD ANALYSIS

BASIN E, AP2 Q= 103 cfs

DETERMINE FLOW RATE TO LAVA RIDGE DRIVE
FROM BASINS 6A, 6B, 6C and 6D.
FROM HYMO ANALYSIS, UNDEVELOPED AREAS
BASIN E, TREATMENT 1 Q100= 30 CFS

DETERMINE FLOW RATE FROM DEVELOPED AREA
CONTRIBUTING TO BASIN 7D.
BASIN E, TREATMENTS = 2 + 3 Q=103 CFS

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Albuquerque, New Mexico 87107

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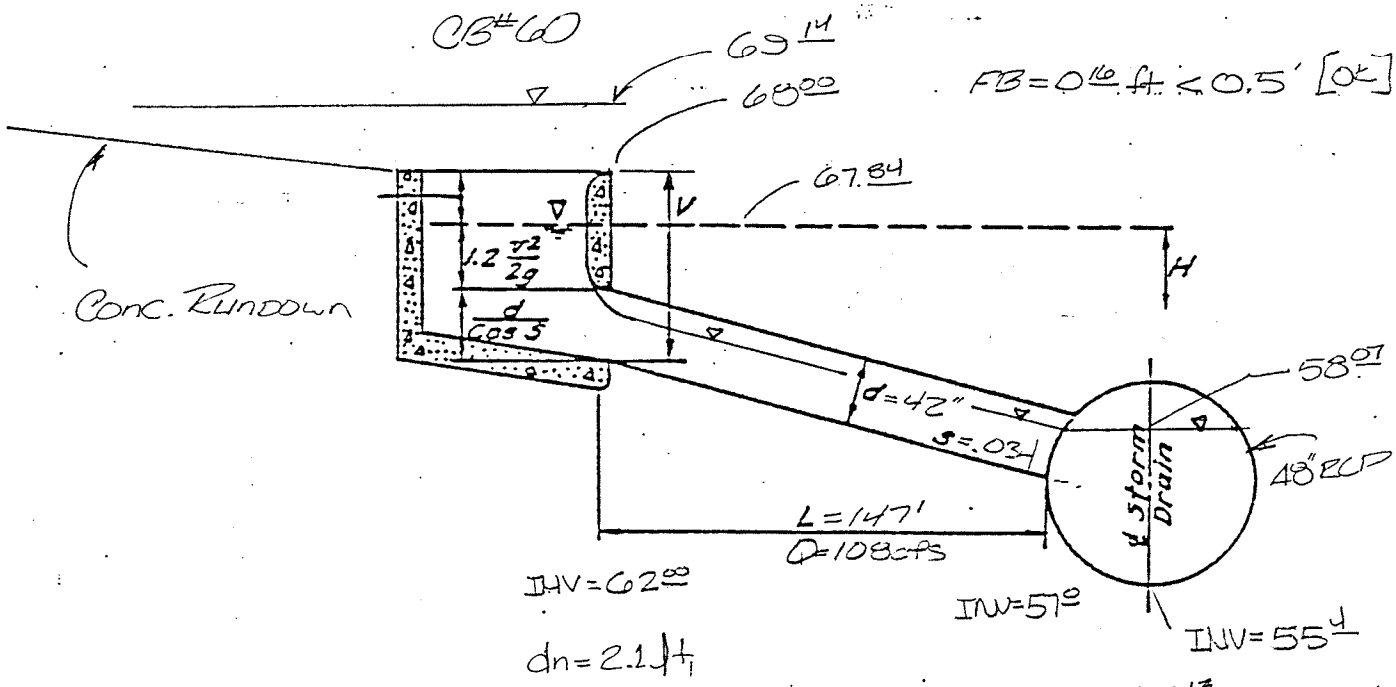
DATE 12/88

DESIGNER RB

PAGE _____

EVALUATE CB HYDRAULICS FOR BASIN 7D



- NOTE: HGL computations show required H = 4.00 @ ELEV. 62.13
  INLET CONTROL CONDITIONS AT THE CB control.
  RESULTING WSEL = 67.84

DETERMINE WSEL FOR QUAD. "D" CATCH BASIN.

4 STANDARD COA GRATES — A = 39" × 24" = 4.56 ft²
P = 2×39" + 2×24" = 10.5 ft

D/A = 5.37 H^1/2 — $H = \left[\frac{10^{\circ}}{(4 \times 4.56 \times 537)} \right]^{2} = 1.21$ ft

D/P = 3.04 H^3/2 — $H = \left[\frac{108}{(4 \times 5.25 + 4 \times 2')(5.0)} \right]^{2/3} = 1.4$ ft

PERIMETER EQUATION CONTROLS — H = 1.4 ft

ENT. LOSS — $1.2V^2/2g$ =

SUMMARY OF HYDRAULIC CALCULATIONS

CLOSED CONDUIT

BY: ELB

DATE: 12/88

SHEET: ___ OF: ___

PROJECT: LAUREL WOOD II

LINE: 42" TO CB#60, BASIN 7

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
STATION	STRUCT	D	Q	A	V	K	S_f	L	Δ	JUNCTION		LOSSES							E.G.	h_v	H.G
										D	θ	h_f	h_b	h_j	h_{mh}	h_t	h_{misc}	Σ			
19+93.51	MH														.10			.10	56.12	1.95	58.07
		42"	108	9.62	11.22	1006	.0115	147				1.52						1.52	56.22	1.95	
	CB#62														.10		2.34	2.44	57.74	1.95	
																			60.18	1.95	60.13

MAPS:

MANNING'S n: ___

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Albuquerque, New Mexico 87107

LOCATION _____

PROJ. NO. _____

DATE 12/88

DESIGNER ELB

PAGE _____

LAVA BLUFF DRIVE SD ANALYSIS

HYDROLOGY & HYDRAULIC ANALYSIS WILL BE BASED ON FLOWS DETERMINED BY THE RATIONAL METHOD. Q_{100} = 56 cfs

½ STREET = 28 cfs.

4 batteries of Catch Basins Are Proposed which would Consist of:

North	Lane	1 Type "A" Double Grate
		1 Type "C" Double Grate
South	Lane	1 Type "A" Double Grate
		1 Type "C" Double Grate

Bypass Flow of ≈ 9 cfs to discharge into existing CB's located on Unser Blvd.

CATCH BASIN CALCULATION SHEET

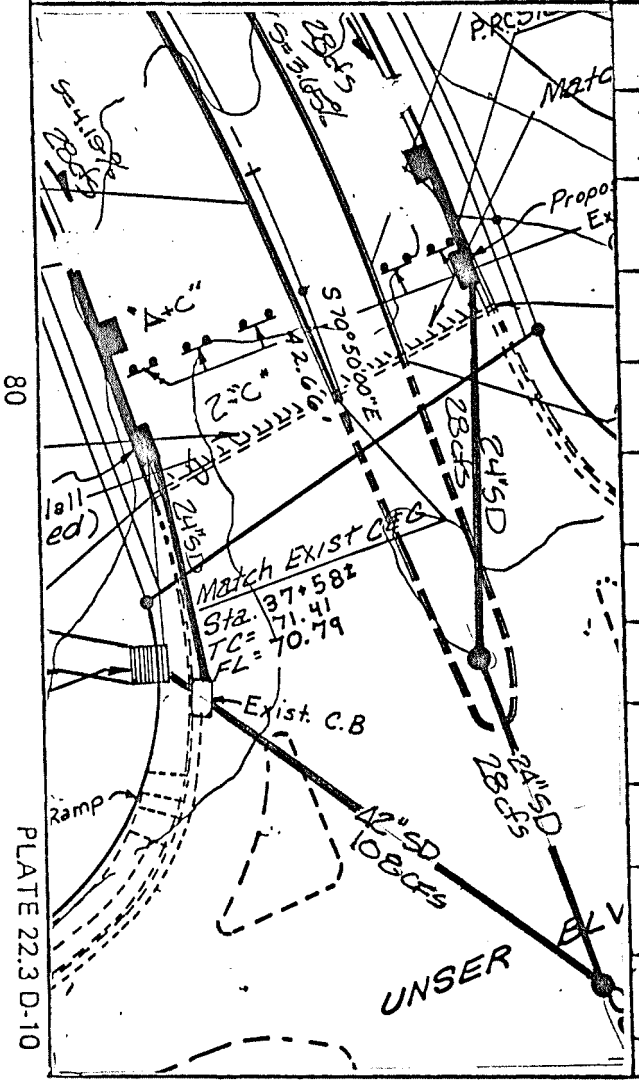
Sht___of___

PROJECT LWOOD II

CALCULATED BY RLB

DESIGN FREQUENCY 100 YR

DATE 12/88



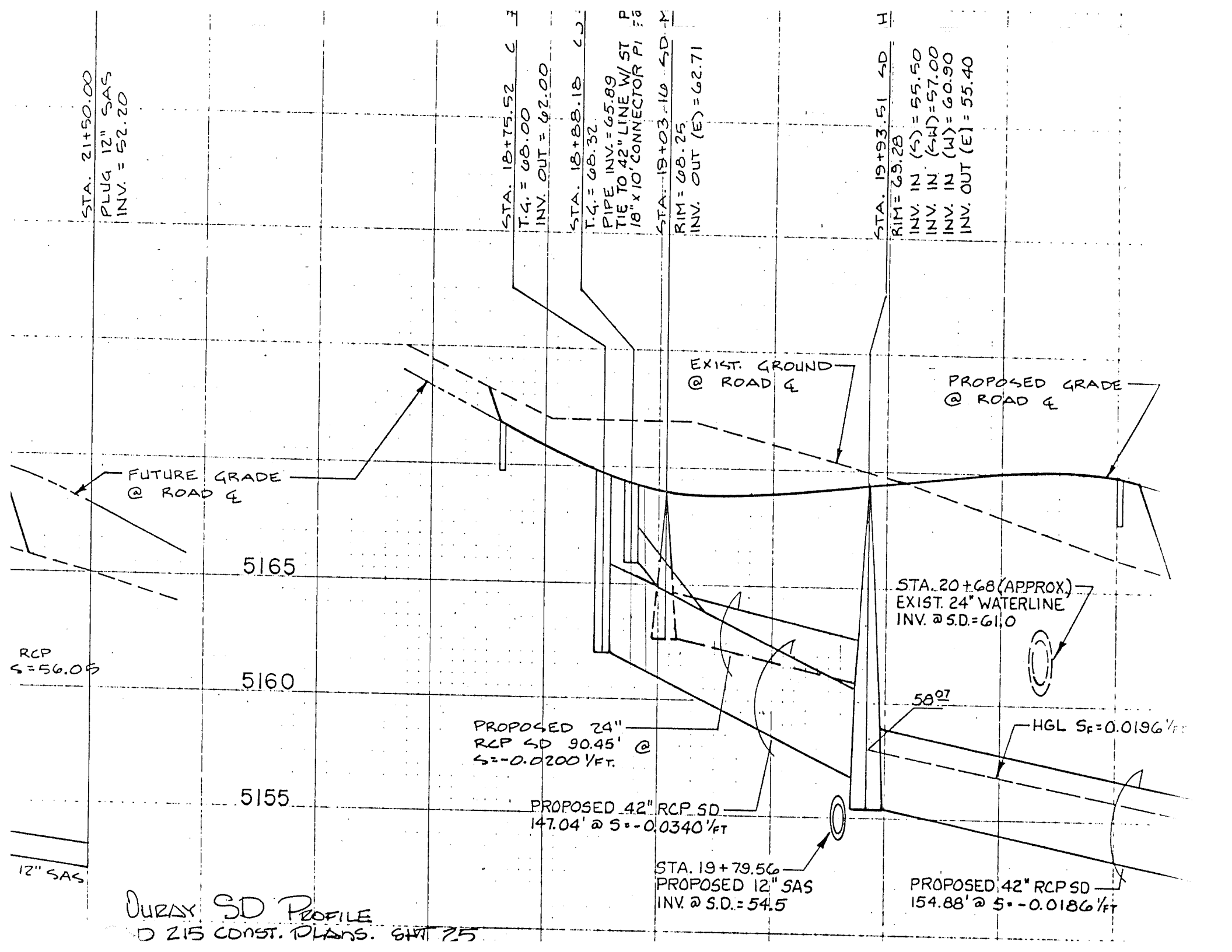
Sym.	Drain. Area	Q Total	Q Inter.	Cap. of ½ Street	Gutter "d"	C.B. No.	C.B. Size	Connector Pipe Head	Connector Pipe L	Connector Pipe Dia.	V Depth
							TYPE				
	S=3.65% NORTH LANE	28	10	—	.52'	2	"A+C"				
		18	9		.45	2	"C"				
		9			.35						
				REMAINDER IS BY-PASS FLOW TO CB's							
				ON UNSER BLVD.							
	S=4.19% SOUTH LANE	28	10	—	.51'	2	"A+C"				
		18	9		.44	2	"C"				
		9	9		.36			EXISTING CB AT LOW			
								POINT, SUMP CONDITION			

4-82

80

PLATE 22.3 D-10

22.3



Ouray SD Profile
D 215 Const. Plans. Sht 25

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2400 Comanche Road, NE
Albuquerque, New Mexico 87107

LOCATION
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DATE 12/88
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PAGE

Concrete Channel Rundown Analysis

Basin 3A

Street Capacity

Design Q_{100} = 36cfs Q_{10} = 24cfs

S = 0.05 ft/ft Street Width = 32 ft

Per COA DPM Plate 22.3 D-1

Q	d	Area	V	d×V
36 cfs	0.62 ft			
24 cfs	0.54 ft	12.16 ft²	1.97 fps	1.06

Max. Street Flow Capacity = 82 cfs

Rundown

Typical COA 10' Conc. Rundown COA DWG 2260

Slope = 2% Q_{100} = 47 cfs W = 10 FT

d = 0.5 ft V = 9.40 fps

Min. Slope = 0.5%

d = 0.75 ft [ok] V = 6.27 fps [ok]

S_c = 0.4% d_c = 0.8

w/ n = 0.015

d = 0.51

F_r = 2.05

v = 8.33

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BASIN 3C

STREET CAPACITY

S = 0.8%

Q	DEPTH	AREA	VELOCITY	d x V
42 CFS	0.59 ft	13.76	3.05	—
28 CFS	0.52 ft	11.52	2.43 FPS	1.26 [OK]

CAPACITY = 102 CFS

BASIN 3D

STREET CAPACITY

S = 2%

Q (CFS)	d (FT)	A (FT²)	V (FPS)	d x V
32	0.46			
21	0.41	8.0	2.62	1.1 [OK]

CAPACITY = 150 CFS

RUNDOWN

Q100 = 74 CFS COA DWG 2360 W = 10 FT

Smin = 0.5% ⇒ d = 1.0 ft [OK]

w/ n = 0.015

d = 1.00'

v = 6.18

F_r = 1.09 N.G.

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2400 Comanche Road, NE
Albuquerque, New Mexico 87107

LOCATION _____

PROJ. NO. _____

DATE 12/88

DESIGNER ZLB

PAGE _____

BASIN 4

STREET CAPACITY

S = 2.62 %

Q (CFS)	d (FT)	A (FT²)	V (FPS)	d × V
20	0.38			
13	0.34	5.76	2.26	0.77 [OK]

CAPACITY = 14 CFS

RUNDOWN

Q_{100} = 20 CFS COA DWG 2260 W = 10 FT

S_{min} = 0.5 % d = 0.42 ft [OK]

w/ n = 0.015 d = 0.47

$N^* = 3.93$ $F_r = 1.02$ (N.G.)

BASIN 5A

STREET CAPACITY

S = 4 %

Q (CFS)	d (FT)	A (FT²)	V (FPS)	V · d
19	0.28 [OK]			
32	0.42	8.32	3.8	1.6 [OK]

CAPACITY = 154 CFS

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Albuquerque, New Mexico 87107

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BASIN 5B

STREET CAPACITY
S = 10%

Q (CFS)	d (FT)	A (FT²)	V (FPS)	d×V
76	0.71 [OK]			
50	0.61	14.4	3.47	2.1

CAPACITY = 116 CFS

CHANNEL (FROM LAVA BLUFF TO RESIDENTIAL ST.)
S = 0.7% / FT Q = 63 CFS (PRO-RATA BASIS)
d = 1.65 ft V = 3.82 FPS V×d = 6.3 [OK]
W = 10 ft conc. Channel COA DWG 2260

RUNDOWN
Q = 76 CFS SMIN = 0.5% d = 1.1 ft [OK]
COA DWG 2260 → W = 10 FT

w/ n = 0.015
d = 0.83'
V = 6.55 FPS
Fr = 1.27

w/ n = 0.015
d = 1.01 FT
V = 6.23 FPS
Fr = 1.09 (N.G.)

FRED DENNEY & ASSOCIATES, INC.
2400 Comanche Road, NE
Albuquerque, New Mexico 87107

LOCATION
PROJ. NO.
DATE 12/80
DESIGNER RLB
PAGE

BASIN 7A

CHANNEL CAPACITY - CONC. CHANNEL
S= 1.8 FT/FT COA DWG 2260 W=10 FT
D_{100} = 19 CFS d=.29 FT V= 6.55 FPS

BASIN 7B

STREET DESIGN S= 2.3%

D (CFS)	d (FT)	A (FT²)	V (FPS)	d×V	
31	0.44				[OK]
21	0.39	7.36	2.85	1.1 FT	

BASIN 7C

STREET DESIGN S= 2.74%

D (CFS)	d (FT)	A (FT²)	V (FPS)	d×V	
72	0.58				[OK]
48	0.50	10.83	4.41	2.2	[OK]

BASIN 7D

STREET DESIGN S= 2.74%

D (CFS)	d (FT)	A (FT²)	V (FPS)	d×V	
73	.63				[OK]
61	.54	12.16	5.01	2.71	[OK]

CAPACITY = 144 CFS

CHANNEL CAPACITY - CONC. CHANNEL
S_{MIN} = 0.5% COA DWG 2260 W=10 FT
D_{100} = 93 CFS d= 4.24 V= 7.75 FPS

W= 11 n=0.015 d= 1.14
A= 6.66 R= 1.10

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DATE _____

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PAGE _____

TRACT IV PHASE I INTERIM

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LOCATION _____

PROJ. NO. _____

DATE 12/88

DESIGNER RLB

PAGE _____

POND DESIGN TABLE

BASIN	DEPTH [1] (ft)	LENGTH (ft)	WIDTH (ft)	VOLUME (ft^3)	Q_{IN} (CFS)	Q_{OUT} [2] (CFS)
1	1.5	305	150	68100	40	3.5
2	1.5	100	75	11500	7	3.5
3	1.5	250	85	30350	18	3.5
4	1.5	455	65	43500	26	3.5
7	1.5	225	225	76200	45	3.5
8	1.5	150	65	14200	9	3.5

NOTES: [1] MAX. ALLOWABLE DEPTH = 1.5 FT

[2] MAX DISCHARGE BASED ON INLET CONTROL, 12" DIA. CULVERT DRAIN PIPE.

COMPUTE MAX. DRAIN TIME

EVALUATE FOR LARGEST POND #7, $V = 76200\ ft^3$
SURFACE AREA = 50625

DEPTH	VOLUME	Q_{AVE}	TIME
1.5 - 1.0	25312.5	3	8437. SEC
1.0 - 0.5	25312.5	1.5	16875 SEC
0.5 - 0	25312.5	0.5	50625 SEC
			75937 SEC = 21 HRS < 24 HRS [OK]

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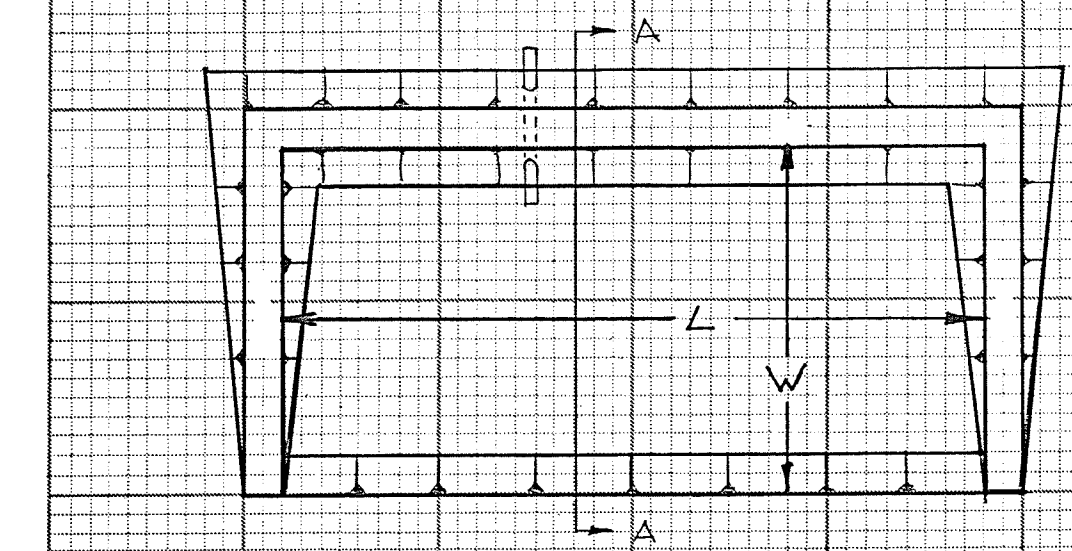
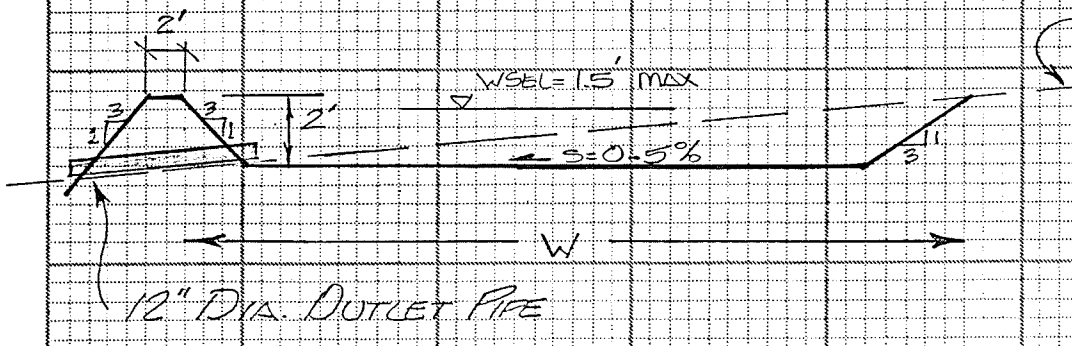
POND DESIGN





12" DIA. OUTLET PIPE

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Albuquerque, New Mexico 87107

LOCATION _____

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DATE 12/88

DESIGNER ELB

PAGE _____

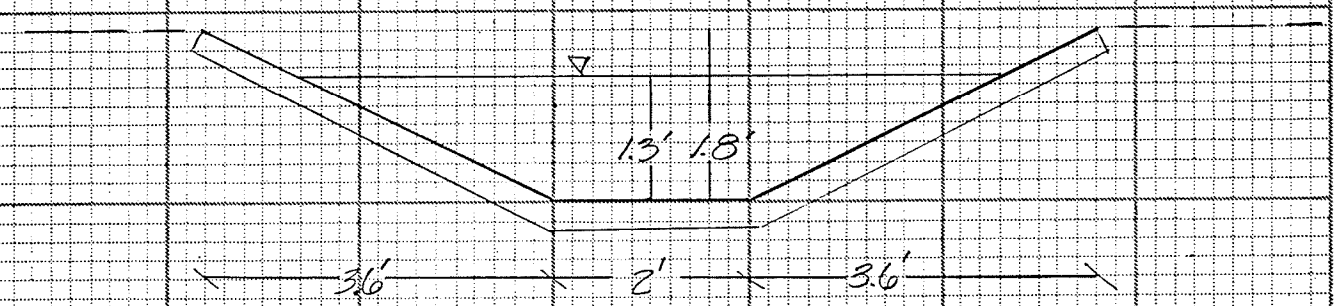
SOIL CEMENT CHANNEL

Q_{100} = 45 cfs n = .017 S = 1% B = 2' SS = 2:1

d = 1.3' FB = .5' D = 1.8'

A = 4.6 ft²

V = 9.8 fps [OK]



d = 1.32 ft

v = 7.37 FPS

F_r = 1.13 (N.G.)

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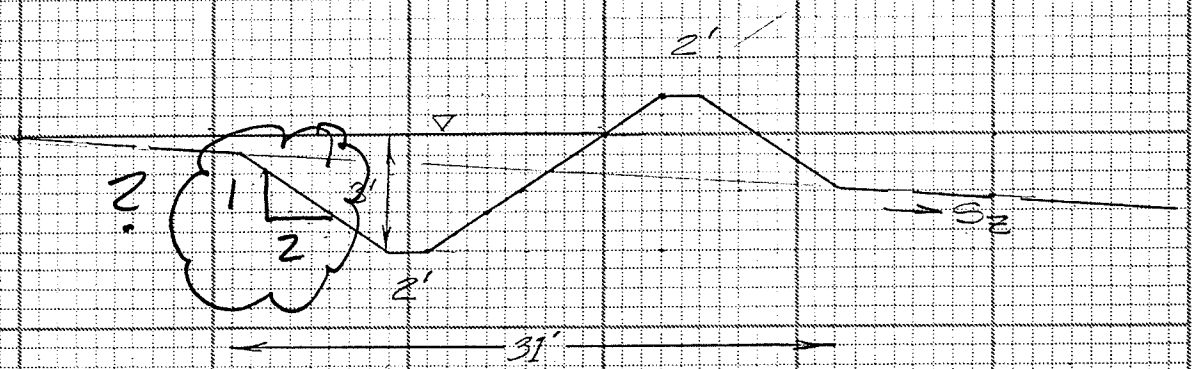
Diversion Berm



n = .030 Earth Lined
S_x = 0.3% Channel Slope
S_2 = 33% Cross Slope
Freeboard = 1 ft

$Q_{Design} = 45\,AC \times .4 \times 4.65\,^{CFS}/_{AC} = 84\,cfs$

d = 2.9 ft A = 31.03 ft²
V = 2.71 FPS < 3 [OK]

d = 2.95'
v = 3.61 FPS
F_r = 0.37
A = 23.28 ft²

Berm Capacity = 170 cfs A = 56 ft²
d = 4.0 ft V = 3.03 FPS

d = 3.97' $Width_{Tw}$ = 17.9'
v = 4.30 FPS F_r = 0.38 Area = 39.5 ft²

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LOCATION _____

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DATE _____

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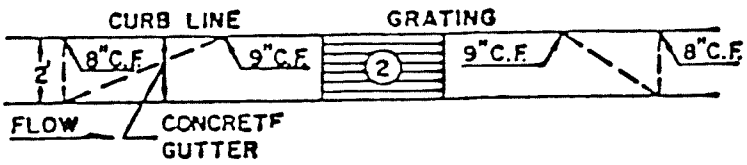
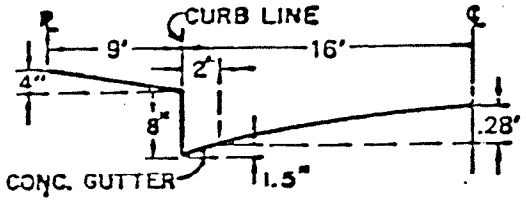
PAGE _____

Design Aids

GRATING CAPACITIES FOR TYPE "A", "C" and "D"



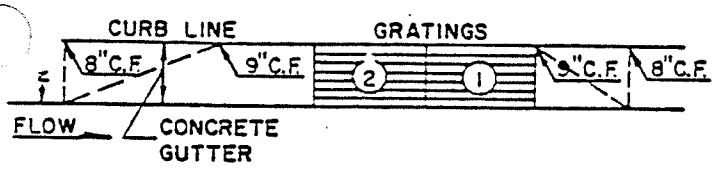
GRATING & GUTTER PLAN



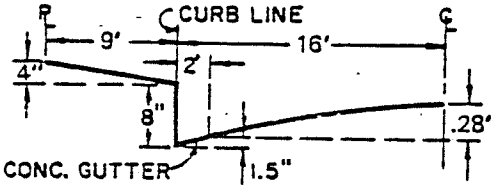
TYPICAL HALF STREET SECTION
(ABOVE BASIN)

D=0.58
Q=11cfs

GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"

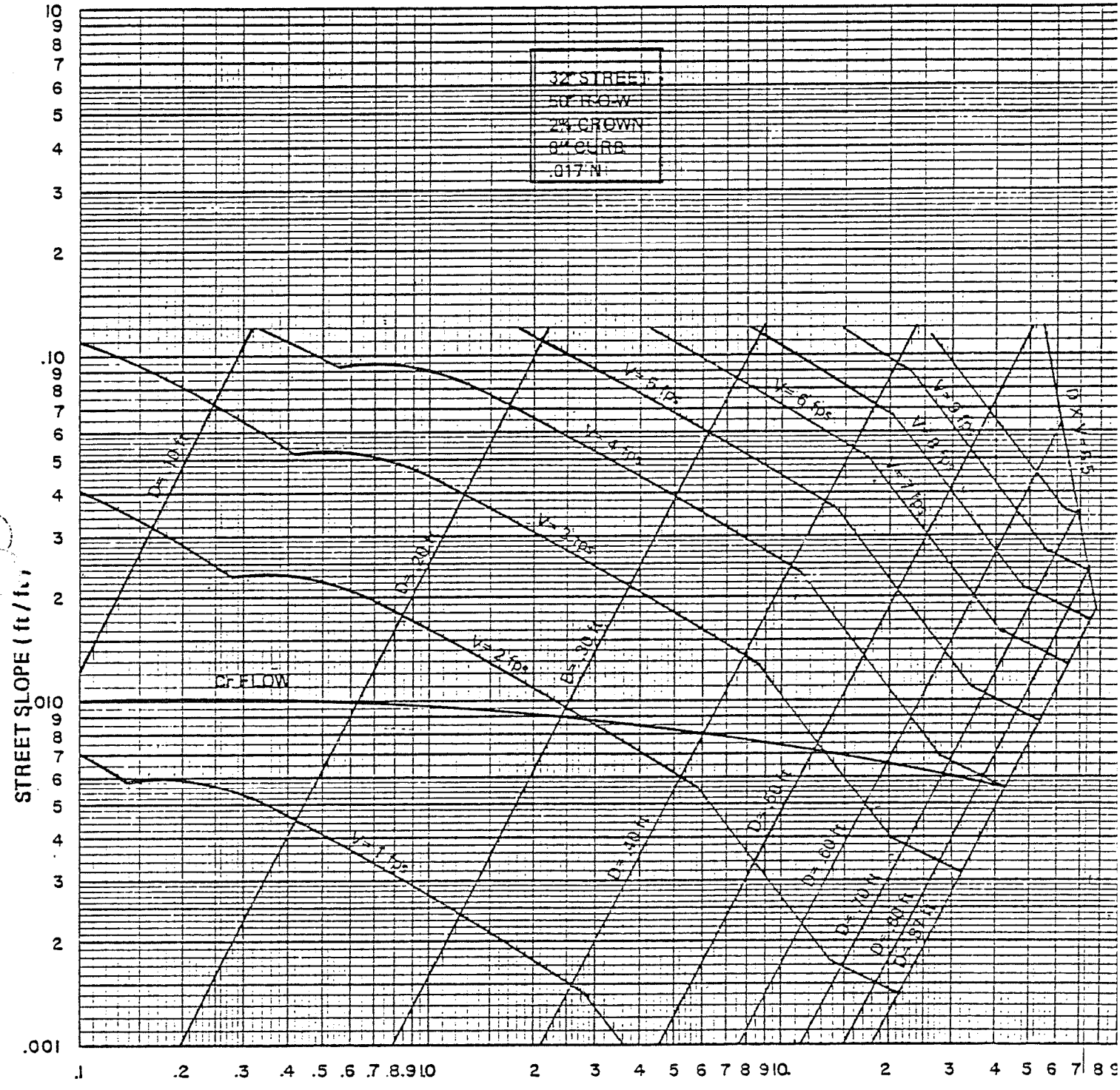


GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)

STREET CAPACITY

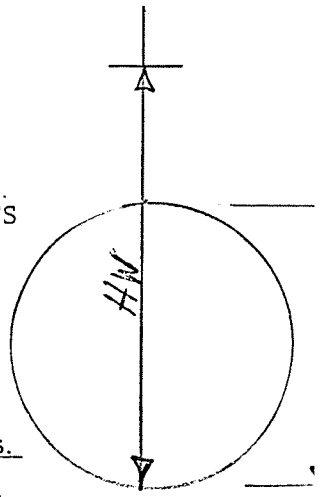


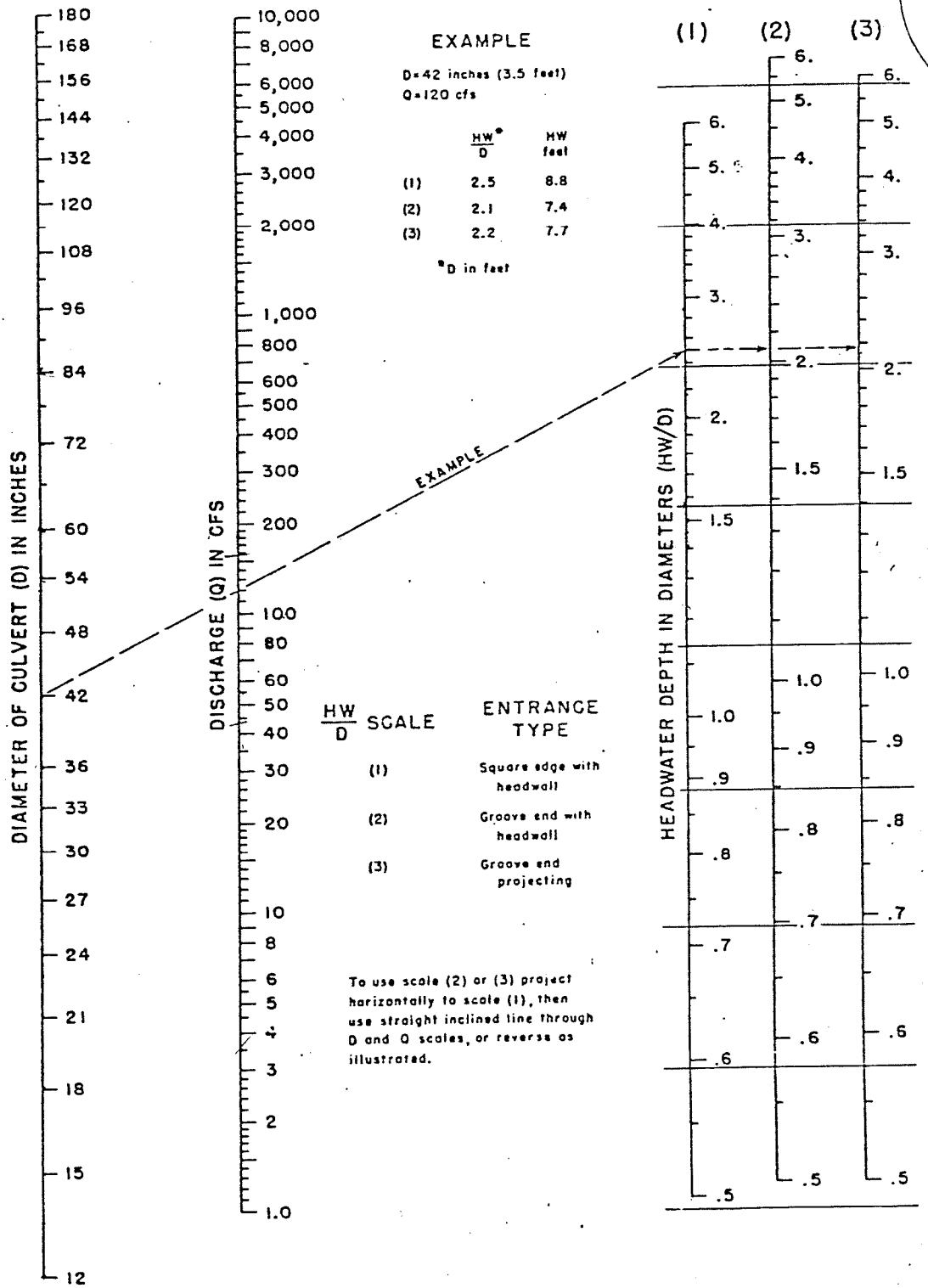
REV 3-83

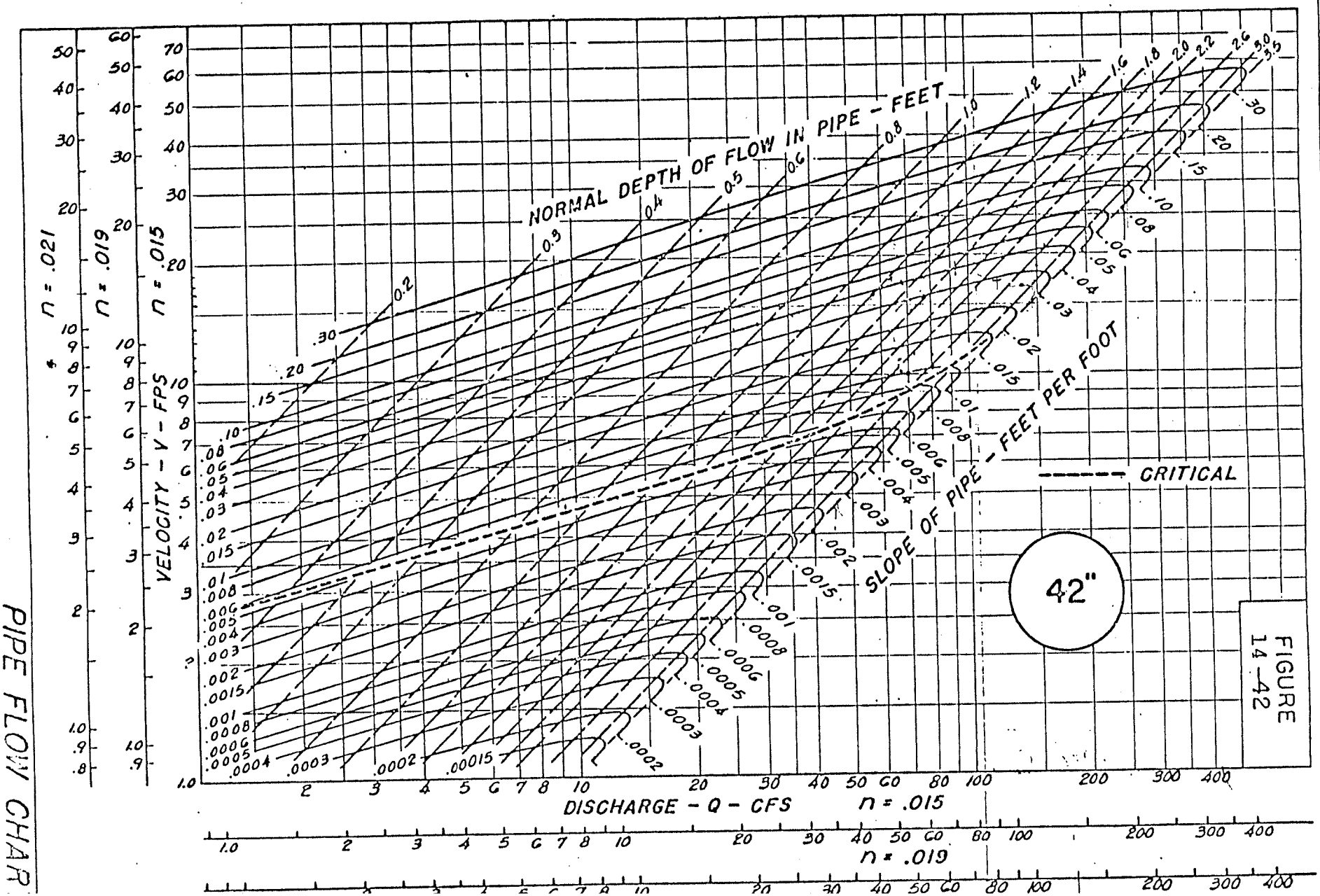
PLATE 22.3 D-1

Figure 11-1

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

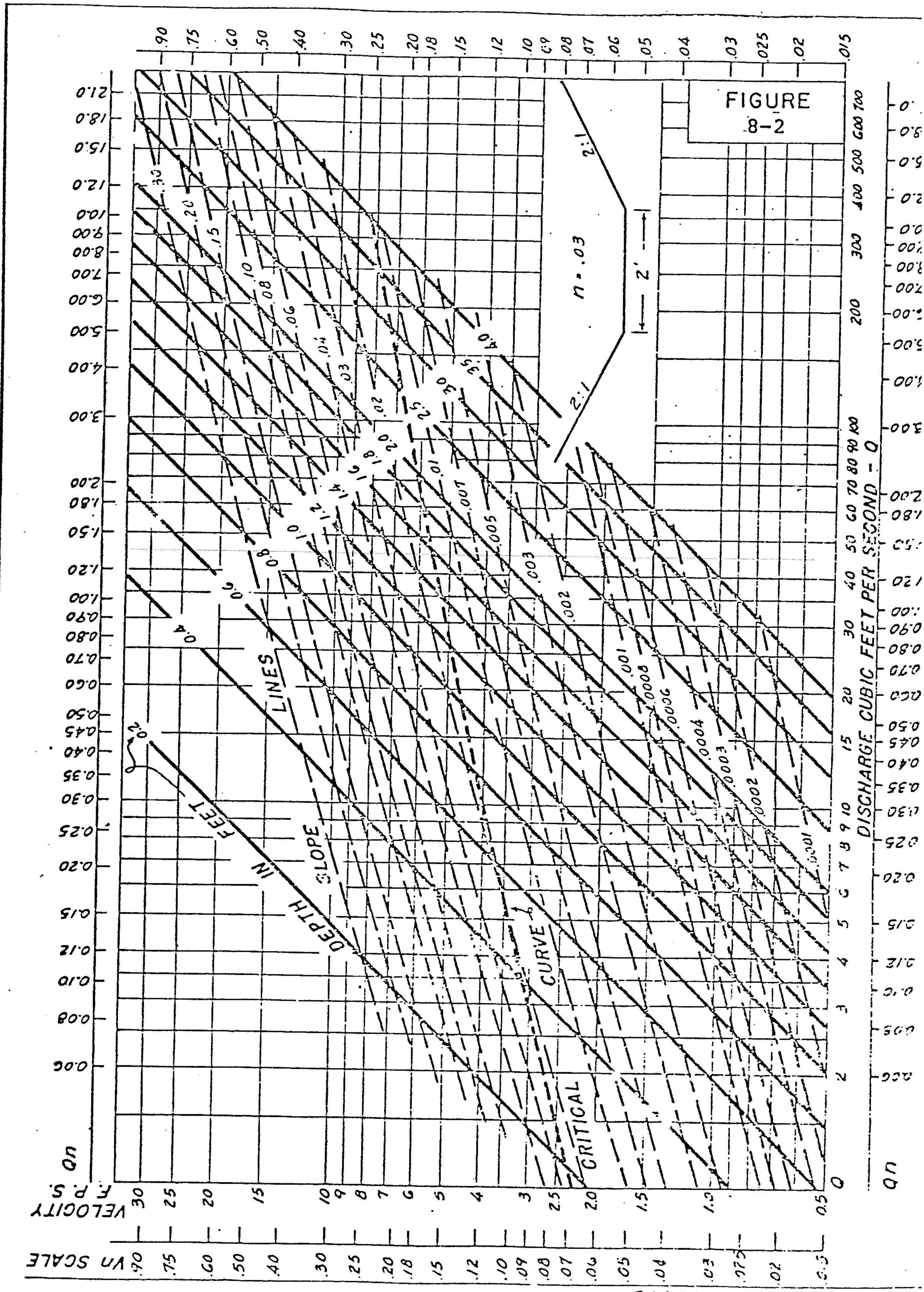






PIPE FLOW CHAR
42-INCH DIAMETE

FIGURE
14-42



CHANNEL CHART

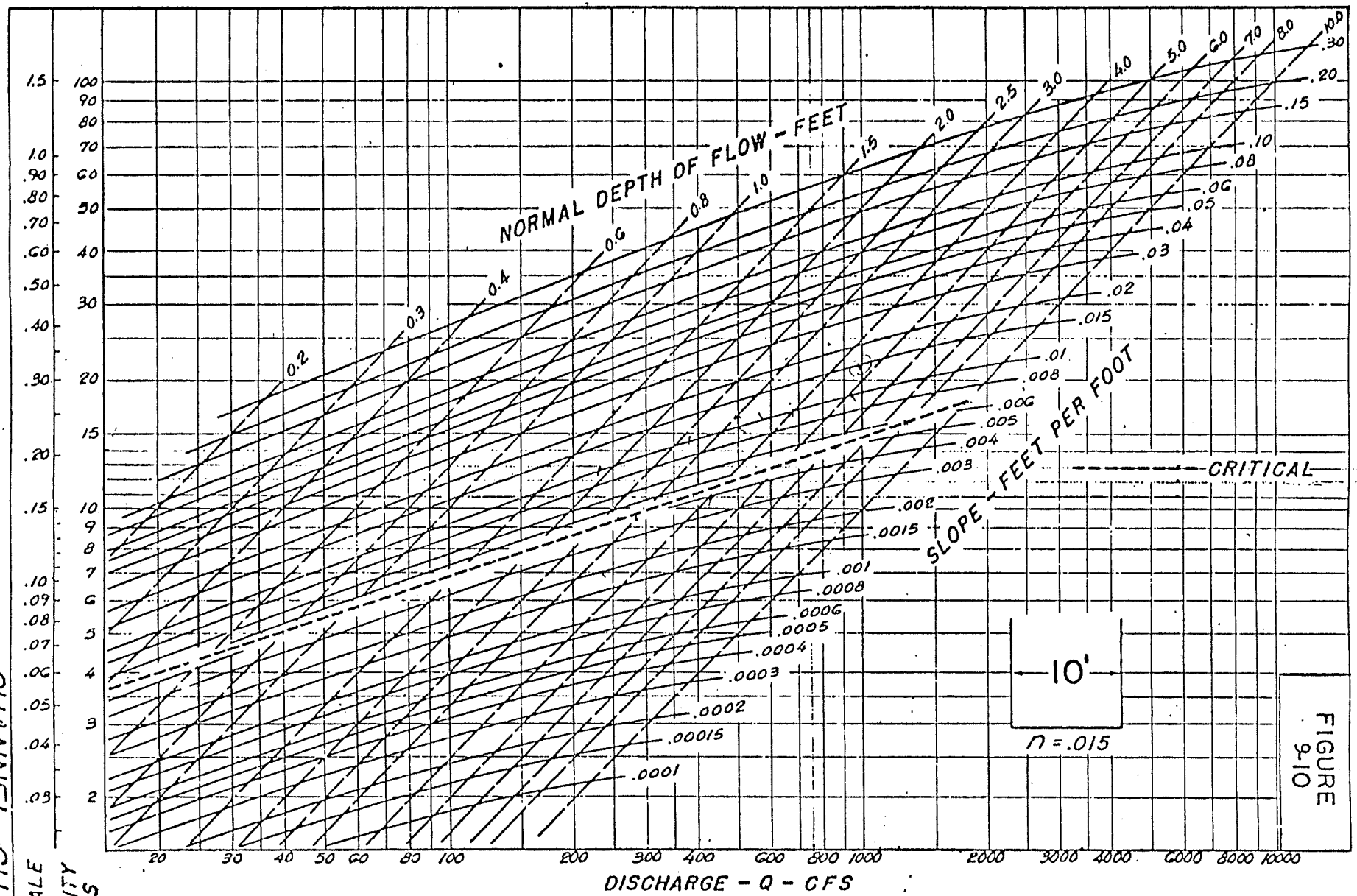
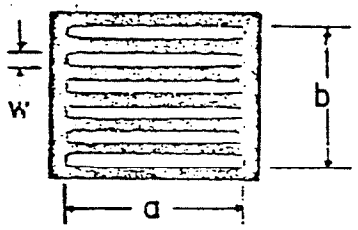


FIGURE 9-10

CHANNEL CHA
VERTICAL b = 10
CALE
CITY

COA · GRATE $A = 4.56\,ft^2$ $P = 2(39") + 2(24")$

FIGURE 7



$P = 2(a + b)$

$A = 6\,aW$

APPENDIX

Infrastructure List

Hymo Analysis Computer Printouts

Excerpts from SAD 215 Drainage Analysis Report

D.R.B. Case No. 88-349
D.R.C. Project No. _____
Date Submitted 12/6/88

FIGURE 11

~~66~~ 9c4.11

EXHIBIT "D"
to Subdivision Improvements Agreement

DEVELOPMENT REVIEW BOARD (D.R.B.)
REQUIRED INFRASTRUCTURE LISTING

for Monument Pointe

Following is a summary of Public/Private Infrastructure required to be constructed or financially guaranteed to be constructed for the above development.

Size	*Type Improvement	Location	From	To
32'	Residential Pavement	Street A	Lava Bluff	Street B
32'	Residential Pavement	Street B	Street E	North End Street B
32'	Residential Pavement	Street C	Street E	North End Street C
32'	Residential Pavement	Street D	Street E	North End Street D
32'	Residential Pavement	Street E	Street B	Cul-De-Sac
52'	Residential Pavement	Lava Bluff	98th Street	North End of Lot Block 7
____	Left Turn Bay	98th Street	98th Street	Lava Bluff

4' SIDEWALK AND CURB & GUTTER ON BOTH SIDES OF ABOVE STREETS

40' Radius	Temporary Turnaround	North End Street B	_____	_____
40' Radius	Temporary Turnaround	North End Street C	_____	_____
40' Radius	Temporary Turnaround	North End Street D	_____	_____

STREET LIGHTS (NOT FINANCIALLY GUARANTEED)

Prepared by: Rick Beltramo
Print Name: RICK BELTRAMO
Firm: FRED DENNEY AND ASSOC.

****

Development Review Board Member Approvals

Traffic Date _____ WUD Date _____ Parks & Rec. Date _____

City Engineer/AMAFCA Date _____ DRB Chairman Date _____

FIGURE 11

(CONTINUED)

Size	*Type Improvement	Location	From	To	
8"	Waterline	Street A	Lava Bluff	Street B	
6"	Waterline	Street B	Street E	North End Street B	
6"	Waterline	Street C	Street E	North End Street C	
6"	Waterline	Street D	Street E	North End Street D	
6"	Waterline	Street E	Street B	Cul-De-Sac	
8"	Waterline	Lava Bluff	98th Street	Ouray Road	
8"	Sanitary Sewer	Street A	Lava Bluff	Street B	
8"	Sanitary Sewer	Street B	Street E	North End Street B	
8"	Sanitary Sewer	Street C	Street E	North End Street C	
8"	Sanitary Sewer	Street D	Street E	North End Street D	
8"	Sanitary Sewer	Street E	Street B	Cul-De-Sac	
8"	Sanitary Sewer	Lava Bluff	350' North of 98th Street	Ouray Road	

MANHOLES, VALVES & FIRE HYDRANTS AS PER CITY CITY REQUIREMENTS

10'	Concrete Drainage Channel	12' Drainage ROW	Street B	60' Drainage ROW	
12'	Service Road	60' Drainage ROW	West Property Line of Tract IV	Unser Boulevard	✓
10'	Concrete-Lined Channel with Appurtenances	60' Drainage ROW	West Property Line of Tract IV	Unser Boulevard	✓
92'	Concrete Box Culvert	Ladera Channel	West ROW of Lava Bluff	East ROW of Lava Bluff	✓
	Soil Cement Trainer Dike	Along Western Boundary of Tract IV			✓
12"	Well Drain	Outfall	Well House on Tract IV	Ladera Channel	

FIGURE 11

(CONTINUED)

Size	*Type Improvement	Location	From	To
12'	Interim Soil Cement Channel	Tract IV	Lava Bluff	60' Drainage ROW
2'	Desiltation Pond	Lava Bluff ROW North of Block 7		
2'	Interim Diversion Swale	Tract IV	Block 6	North of Block 7
2'	Interim Swale	Tract III	98th	West end of Ladera Channel
2'	Desiltation Pond	Tract III	@ West end of Ladera Channel	
2'	Desiltation Pond	Tract III	@ Ladera Channel	& Lava Bluff
2'	Desiltation Pond	Tract III	@ 98th Street &	Lava Bluff
2'	Desiltation Pond	Tract III	@ Unser Blvd &	Lava Bluff

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ENGINEERS SURVEYORS PLANNERS
2400 COMANCHE ROAD N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

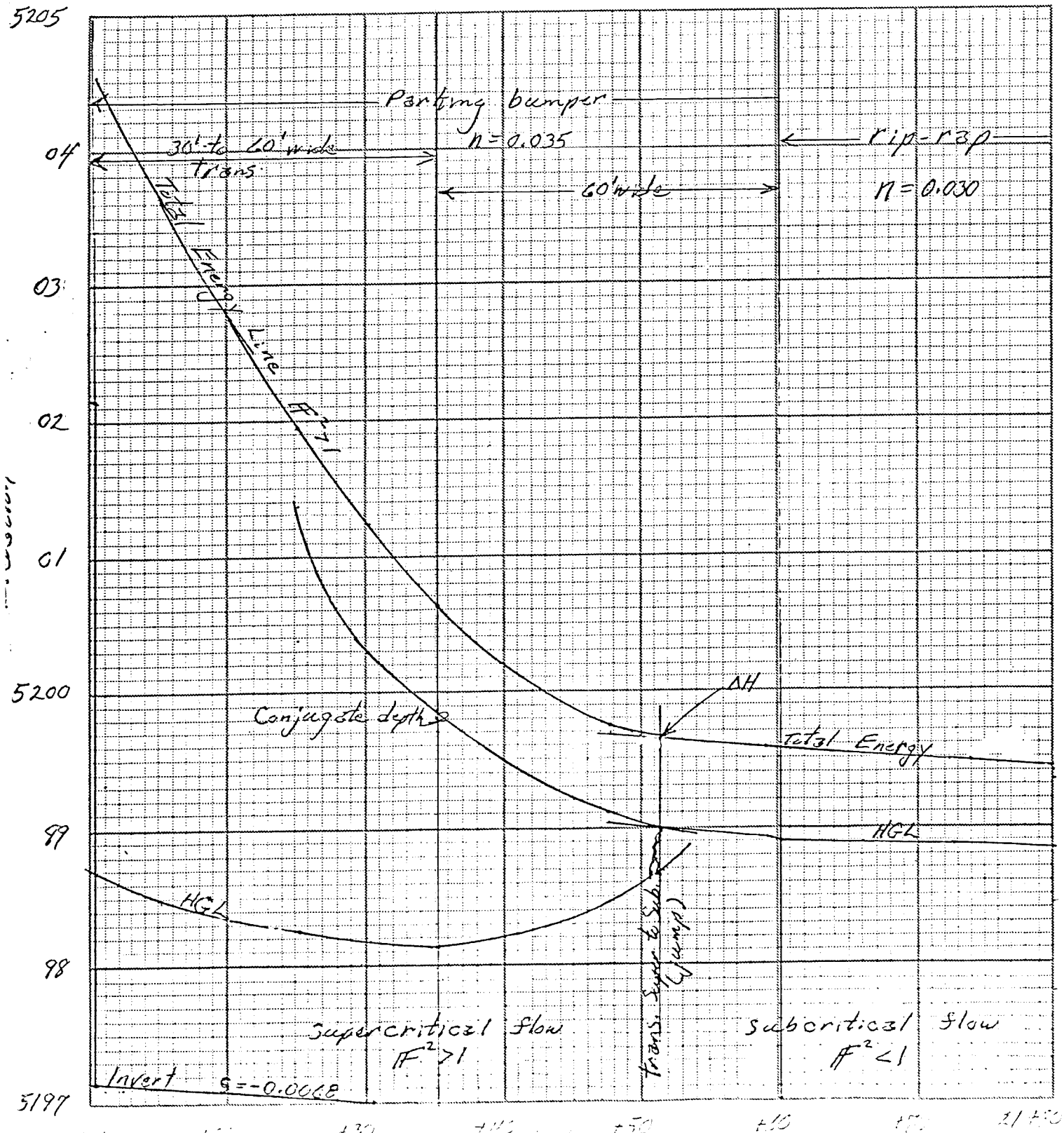
LOCATION Ladera chan. @ outfall of Unser

PROJ. NO. 964.11

DATE 12-8-88

DESIGNER JC

PAGE 1 of 1



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ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION @ Vinson Sub Channel (2)

PROJ. NO. 964.11

DATE 1-6-89

DESIGNER JC

PAGE inflow/outflow hydrographs

$Q = 7 cfs$ $V = 0.2640 \frac{ac\text{-}ft}{hr}$ $11,500 ft^3$

$T_c = 10$ min.

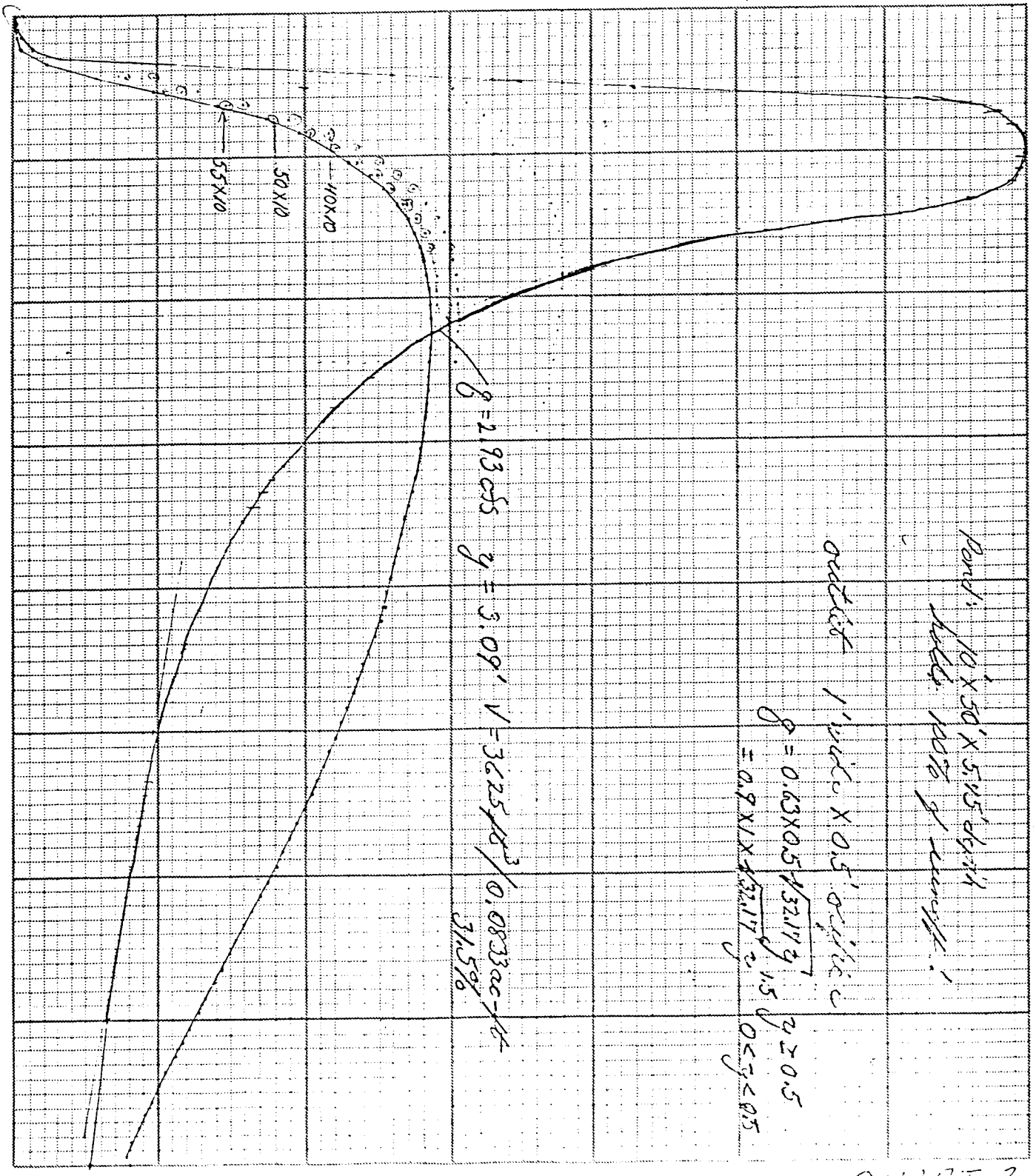

CHART 2

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ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION @ N. P Dr S of Channel

PROJ. NO. 9611

DATE 1-9-87

DESIGNER JC

PAGE inflow/outflow hydrograph

$Q = 18$ cfs $V = 0.696$ ac-ft or $30,350$ ft^3
$T_c = 10$ min

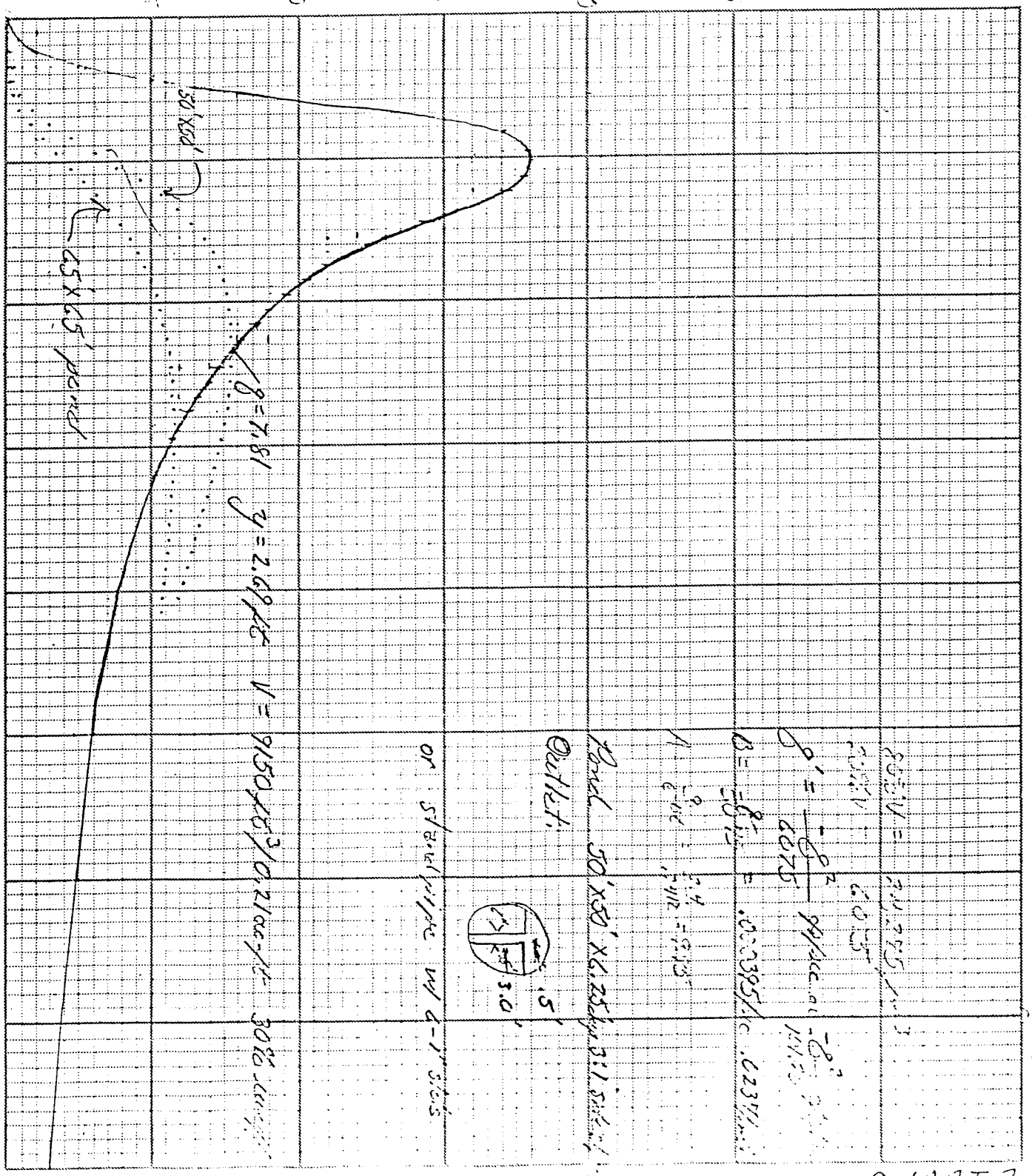

CHART 3

(4)

DENNEY - GROSS & ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
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ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION @ west end of channel, S. side

PROJ. NO. 964.11

DATE 1-9-89

DESIGNER JC

PAGE inflow/outflow hydrograph

Q_{100} = 26 cfs V = 0.9973 ac-ft / 43 440 cft
Tc = 10 min.

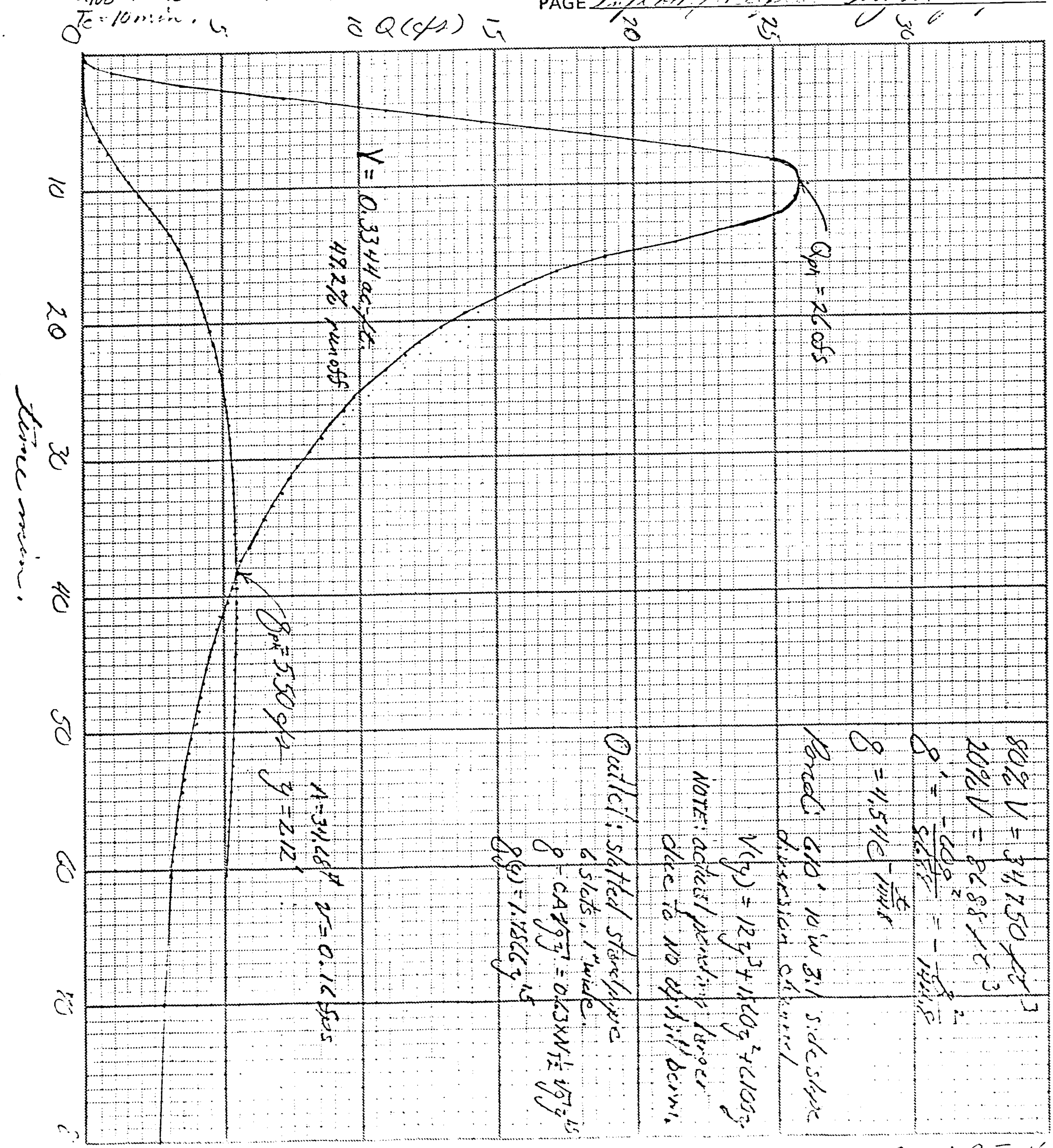

CHART 4

DENNEY - GROSS & ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
2400 COMANCHE ROAD N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION Channel: Mon. Pt to Above (7)

PROJ. NO. 9

DATE 1-5-89

DESIGNER J'C

PAGE Inflow/outflow hydrograph

G=37 V=1,5166 64,075 ft^3 Q (cfs)

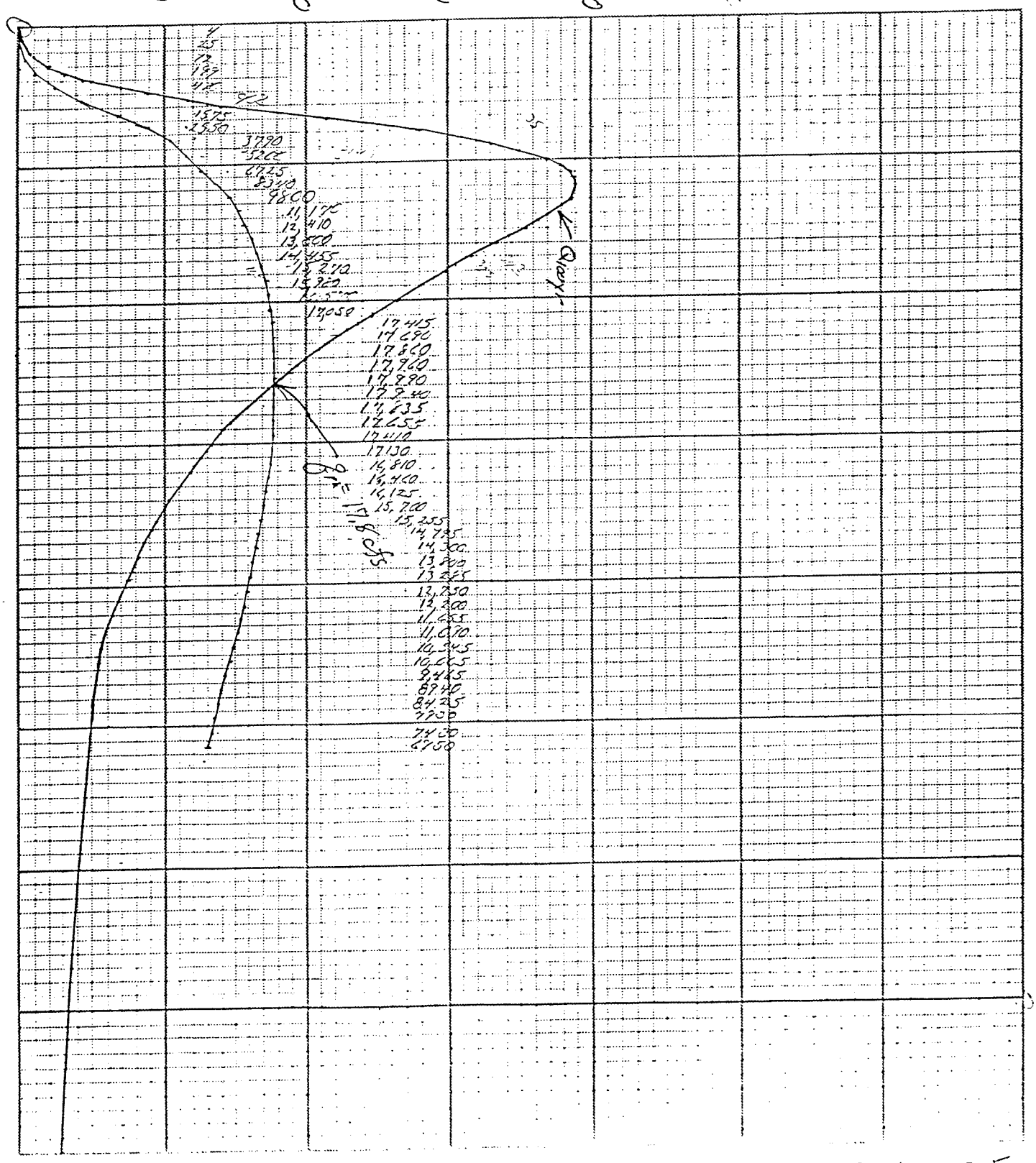

CHART 5

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ENGINEERS SURVEYORS PLANNERS
2400 COMANCHE ROAD N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION [illegible]

PROJ. NO. 964.11

DATE 1-10-87

DESIGNER jc

PAGE Inflow/Outflow hydrograph

$Q_{100} = 13$ cfs $V = 0.4816$ ac-ft $= 20,977$ ft^3

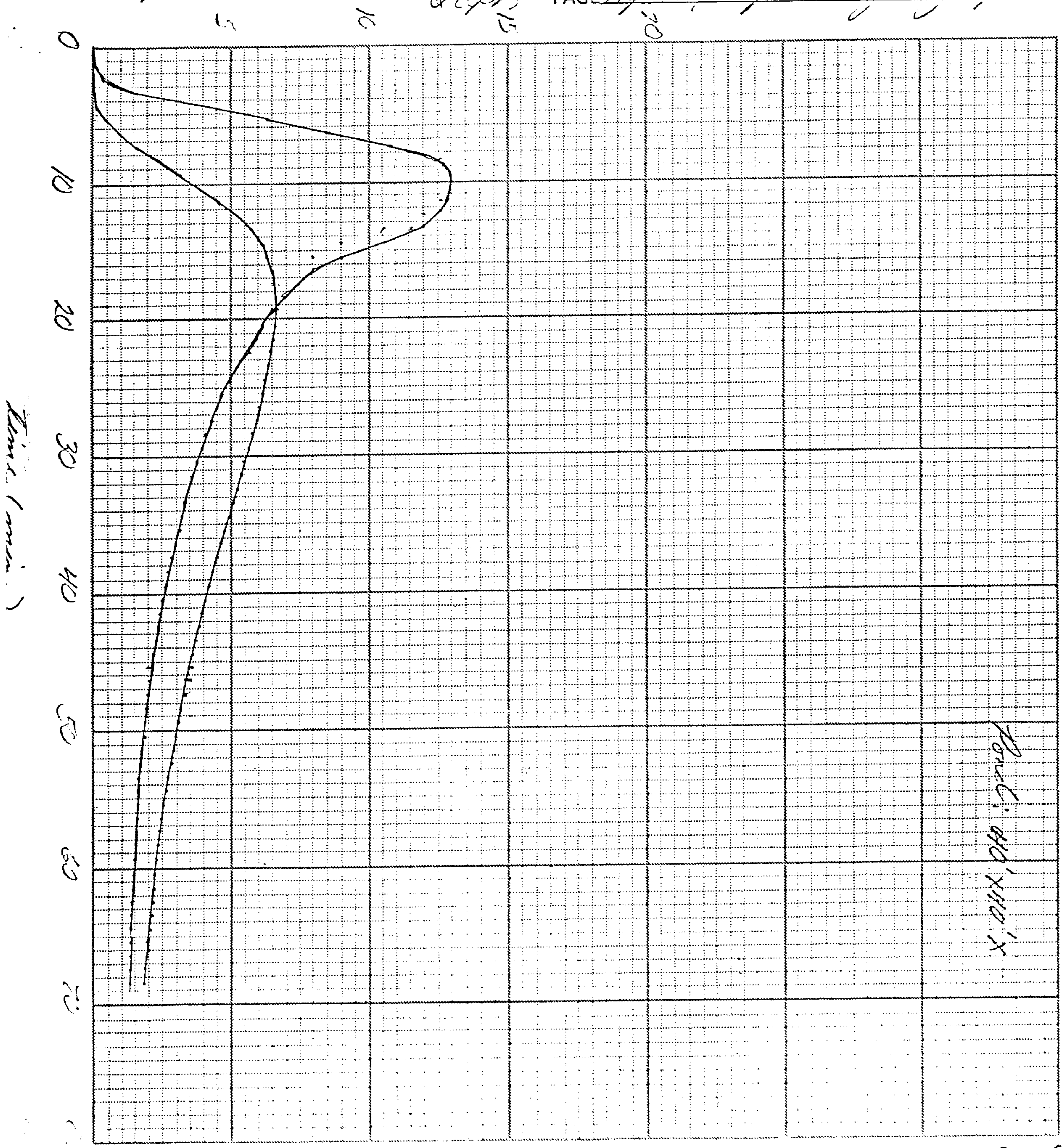
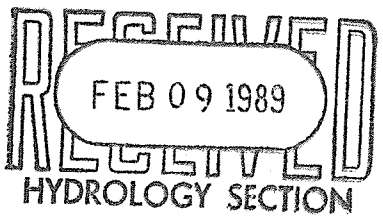


CHART 6

TABLE OF CONTENTS

H-9/D1D2



SPECIAL PROVISIONS

1. General Conditions and Supplementary General Conditions for this job shall be referenced by the City of Albuquerque Standard Specifications for Public Works Construction, 1986 Edition, General Conditions and Technical Specifications, as amended, are incorporated by reference, the same as if fully written herein and shall govern this Project except where revised, amended or supplemented by the Special Provisions and/or the Supplemental Technical Specifications.

   The City of Albuquerque Standard Specifications for Public Works Construction, 1986 Edition, may be purchased separately by contacting the Engineering Group, Public Works Department, P.O. Box 1293, Albuquerque, NM 87103.

   Amendments to the City of Albuquerque Standard Specifications for Public Works Construction, 1986 Edition, shall be in effect through the advertised bid date.

2. Where there is a conflict between the standard City of Albuquerque measurement and payment specification and the bid items listed, the bid item shall govern.

TECHNICAL SPECIFICATIONS

Technical Specifications regarding the installation of water, sewer and storm drainage facilities along with curb and gutter, sidewalks and paving shall be of City of Albuquerque Standard Specifications for Public Works Construction, 1986 Edition, including any applicable amendments in effect.

SUPPLEMENTAL TECHNICAL SPECIFICATIONS

The following revisions and/or additions to the Technical Specifications of the Standard Specifications are hereby made a part of the Contract Documents.

Section 605 - Soil Cement

SUPPLEMENTAL TECHNICAL SPECIFICATIONS

SECTION STS 605

SOIL CEMENT

STS 605.1 GENERAL

This Section governs the construction of the soil cement mixture for the lining of channels, dikes or dams on a prepared subgrade in substantial compliance with lines, grades, thickness and typical cross sections shown on the Contract Documents or established by the ENGINEER.

STS 605.2 REFERENCES

STS 605.2.2 ASTM

D558	C-150
D559	C-595
D560	C-618

STS 605.2.3 AASHTO

T135	M-85
T136	M-240

STS 605.3 MATERIALS

STS 605.3.1 Soil

STS 605.3.1.1 Soil shall consist of material locally available at the site or from other borrow areas as approved by the Engineer, to conform with the following gradation.

Sieve Size	Percent Passing (by dry weight)
2 inch	100%
No. 4	60%-90%
No. 200	10%-35%

The distribution and gradation of material in the soil cement lining shall not result in lenses, pockets, streaks, or layers differing substantially in texture or gradation from the surrounding materials. Clay lumps, larger than 1 inch in diameter, shall be pulverized to pass No. 4 sieve or screened out of the raw soil mixture prior to mixing.

STS 605.3.2 Aggregates

STS 605.3.2.1 Portland Cement: Portland cement shall meet the requirements of ASTM C-150 for Type I and Type II cements or ASTM C-595 or AASHTO M-240 for blended hydraulic cements, excluding slag cements types S and SA.

STS 605.3.3 Water: Water shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or any other deleterious substances.

STS 605.3.4 Fly Ash: Fly ash may be used at the option of the Contractor. A maximum of twenty (20) percent of the total weight of cement may be replaced with fly ash, in accordance with the following requirements: Fly ash shall conform to the requirements of ASTM C-618 for Class F. The Blain fineness shall have an average value of at least 2,800 with a minimum value of 2,600 for any one sample. The average value will be determined on the last five consecutive samples. The loss of ignition shall not exceed 3.0 percent.

STS 605.4 MATERIALS HANDLING

STS 605.4.1 Soil: Soil shall be stockpiled to minimize the accumulation of moisture and to promote runoff and drying of any accumulated moisture. The Engineer may reject soil if the optimum moisture content immediately prior to mixing exceeds the optimum moisture content for the soil cement.

STS 605.4.2 Cementiteous Material: Portland cement and fly ash, whether in bags, or bulk, shall be stored in such a way as to maintain it in a dry condition. Material in bags shall be withdrawn for use in the chronology of the delivery to the site with the oldest material being used at all times.

STS 605.5 EQUIPMENT

STS 605.5.1 Mixing Plant: Soil cement shall be mixed in an approved, twin shaft, continuous flow or batch type pugmill. Facilities for efficiently storing, handling, and proportioning shall be provided at the plant. The plant shall be equipped with metering and feeding devices that will allow the addition of soil, cement, and water in the proportions indicated in this specification to a tolerance of $\pm$2.0%.

STS 605.5.2 Compaction: Soil cement shall be compacted with one or a combination of the following such that compaction requirements presented elsewhere in this specification are met: tamping or grid roller pneumatic tire roller, steel wheel roller, vibrating roller or vibrating plate compactor.

STS 605.6 CONSTRUCTION

STS 605.6.1 Preparation of Subgrade: Before soil cement processing begins, the area to be lined shall be graded and shaped to the lines and grades shown on the plans. The base of the subgrade shall not be over-excavated. If over-excavated, subgrades shall be brought to grade and compacted to a minimum of 95% of the maximum density by the standard Proctor method. If soft, yielding or unsuitable subgrade material is uncovered during construction, the Contractor shall immediately notify the Engineer. Removal and replacement of unsuitable material shall be at the discretion of the Engineer. The Contractor shall consider that all costs incurred for correcting unsuitable subgrade shall be the Contractor's responsibility. Preparation of the subgrade will be completed no more than twenty-four (24) hours prior to the beginning of soil cement placement. The subgrade shall be maintained in a moist condition until placement of the soil cement. Soil cement shall not be placed until subgrade preparation has been tested by the Engineer.

STS 605.6.2 Proportions of Soil and Cement: The Contractor shall be responsible for the soil cement design mix. The Engineer shall approve the mix upon verifying compliance with these specifications. The design required for this project should employ standard laboratory procedures outlined in ASTM D558, D559 and D560 to determine proper cement content, optimum moisture content and maximum density of the soil-cement mixture. These tests should be performed using the pre-approved soils and cement sources intended for use.

The proper moisture (optimum moisture) and density (maximum density) for molding laboratory testing specimens will be determined using the moisture-density test (ASTM D558). Test specimens should then be molded at several cement contents and subjected to the ASTM wet-dry test and free-thaw testing, ASTM D559 and ASTM D560, respectively. Accumulated weight loss shall not exceed 6 percent when tested in accordance with ASTM D559 and 8 percent when tested in accordance with ASTM D560.

After proper cement content has been determined using the above referenced procedures, 2% additional cement should be added to the previously determined cement content. The moisture-density testing and durability testing should then be repeated. The mix design has been estimated to utilize from 10% to 12%, but not less than 8%, cement by weight, however, specific cement content should be determined during the mix design procedures.

The percent cement to be incorporated shall be calculated as the weight of cement divided by the total weight of the dry compacted soil. The design mix may require adjustment by the Engineer based on field tests conducted immediately prior to the first soil cement mixture and placement. The design mix may also be modified through the job by the Engineer if field testing indicates a need for such adjustments.

In addition to the testing outline above, a minimum compressive strength of 700 psi after a 7-day cure period is required. Compressive strength specimens should be prepared at 96% of the laboratory maximum dry unit weight. A minimum of twelve specimens should be prepared for the design mix cement content so that three can be tested at 3, 7, 28 and 90 days.

The mix design shall be submitted at least 5 days prior to commencement of work. The mix design must include appropriate aggregate testing such as grain size analysis and sand equivalence (ASTM 2419-74) determination.

STS 605.6.3 Proportion of Water: Optimum moisture and maximum density for the material being processed shall be determined during construction by moisture density test ASTM D558 or AASHTO T134 on representative samples of soil cement mixture obtained from the area being processed. When the mean air temperature during construction is 90° F or less, the moisture content at the time of compaction shall be between 1.0% dry and 2.0% wet of optimum moisture. When the mean air temperature exceeds 90° F or when there is a breeze that promotes rapid drying of the soil cement, the moisture content shall be increased as needed but shall be less than that quantity of moisture which will cause the soil cement to become unstable during compaction and finishing operations (determined by laboratory mix design).

STS 605.6.4 METHODS OF MIXING SOIL-CEMENT: PLANT MIXING

STS 605.6.4.1 If soil cement is plant mixed, the plant may be either a batch or a continuous mix type. The plant shall be designed, coordinated and operated so as to produce a mixture of soil-cement within the limits required by these specifications at a rate compatible with construction procedures.

STS 605.6.4.2 Requirements for Mixing Plants-General

(a) Plant Scales - Scales may be either of the beam type with over-and-under indicator, or springless dial type, and shall be of a standard make and design, sensitive to one percent (1%) of the maximum load that may be required or imposed. If the beam-type scale is used, there shall be included a separate beam for soil and for cement, each beam being connected so as to actuate the over-and-under indicator, and a tare beam for balancing the hopper.

(b) Control Unit - Suitable means, either by weighing or metering shall be provided to obtain the proper amount of cement, soil and water. All control devices are to be sensitive to a 2% variation above or below the actual weight in pounds required.

(c) Control of Mixing Time - The plant shall be equipped with positive means for controlling the mixing time of each batch. The mixing time shall be considered as the interval between the time the cement contacts the soil and water and the time the mixture leaves the mixing unit.

(d) Safety Requirements - Safe stairways to the mixer platform and guarded ladders to other plant units shall be provided where required for accessibility to all plant operations. all gears, pulleys, chains, sprockets and other dangerous moving parts in proximity to workmen shall be thoroughly guarded and protected. Ample and unobstructed space shall be provided on the mixing platform. A clean and unobstructed passage shall be maintained at all times in and around the truck-loading space. This space shall be kept free from droppings from the mixing platform.

STS 605.6.4.3 Additional Requirements for Batch Type Plants:

(a) Weight Box or Hopper - The equipment shall include means for accurately weighing soil and cement in a weight box or hopper suspended on scales, with the box or hopper being ample in size to accommodate batching without running over or requiring hand spreading on the surface of the load. The weight box or hopper shall be supported on fulcrums and knife edges so constructed that they will not be easily thrown out of alignment or adjustment.

(b) Mixer Unit - The plant shall include a mixer of an approved twin-pugmill type and shall be capable of producing a uniform mixture within the job mix tolerances specified. A rotary-drum type mixer shall not be allowed on this project.

STS 605.6.4.4 Additional Requirements for Continuous Mix Type Plants

(a) Proportioning Control - The plant shall include a means for accurately proportioning soil, water and cement by weighing or metering. Equipment shall be provided to insure positive interlocking control of the flow of soil and cement from the bins.

(b) Mixer Unit - The plant shall include a continuous mixer of an approved twin-pugmill type, and shall be capable of producing a uniform mixture within the job mix tolerance specified.

(c) Encasement or shielding of the mixing hopper and the conveying belt will be required to prevent cement loss by wind action.

(d) An easily and quickly operated by-pass to divert cement flow to scales, for calibration purposes, will be required. Suitable means of return of the cement used for calibration purposes to conveyor belt or silo will be provided.

(e) A vibrator of sufficient size to insure a uniform flow of soil materials will be provided.

STS 605.6.4.5 Inspection of Plant and Equipment: The Engineer shall have access at all times to all parts of the plant for checking the safety and adequacy of the equipment in use, for inspecting the operation of the plant, and for verification of weights or proportions and character of material. Quantity determination of soil materials and cement for calibration purposes will be made simultaneously, so that the plant performance during testing closely approximates actual working conditions.

STS 605.6.4.6 Mixing Soil-Cement - The soil, cement and water shall be accurately measured and conveyed into the mixer in the proportionate amounts necessary to meet the specified requirements. All ingredients shall be mixed for at least 30 seconds or longer as may be necessary to insure a thorough, uniform mix of soil, cement and water, and until the resulting mixture is homogeneous and uniform in appearance.

Mixing time and the proportions of the mix may be adjusted by the Engineer in light of tests and determinations performed by the Engineer. When mixing is completed, the percentage of moisture in the mixture on a dry weight basis, shall be such that at time of compaction the moisture content is within the range of two percentage points below optimum moisture content to two percentage points above optimum moisture content.

STS 605.6.4.7 Transporting Soil-Cement Mixture: The soil-cement mixture shall be transported from the mixing plant to the site of placement in vehicles having tight, clean and smooth beds. Haul time shall not exceed 45 minutes. "Haul time" shall be considered to mean the time elapsed from the time the water and cement were introduced in the mixing process until the mixture is spread to the specified thickness.

The Contractor shall protect the soil-cement mixture if it is transported during unfavorable weather. Any loads wetted excessively by rain will be subject to rejection. Equipment shall not be operated on a finished and compacted layer of the soil-cement, except where specifically permitted; and any damage resulting to the finished surfaces of soil-cement from such operation shall be repaired by the Contractor.

STS 605.6.5 Methods of Mixing Soil-Cement: In-Place Mixing

(a) Equipment - Acceptable equipment for mixing soil, cement, and water in-place shall be a single or multiple transverse shaft mixer, traveling pugmill, or similar equipment approved by the Engineer. Where pulverization of soil material is required, this operation shall be completed prior to the addition of cement to in-place soil. Rotary mixers, disc harrows or rollers should be used to minimize pulverization work.

(b) Pulverization - Before cement is applied, the soil materials shall be pulverized so that at the completion of moist-mixing 100% by dry weight passes a 2-inch sieve and minimum of 60% passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves. Sieve analysis testing will be performed by the Engineer at the end of the moist mixing operation.

(c) Soil Preparation - Soil material to be mixed with cement and water in-place may be formed into windrows or divided into known grid areas. If windrows are used, they shall be prepared to a known size with a sizing device, and the tops shall be flattened or slightly trenched to receive the cement.

(d) Cement Spreading - The cement quantity necessary to meet the specified rate of cement to soil ratio, computed in pounds, shall be distributed uniformly on the windrowed soil or over the prepared grid areas. Spread cement that has been displaced or is found to be less than that specified, shall be properly adjusted or replaced prior to starting mixing operations.

(e) Mixing Soil-Cement - After the cement is spread, it shall be thoroughly mixed with the soil material and water. Materials to be processed in windrows shall be mixed with a traveling mixing machine (traveling pugmill, etc.). Materials to be processed by the grid procedures shall be mixed with traveling single or multiple transverse shaft mixers. Motor patrol equipment shall not be used in lieu of the mixing equipment specified.

Regardless of the mixing equipment used, mixing shall be deep enough so that there will be no unmixed seams of soil between the layers. Moisture content at the time of compaction shall be within the range of two percentage points below optimum moisture content to two percentage points above optimum moisture content. Excessive striking of the soil-cement below the layer being mixed shall be avoided. When mixed-in-place methods are used, it may be necessary to shape the soil-cement layer before the final rolling. If this is necessary, raw soil shall not be bladed onto the mixed soil-cement.

(f) Water Application - The water may be applied through the mixing machine or separately by approved pressure-distributing equipment. The soil material and cement shall be mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall be continued until the moisture is uniform in color and at the required moisture content throughout. Operations of cement spreading, water application and mixing and spreading mixed material shall result in a uniform soil, cement, and water mixture for the full depth and width.

STS 605.6.6 Placing: The mixture shall be placed on the moistened subgrade, embankment, or previously completed soil cement with spreading equipment that will produce layers of such widths and thicknesses as are necessary for compaction to the required dimensions of the completed soil cement layers. The compacted layers of soil cement shall not exceed nine (9) inches in thickness.

Mixing and placement shall not proceed when the soil-aggregate or the area on which the soil cement is to be placed is frozen. Soil cement shall not be mixed or placed when the air temperature is below 45 F (7 C), unless the air temperature being at least 40 F (5 C) is rising. Soil cement shall not be mixed or placed if the weather conditions are such that the material being processed cannot be completely compacted or protected before the advent of damaging weather, (such as overnight lows below 40 F, cold fronts, rainstorms, etc.). The soil cement shall be protected from temperatures below 32 F for seven (7) days after placement.

Soil cement shall not be placed in the presence of water. The Contractor shall submit a water control plan to be reviewed and approved by the Engineer and must be designed to place soil cement in dry conditions.

If in the best interest of the City and at the discretion of the Engineer, placement of soil cement may be deemed acceptable in wet conditions in limited working areas. Placement of any soil cement in wet conditions will require written approval by the Engineer prior to placement. Soil cement placement in wet conditions shall be done according to the following conditions, or as directed by the Engineer.

Cementiteous material content shall be increased to at least six hundred and fifty (650) pounds of cementiteous material per cubic yard. Slump shall be between six (6) and eight (8) inches so as to insure that the moisture is plastic and will flow into place without puddling or segregation. Placement shall be by the tremie method. Tremie pipe diameter shall be at least eight times (8) the size of the largest aggregate. A seal shall be used to start placement. After the initiation of placement, the tremie pipe shall be kept full of soil cement and the end of the pipe shall always be embedded in the mixture. If the seal is lost, the tremie pipe shall be withdrawn, resealed and the charging operation started again. Placement shall be continuous until the soil cement layer is brought above the water surface. The continuous layer shall be brought up at least one (1) foot per hour. Placement shall only be made in quiescent water (flows less then ten (10) feet per minute) to avoid laitance. Soil cement placed in water shall be protected from the motion of water for at least four (4) days.

It is the intent of this project to control water and to place soil cement in a dry condition. Therefore, all costs associated with placing soil cement in wet conditions shall be born entirely by the Contractor.

STS 605.6.7 Compaction: Soil cement shall be uniformly compacted to a minimum of ~~96%~~ 93% percent of the maximum density as determined by field density tests. Moisture and density shall be determined in the field during construction by moisture-density test ASTM D558 or AASHTO T134. Wheel rolling with hauling equipment shall not be an acceptable method of compaction.

STANDARD PROCTOR or Reduce ... modified Proctor

At the start of compaction, the moisture shall be in a uniform, loose condition throughout its full depth. Its moisture content shall be as specified in other portions of this specification. No section shall be left undisturbed for longer than thirty (30) minutes during compaction operations.

Compaction of each layer shall be completed in such a manner as to produce a dense surface free of compaction planes in not longer than one (1) hour from the time the soil cement mixture has been spread in place. Whenever the Contractor's operation is interrupted for more than four (4) hours, the top surface of the completed layer, if smooth, shall be scarified to a depth of at least one-half (1/2) inch with a spiketooth instrument prior to placement of the next lift. The surface, after said scarifying, shall be swept using a power broom or other method approved by the Engineer to completely free the surface of all loose material prior to actual placement of the soil cement mixture for the next lift.

STS 605.6.8 Finishing of the Soil Cement: After completion, the soil cement shall be further shaped, if necessary, to the required lines, grades, and cross sections and rolled to a reasonably smooth surface, satisfactory to the Engineer. This includes compacting and rounding the exposed edges of the soil cement layers as shown on the Plans.

STS 605.6.9 Placement, Compaction, and Finishing of Subsequent Layers: Each successive layer of soil cement shall be placed and compacted as soon as practicable after the preceeding layer is completed and tested.

All soil cement surfaces that will be in contact with succeeding layers of soil cement shall be kept continuously moist until placement of the subsequent layer, provided that the Contractor will not be required to keep such surfaces continuously moist for a period longer than seven (7) days.

The Contractor shall take all necessary precautions to avoid damage to completed soil cement by the equipment and to avoid the deposition of raw earth or foreign materials between layers of soil cement. All extraneous material shall be swept using a power broom or other method approved by the Engineer to completely free the surface of foreign material before the next layer of soil cement is placed. The surface should be moistened by fog spraying immediately before placement of the next layer. Earth ramps crossing completed soil cement must be at least 2-feet in compacted thickness. Additional thickness may be required by the Engineer to insure that the soil cement below does not yield or deform under wheel loads. Where ramps are constructed over soil cement that is not to grade or where new soil cement is to overlap the face of existing soil cement, all foreign materials and the uppermost one (1) inch of the previously placed soil cement mixture must be removed prior to continuation of the soil cement construction.

STS 605.6.10 Protecting and Curing Surfaces of Soil-Cement: Compacted surfaces of soil-cement that are to receive an overlying layer of soil-cement, shall be kept moist within the specified moisture limits, until the overlying or adjacent layer of soil-cement is placed, provided that, the Contractor will not be required to keep such surfaces moistened for a period longer than 7 days. Moisture must be retained by continuous wetting, application of waterproof paper or plastic sheets, or by an alternate Engineer approved method. If the time elapsed between completing compaction on a layer and starting the placement of the next soil-cement layer is greater than four (4) hours, or if deleterious material is accumulated through the moisture retaining process, the Contractor shall clean off bonding surfaces thoroughly by power-brooming or other approved methods prior to placing the next layer of soil-cement as specified in STS 605.6.7.

Permanently exposed surfaces shall be kept in a moist condition for seven (7) days. Moisture must be retained by application of an Engineer approved curing compound, by continuous wetting, application of waterproof paper or plastic sheets, or by an alternate Engineer approved method.

STS 605.6.11 Construction Joints: At the end of each day's work, or whenever construction operations are interrupted for more than two (2) hours, a transverse construction joint shall be formed by cutting back into the completed work to form a full-depth vertical face.

STS 605.6.12 Maintenance: The Contractor shall be responsible within the limits of this contract, to maintain the placed soil cement in good condition until work is completed and accepted by the City. Maintenance shall include immediate repairs of defective work or damage that may occur during construction. All defective work shall be replaced for the entire depth of the layer.

STS 605.7 INSPECTION AND TESTING

The Engineer, with the assistance and cooperation of the Contractor, shall make such observations and tests as he deems necessary to ensure the compliance of the work with the contract documents. These observations and tests may include, but shall not be limited to, (1) the soil cement and its individual components at all stages of processing and after completion, and (2) the operation of all equipment used on the work. Only those materials, machines, and methods meeting the requirements of the Contract Documents shall be approved by the Engineer.

All testing of soil cement and its individual components, unless otherwise provided for specifically in the Contract Documents, shall be in accordance with the latest applicable ASTM or AASHTO specifications in effect as of the date of advertisement for bids on the project.

Testing for proper compaction shall be done on at least every other lift of compacted soil cement at any location chosen by the testing personnel. If the lift being tested does not pass the density requirements, additional passes with compaction equipment must be made as required to increase density of the in-place material until it does pass or the material must be removed at the Contractor's expense.

The Contractor shall not be permitted to continue placing lifts of soil cement on any lift which has failed the compaction test, until such time as that lift has been reworked, retested and passed the density requirements.

The initial acceptance of material shall in no way preclude further examination and testing at any time the Engineer suspects that the material is no longer properly represented by the acceptance sample. The acceptance at any time of any material shall not bar its future rejection if it is subsequently found to be defective in quality or uniformity.

STS 605.8 MEASUREMENT AND PAYMENT

STS 605.8.1 Measurement: The work shall be measured by the square yard of soil cement channel lining, complete and in-place as determined by the specific lines, grades, cross section and compaction shown on the Plans. Any waste of cementiteous material and/or soil cement by the Contractor during the handling, mixing, placing, or other operation shall not be measured.

STS 605.8.2 Payment: This work shall be paid for at the contract unit price per square yard, for soil cement channel lining. Such payment shall constitute full reimbursement for all work necessary to complete the soil cement channel lining, including excavation required for constructing the soil cement, compacting, curing, inspection and testing assistance, and all other incidental operations.

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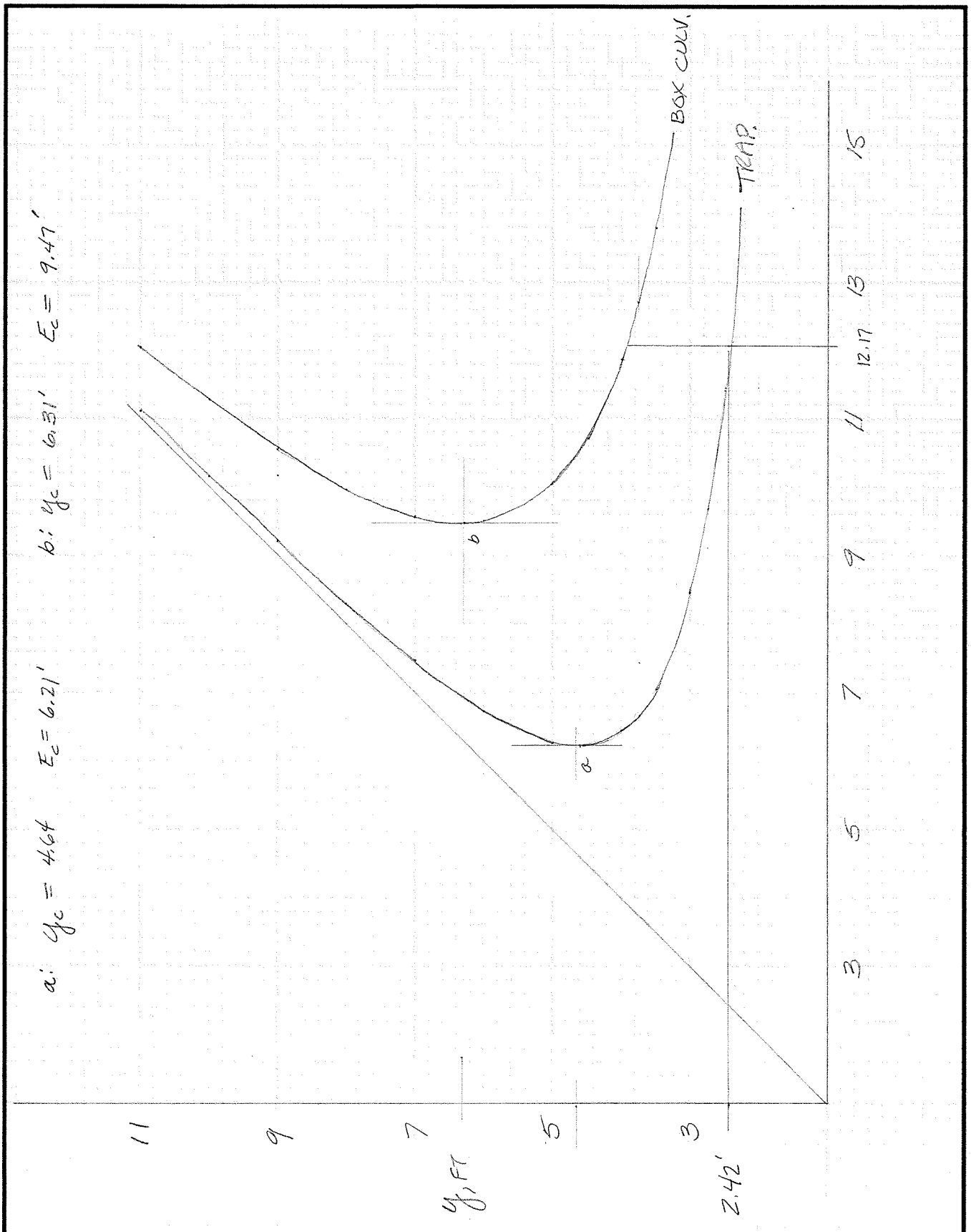

FOR _____ DESCRIPTION _____

PREPARED BY _____ DATE _____ FILE _____

CHECKED BY _____ SHEET ____ of ____

ALBUQUERQUE PUBLIC WORKS DEPARTMENT

HYDRAULIC DESIGN
OF DRAINAGE STRUCTURES

FOR
MONUMENT POINTE DRIVE AND THE LADERA CHANNEL
LAURELWOOD II SUBDIVISION

CITY OF ALBUQUERQUE
BERNALILLO COUNTY
NEW MEXICO

JANUARY, 1989

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OF DRAINAGE STRUCTURES
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MONUMENT POINTE DRIVE AND THE LADERA CHANNEL

I. HYDROLOGY

The 100-year flow rate of 900 cfs in the Ladera Channel was stipulated by the Northwest Mesa Drainage Management Plan. At this time the study is under review and is not yet approved. However, it does provide the most current design hydrology. The 10-year flow rate was taken as 0.657 times the 100-year rate or 590 cfs.

All other design flows, volumes, etc., were taken from the report entitled "Drainage Plan for Tract IV, Phase I 'Monument Pointe' Laurelwood II Subdivision" as prepared by Richard Beltramo of Fred Denney & Associates, Inc.

II. HYDRAULIC DESIGN

A. Ladera Channel

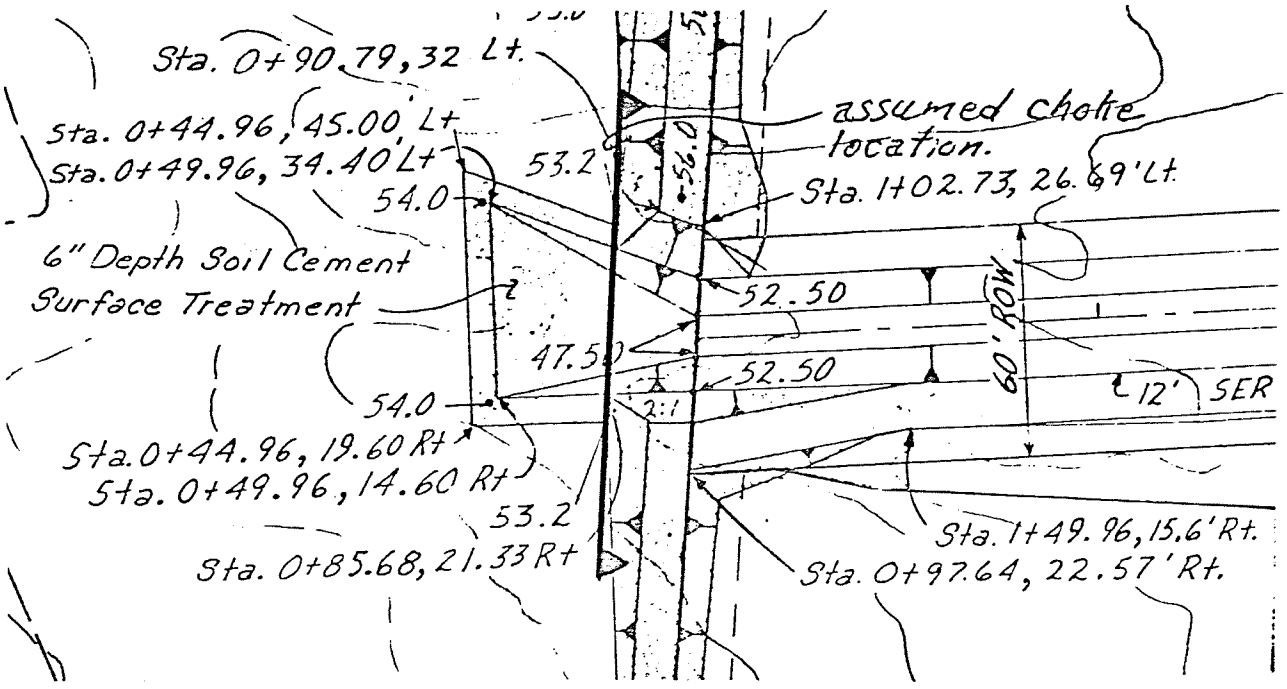
1. Design Objectives:
   a. Convey runoff (no attenuation required);
   b. Concrete-lined channel (C.O.A. standards);
   c. Discharge into existing concrete box culvert at Unser Boulevard so as not to erode the existing earthen channel downstream;
   d. Prevent head cutting or other damage upstream of proposed channel;
   e. Minimize maintenance (discourage silt deposition, erosion, etc.).

2. Inlet (Station 1+00)

The existing waterway upstream of the channel is a winding swale on a grade of approximately 2%. Due to the ill definition of a channel, a trainer dike or berm will be used to intercept and direct flows into the concrete-lined channel. To minimize maintenance, ponding (thus desiltation) upstream of the berm will be minimized. Since flow in natural arroyos and channels is almost certainly supercritical, a nonerosive grade check at natural grade will prevent headcutting upstream.

The maximum velocity obtained at the inlet is 9.18 Fps. Soil cement is used to protect both the diversion berm and the inlet.

Hydraulic analysis is based on analyzing the section where flow is restricted the most. For this case, that section is located in the channel at the berm (see Sketch). Assuming zero velocity in the upstream pool, and critical depth at the choke section, the following equations apply.



TRAPEZOIDAL CHANNEL

Flow Rate	=	900
Depth	=	4.646312
Side Slope	=	2
Bottom Width	=	10
Area	=	89.63954
Velocity	=	10.04021
Top Width	=	28.58525

TRAPEZOIDAL CHANNEL

Flow Rate	=	456.6323
Depth	=	3.22
Side Slope	=	2
Bottom Width	=	10
Area	=	52.9368
Velocity	=	8.625988
Top Width	=	22.88

2. Inlet (Station 1+00) (Continued)

$$Y_c = 3.22' \quad A_c = 97.98 \text{ sq.ft.} \quad V_c = 9.18 \text{ Fps}$$

$$T_c = 37.25' \quad d_c = \frac{Ac}{Tc} = 2.63'$$

$$Fr^2 = \frac{V^2}{gd} = \frac{9.18^2}{32.2 \times 2.63} = 1.00$$

$$h_v = \frac{Vc^2}{2g} = \frac{9.18^2}{2 \times 32.2} = 1.31'$$

$$H = \text{elev.} + y + h_v = 5{,}250 + 3.22 + 1.31 = 5{,}254.53'$$

Thus, the maximum elevation of water in a pooled condition will be 5,254.53 feet. The top of the berm is placed at 5,256 feet providing 1.5 feet of freeboard. The assumption that the inflow has a zero velocity is conservative. The actual case has some velocity and therefore the standing pool is less than the 5,254.53 foot elevation, depending on the magnitude of this velocity.

3. Channel

In general, the frictional grade of the flow or the slope of the total energy line must remain greater than the grade of the silt source or silt deposition will occur in the channel. By placing the top of the channel at natural grade, not only is the aesthetics and adjoining drainage improved, but self-cleaning is assured. A trapezoidal cross section with a ten foot bottom and 2:1 side slopes was sized for depth (n = 0.013 for concrete). For a design grade of 2.34%:

TRAPEZOIDAL CHANNEL

Flow Rate	(cfs)	=	900
Depth	(ft)	=	2.415518
Velocity	(ft/s)	=	25.12238
Mannings n		=	.013
Slope	(ft/ft)	=	.0234
Side Slope	(H:V)	=	2
Bottom Width	(ft)	=	10
Top Width	(ft)	=	19.66207
Area	(ft^2)	=	35.82464
Hydraulic Radius		=	1.722129
Freeboard	(ft)	=	0
Top Width (w/ freebrd)		=	19.66207
Froude Number		=	2.049903

3. Channel (Continued)

$$Y_n = 2.42'$$

$$A_n = (2y+10)y = (2x2.42+10)x2.42 = 35.91 \text{ sq.ft.}$$

$$P_n = 2\sqrt{5}y+10 = 2x2.236x2.42+10 = 20.82'$$

$$R_n = A/P = 35.91/20.82 = 1.72'$$

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} = \frac{1.486}{.013} \times 35.91x(1.72)^{2/3}$$

$$x(0.0234)^{1/2} = 903.1 \text{ cfs } \underline{\text{chk}}.$$

$$V_n = Q/A = 900/35.91 = 25.06 \text{ Fps}$$

$$h_v = \frac{V^2}{2g} = \frac{25.06^2}{2x32.2} = 9.75'$$

$$T_n = 4y+10 = 4x2.42+10 = 19.68'$$

$$d_n = A/T = 35.91/19.68 = 1.82'$$

$$Fr^2 = \frac{v^2}{gd} = \frac{25.06^2}{32.2x1.82} = 10.72 \text{ (supercritical)}$$

Therefore, flow will assume an S_2 profile beginning at critical depth at the inlet of the channel.

A five-foot deep channel will provide 2.6 feet of freeboard at normal depth.

In the curve (Stations 8+05.44 to 11+16.58) superelevation on the south side of the channel will be needed.

$$S = \frac{V^2(b+2zd)}{2gr} = \frac{24.84^2(10+2x2x2.44)}{2x32.2x594.4} = 0.32'$$

For simplicity, superelevation of one foot was used in lieu of 0.32 feet.

3. Channel (Continued)

The proposed ten-foot span concrete box culvert at Monument Pointe Drive (Station 12+02.81) requires a drop in the channel upstream of the crossing (Station 11+82.81 to 12+02.81). Several combinations of cross-sectional transit (Station 11+52.81 to 12+02.81) and drops were analyzed. The drop in the last 20 feet of the transition resulted in the smallest choke.

The drop serves to accelerate the flow to a velocity well above normal velocity. The grade through the box culvert and downstream must be considerably less to bring the channel back to ground level. Normal depth at a grade of 1% is 3.03 feet. This is less than critical depth of 4.64 feet. Therefore, unless the flow slows a great deal in the hydraulically more efficient cross section of the box culvert, flow will assume an S_3 profile. The depth of the flow will quickly increase and then approach normal depth from below. From the water surface profile analysis, the frictional grade at the grade break downstream of Monument Pointe Drive (Station 15+00) is 1.69%. Although this indicates silt deposition would be imminent with full silt load, some desiltation will occur at the inlet to the channel. We, therefore, feel that with proper maintenance of the inlet, silt accumulation in this reach will not be a problem.

When the flow passes the grade break (Station 15+00) downstream of Monument Pointe Drive, it will be between critical and the new normal depth. An S_2 profile will result.

In the horizontal transition to the existing concrete box culvert at Unser Boulevard (Station 18+12.21 to 19+12.00) the width of flow

3. Channel (Continued)

will increase, the water surface will drop and thus the velocity will increase. The channel must then drop in elevation (Station 19+12.00 to 19+32) and the flow will be further accelerated.

Upon emergence from the box culvert, the existing channel further widens in a concrete section. Concrete parking bumpers, comparable in height to the depth of flow, serve as energy dissipaters in this section. A rip rap section between the concrete section and the earthen channel downstream also exists. If the flow is to not adversely affect the earthen channel, it must be at less than normal velocity before reaching this section.

The water surface profile analysis indicates the flow will assume an M_3 profile. The depth is increasing toward critical depth by Station 21+50.

A check of normal depths on the rip rap section and on the earthen section indicates the rip rap section to be a mild slope, whereas the earthen section is a steep slope. Therefore, critical depth will occur near the downstream edge of the rip rap (approx. Station 21+85). Running a water surface profile analysis upstream from this point and comparing conjugate depth with the profile from above locates a hydraulic jump of .035 feet at Station 21+51 (see Chart 1).

The above analysis was undertaken as the worst case. In all likelihood, the parking bumpers will supply enough upstream thrust to force the hydraulic jump sooner. The flow will then be subcritical longer, but will still go through critical depth at the same point.

3. Channel (Continued)

The existing arroyo has slower velocities than the proposed concrete channel and consequentially the hydraulic jump is even further upstream. Thus, the conditions in the existing earthen channel will be unchanged by the proposed improvements.

B. INTERIM PONDS

Six desiltation-detention ponds are shown as interim ponds on the drainage report. Each pond will be designated by the number of its respective drainage basin.

1. Pond 1

This pond was eliminated by the proposed installation of a 30" diameter reinforced concrete pipe culvert under Monument Pointe Drive at Station 2+75. This is intended to be temporary; when the southern portion of Tract IV is developed, grading and/or a storm drain will intercept and discharge the flows into the Ladera Channel at Monument Pointe Drive. In the time being, flow will follow its historic path to the storm drain inlet north of 98th Street on Unser Boulevard.

Each of the remaining five ponds were sized to hold the entire runoff of their respective basins in the event an outlet should become blocked. This was deemed prudent due to the danger of blockage of the relatively small outlet structures.

2. Pond 2 (See Chart 2)

The hydrology indicates a peak inflow of 7 cfs, a time to peak of 10 minutes, and a total volume of 0.264 acre-feet or 11,500 cubic feet.

2. Pond 2 (Continued)

A hydrograph having this peak, time to peak, and runoff of 80% of the total volume (9,200 cf) within the first hour was sketched using the assumption that the remaining 20% (2,300 cf) of the volume would be an exponential decay.

$$q(t) = Ae^{-60Bt} \quad t>60 \text{ minutes}$$

$$20\%\ V = \int_{60}^{\infty} Ae^{-60Bt}\,dt = \frac{Ae^{-3600B}}{60B} = \frac{1}{60B}q(60)$$

$$\therefore \quad B = \frac{q(60)}{.2x60V}$$

The hydrograph should be smooth at the one-hour point. The flow as well as the grade of the hydrograph will have to match at the one-hour point.

$$\frac{d}{dt}q(t) = -60ABe^{-60Bt} = -60Bq(t)$$

$$\text{or} \quad \frac{d}{dt}q(60) = -60 \cdot \frac{q^2(60)}{.2x60V}$$

Thus, the slope of the hydrograph for any flow is known.

Discharges [q(60)] were assumed, the slopes plotted, and curves sketched and adjusted until a reasonably shaped hydrograph was obtained.

The outlet structure was sized to give a discharge of three cfs at a depth of approximately three feet. The geometry of the pond was adjusted to give a maximum depth of approximately three feet.

The outlet structure selected is a 12" PVC standpipe with 6 one-inch wide vertical slots three feet long. Six inches above the slots, the standpipe will be left uncapped to act as a spillway in case of blockage of the slots.

3. Pond 3 (See Chart 3)

The hydrology of Basin 3 indicates a peak inflow of 18 cfs, a time to peak of 10 minutes, and a volume of 0.6967 acre-feet or 30,350 cf. The same process to obtain a hydrograph was used as for Pond 2.

The same 12" PVC standpipe was used for an outlet for Pond 2.

The geometry of the pond was adjusted until a maximum depth of approximately three feet was obtained.

4. Pond 4 (See Chart 4)

The hydrograph having a peak inflow of 26 cfs, a time to peak of 10 minutes, and a volume of 0.9973 acre-feet or 43,440 cf for Basin 4 was sketched as above.

The same 12" PVC slotted standpipe outlet was used for Pond 4.

Due to the length of the diversion ditch for this pond, the volume of the ditch is more than enough and no pond is needed. A berm downstream of the ditch provided enough volume to impound the total runoff if needed.

This resulted in a maximum depth of 2.1 feet.

5. Pond 7 (See Chart 5)

The hydrograph having a peak inflow of 39 cfs, a time to peak of 10 minutes, and a volume of 1.5168 acre-feet or 66,075 cf for Basin 7 was sketched as above.

The length of the channel and the required depths of each end indicated the ditch could serve as the pond as in Pond 4 above.

The outlet structure selected is the lower 15 inches of a 42" RCP being left open, the rest being closed by a concrete plug. A three-inch wide vertical slot was provided to help prevent blockage by sand.

5. Pond 7 (Continued)

This resulted in a maximum depth of 3¼ feet and the ditch has adequate capacity to impound the total runoff if necessary.

6. Pond 8 (See Chart 6)

The hydrograph having a peak inflow of 13 cfs, a time to peak of 10 minutes, and a volume of 0.4816 acre-feet or 21,000 cf for Basin 8 was sketched as before.

The 12" PVC slotted standpipe was used for the outlet.

The geometry of the basin was selected so that the maximum depth would be 2.4 feet.

All ponds will have soil-cement slope where inflows are expected to prevent erosion. The shallow depths and 3:1 side slopes have been selected for safety reasons.

DENNEY - GROSS & ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
2400 COMANCHE ROAD N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION LAKEWOOD IL

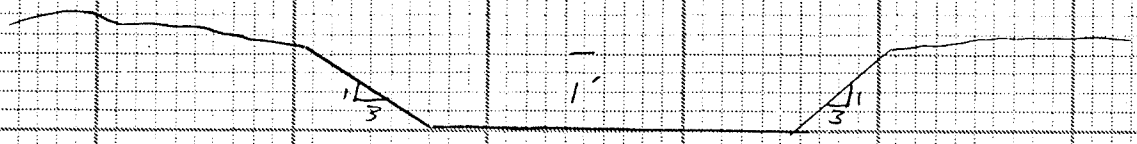
PROJ. NO. 765.12

DATE 8/13/87

DESIGNER J. Jones

PAGE 3

GRADED SWALE SECTION



MANNING'S

$A = \frac{1}{2}(10+16)(1) = 13$

$Q = \frac{1.486}{0.03}(0.02)^{1/2}(13)(0.8)^{.67}$

$R = A/P = \frac{13}{16} = 0.80$

$Q = 78 cfs >> 23 cfs$ (FROM PG 1)

> 46.5 OK

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ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION LAURELWOOD II

PROJ. NO. 765.12

DATE 8/12/87

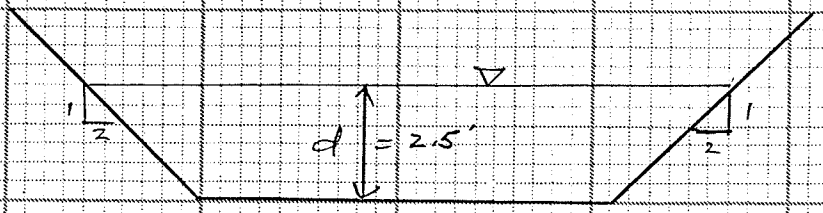
DESIGNER JONES

PAGE 2

CHANNEL CALCULATIONS

Manning's

$$Q = \frac{1.486}{n} S^{1/2} A R^{2/3}$$



$Q = 900$ cfs

$S = 0.02\%$

$n = 0.013$

TRY $d = 2.5'$

$$A = \tfrac{1}{2}(10+20)2.5 = 37.5 \text{ SF}$$

$$R = A/P = \frac{37.5}{21.2} = 1.8$$

$$Q = \frac{1.486}{0.013}(0.02)^{1/2}(37.5)(1.8)^{0.67}$$

$Q = 879$ cfs ≈ 900 cfs (OK)

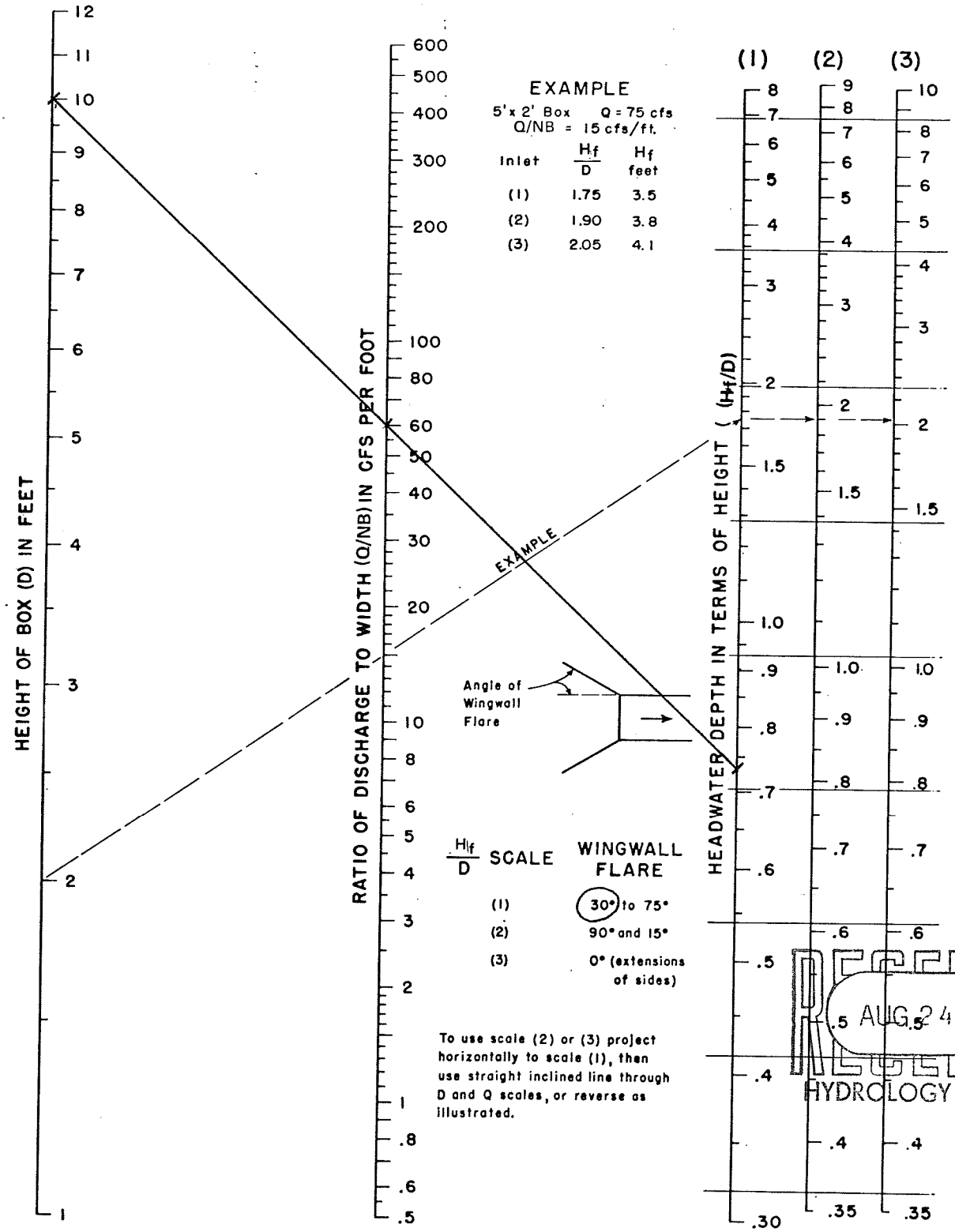
$Q_{100} = 900$ cfs

3 - 10'x5' CBC's EXIST @ U-1SER

$\frac{900 cfs}{3\text{-}CBC's} = 300 cfs/CBC$

$Q/NB = 300/5 = 60 cfs/ft$

Chart 7



$Hf/D = 0.73$

$Hf = 7.3'$ 300D

HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

DENNEY - GROSS & ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
2400 COMANCHE ROAD N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0695

LOCATION LAUREL WOOD II

PROJ. NO. 765.12

DATE 8/25/87

DESIGNER J JONES

PAGE

LADERA CHANNEL

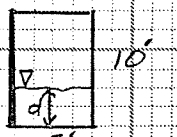
Q = 900 cfs (DEVELOPED RUNOFF)

3 - 10'X5' CBC's EXIST

DEPTH @ INLET OF CBC's = 7.3' (SEE SHT 13-71)

CHECK MANNING'S IN BOX CULVERT

TYPICAL CBC



MANNING'S

$Q = \frac{1.486}{n} S^{1/2} R^{2/3}$

n = 0.013

S = 0.0147 (SAD 215)

TRY d = 3.5' A = 17.5 $R = \frac{17.5}{12}$

$Q = \frac{1.486}{0.013}(0.0147)^{1/2}(17.5)(1.46)^{0.67}$

Q = 313 cfs PER CBC X3 = 939 cfs (OK)

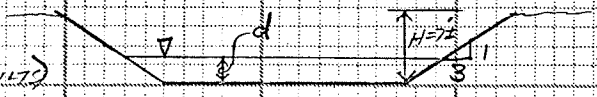
USE 0.014 TO 0.016

∴ d = 3.5' IN CBC's

CHECK MANNING'S DOWNSTREAM OF CBC

n = 0.025

S = 0.02 (FROM EXIST. CONTOURS ON SAD 215 DOWNAGES REASONABLY WITH AS-BUILTS)



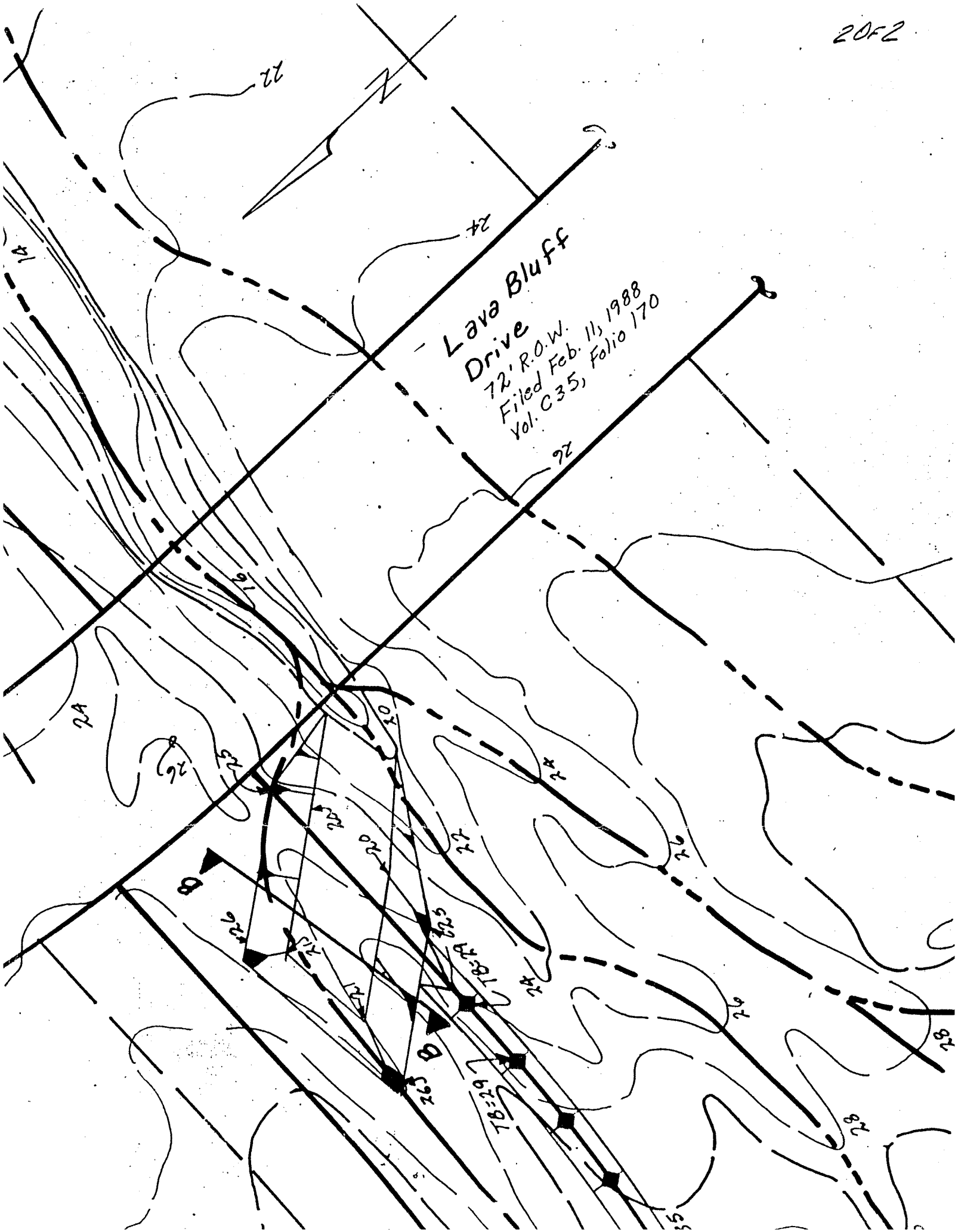
TRY d = 1.5'

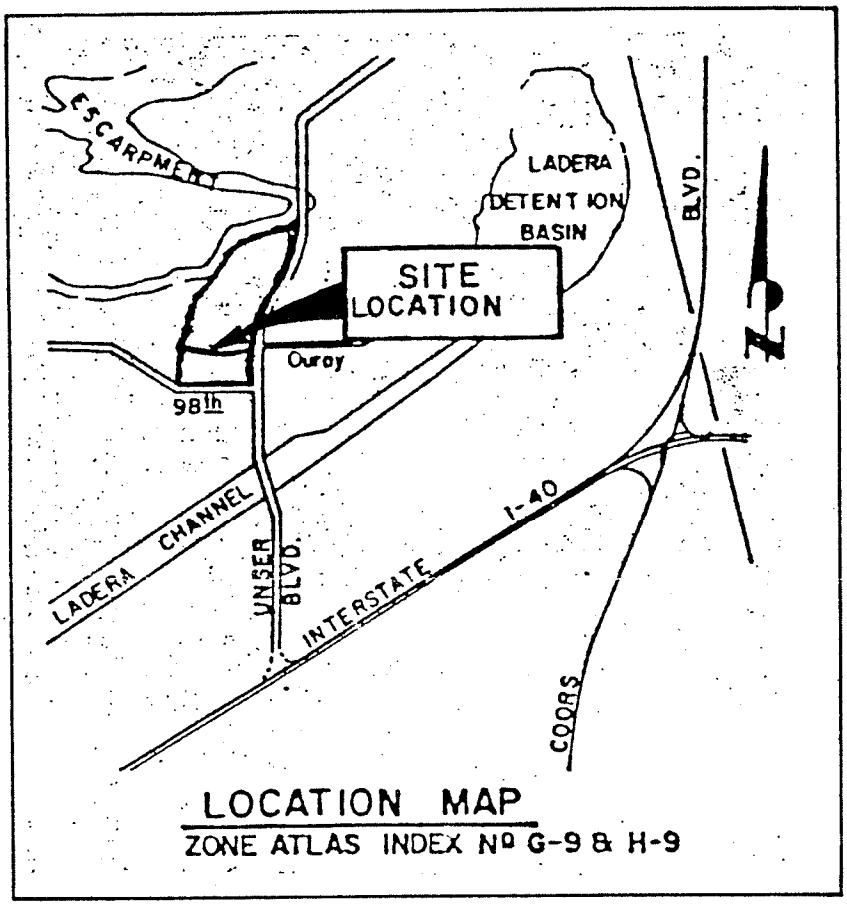
A = ½(60+69)1.5 = 96.75 $R = A/p = \frac{96.75}{69.5} = 1.39$

$Q = \frac{1.486}{0.025}(0.02)^{1/2}(96.75)(1.39)^{.67}$

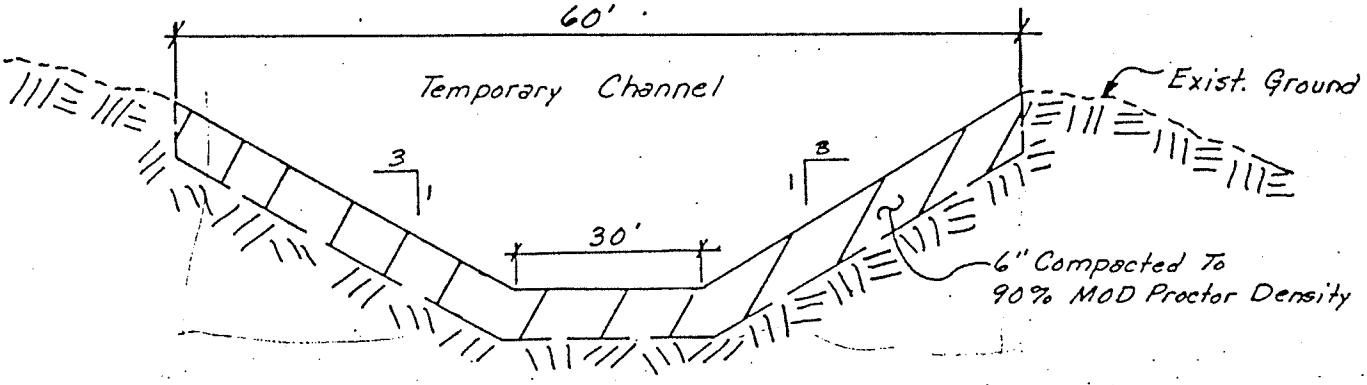
Q = 1014 cfs > 900 cfs (OK)

∴ d IN DOWNSTREAM CHANNEL = 1.5'


Lava Bluff
Drive
72' R.O.W.
Filed Feb. 11, 1988
Vol. C35, Folio 170
TB=27
TB=27
TB=26



LOCATION MAP
ZONE ATLAS INDEX Nº G-9 & H-9



Refer To General Notes

SECTION B-B
N.T.S.

PC# 890455

#3411

9032220

RECEIVED
MAY 2 1990
HYDROLOGY DIVISION

DRAINAGE COVENANT 3053

This Drainage Covenant, between (state the name of the present real property owner wxactly as shown on the real estate document conveying title to the present owner and state the legal satus of the owner, for example, "single person," "husband and wife," "corporation of the State of X," "partnership":) LAURELWOOD II JOINT VENTURE, a Joint Venture ("Owner"), whose address is 4520 Montgomery Blvd. NE, Suite 4-A, Albuq. NM, and the City of Albuquerque, New Mexico municipal corporation ("City"), whose address is P.O. Box 1293, Albuquerque, New Mexico 87103, is made in Albuquerque, Bernalillo County, New Mexico and is entered into as of the date Owner signs this Covenant.

1, Recital. Owner is the owner of certain real property located at (give legal description, e.g., subdivision, lot and block and street address:) El Rancho Atrisco Phase IV
UPC No. 1-009-059-340-400-20150
Replatted as Laurelwood II, Tracts I, II, III & IV
Located at the NW Quadrant of Unser Boulevard & 98th Street NW
in Bernalillo County, New Mexico (the "Property").

Pursuant to City ordinances, regulations and other applicable laws, the Owner is required to construct and maintain certain drainage facilities on the Property, and the parties whish to enter into this agreement to establish the obligations and responsibilities of the parties.

2. Description and Construction of Drainage Facilities. Owner shall construct the following "Drainage Facility" within the Property at Owner's sole expense in accordance with the standards, plans and specifications approved by the City:
As per attachment "A" hereto

The Drainage Facility is more particularly described in the attached Exhibit A. The Owner will not permit the Drainage Facility to constitute a hazard to the health or safety of the general public.

3. Maintenance of Drainage Facility. The Owner will maintain the Drainage Facility at Owner's cost in accordance with the approved Drainage Report and plans.

4. City's Right of Entry. The City has the right to enter upon the Property at any time and perform whatever inspection of the Drainage Faiclity it deems appropriate, without liability to the Owner.

5. Demand for Construction or Repair. The City may send written notice ("Notice") to the Owner requiring the Owner to construct or repair the Drainage Facility within 30 days ("Deadline") of receipt of the Notice, as provided in Section 12, and the Owner will comply promptly with the requirements of the Notice. The Owner will perform all required work by the Deadline, at Owner's sole expense.

(Approved by Legal Dept.
as to form only 12/89)

6. Failure to Perform by Owner and Emergency Work by City. If the Owner fails to comply with the terms of the Notice by the Deadline, or if the City determines that an emergency condition exists, the City may perform the work itself. The City may assess the Owner for the cost of the work and aofr any other expenses or damages whhich reulst from Owner's failure to perform. The Owner agrees promptly to pay the City the amount assessed. If the Owner fails to pay the City within thirty (30) days after the City gives the Owner written notice of the amount due, the City may impose a lien against Owner's Property for the total resulting amount.

7. Liability of City for Repair after Notice or as a Result of Emergency. The City shall not be liable to the Owner for any damages resulting from the City's repair or maintenance following notice to the Owner as required in this agreement or in an emergency unless the damages are the result of the reckless conduct or gross negligence of the City.

8. Indemnification. As a part of the consideration for this grant, subject to the provisions of the New Mexico Tort Claims Acts and all other applicable New Mexico Laws, the City agrees to save owner harmless from any and all liability arising from the City's negligent use of the Drainage Facility. The City does not agree to save Owner harmless from any liability which may arise from Owner's use of the Drainage Facility and Property. Owner agrees to indemnify and save the City its officials, agents and employees harmless from all claims, actions, suits and proceedings arising out of or resulting from the Owner's negligent maintenance, construction or use of the Drainage Facility. To the extent, if at all, Section 56-7-1 NMSA 1978 is applicable to this Agreement, this Agreement to indemnify will not extend to liability, claims, damages, losses or expenses, including attorney's fees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications by the indemnitee, or the agents or employees of the indemnitee; of (2) the giving of or the failure to give direction or instructions by the indemnitee, where such giving or failure to give directions or instructions is the primary cause of bodily injury to persons or damage to property.

9. Cancellation of Agreement and Release of Covenant. This agreement may be cancelled and Owner's covenants by the City following by the City's mailing to the owner notice of the City's intention to record a cancellation and release with the Bernalillo County Clerk. The Cancellation and Release will be effective thirty (30) days after the date of mailing the notice to the user unless a later date is stated in the notice or in the Cancellation and Release. After the effective date, the City will record the Cancellation and Release with the Bernalillo County Clerk.

10. Assessment. Nothing in this agreement shall be construed to relieve the Owner, his heirs, assigns, and sucessors from an assessment against owner's property for improvement to the property under a duly authorized and approved Special Assessment District. The parties specifically agree that the value of the Drainage Facility will not reduce the amount assessed by the City.

(Approved by Legal Dept.
as to form only 12/89)

11. Notice. For purposes of given formal written notice to the Owner, owner's address is:

Laurelwood II Joint Venture
4520 Montgomery Boulevard NE, Suite 4-A
Albuquerque, NM 87109

Notice may be given to the Owner either in person or by mailing the notice by regular U.S. mail, postage paid. Notice will be considered to have been received by the Owner within three days after the notice is mailed if there is no actual evidence of receipt. The Owner may change owner's address by given written notice of the change by Certified Mail, return receipt requested, to the City Public Works Department, P.O. Box 1293, Albuquerque, New Mexico, 87103.

12. Term. This Agreement shall continue until termined by the City pursuant to Section 9 above.

13. Binding on Owner's Property. The covenants and obligations of the owner said forth herein shall be binding on owner, his heirs, assigns and successors and on owner's property and constitute covenants running the owner's property until released by the City.

14. Entire Agreement. This agreement contains the entire agreement of the parties and supercedes any and all other agreements or understanding, oral or written, whether previous to the execution hereof or contemporaneous herewith.

15. Changes to Agreement. Changes to this Agreement are not binding unless made in writing, signed by both parties.

16. Construction and Severability. If any part of this agreement is held to be invalid or unenforceable, the remainder of the agreement will remain valid and enforceable if the remainder is reasonably capable of completion.

17. Captions. The Captions to the Sections or paragraphs of this agreement are not part of this agreement and will not affect the meaning or construction of any of its provisions.

18. Form Not Changed. Owner agrees that changes to the wording of this form are not binding upon the City unless initialed by the Owner and approved and signed by the City Legal Department in writing on this form.

OWNER:

By: MK Lee/Kirkpatrick
Its: Managing Partner
Dated: Feb 23, 1990

(Approved by Legal Dept.
as to form only 12/89)

3056

STATE OF New Mexico)
) ss
COUNTY OF Bernalillo)

The foregoing instrument was acknowledged, before me this 23rd day of February, 19 90, by [name of person signing:] Max Lee Kiehne, {title or capacity, for instance, "President" or "Owner":] Managing Partner of {name of the entity which owns the Property if other than the individual signing, for instance, the name of the corporation, partnership, or joint venture:] Laurelwood II Joint Venture.

Jane E. Jensen
Notary Public

My commission Expires:
December 6, 1992

CITY OF ALBUQUERQUE:

Approved:

By: Russell B. Smith
Title: City Engineer
Dated: 4-24-90

STATE OF NEW MEXICO
COUNTY OF BERNALILLO
FILED FOR RECORD

90 APR 24 PM 3:10 (EXHIBIT A ATTACHED)

BK 90-7 PG 3053-3059
GLADYS M. DAVIS
CLERK & RECORDER
DEPUTY

(Approved by Legal Dept.
as to form only 12/89)

TABLE 2

FLOW CHARACTERISTICS AT KEY INTERSECTIONS

STREET	LOCATION	ST. WIDTH	% SLOPE	Q100	Dn	Dc	Vn	Vc	AREA	TOP WIDTH	EG	F	*POOL DEPTH
WEDGEWOOD CT	5+50	20 MOUNT	1.58	4.66	0.22	0.24	2.33	1.98	2.00	20.23	0.31	1.31	0.32
STONEWOOD	SADDLEBROOK	22 STAND	0.50	26.46	0.56	0.54	3.16	3.40	8.38	22.29	0.72	0.91	
GARDENBROOK	WINDWARD	25 MOUNT	2.72	11.62	0.28	0.34	3.60	2.43	3.23	25.74	0.48	1.79	0.45
MILLSTREAM	WINDWARD	25 MOUNT	2.50	12.26	[illegible]	0.34	3.58	2.47	3.42	25.81	0.48	1.73	0.46
SKYBROOK	MEADOWBROOK	25 MOUNT	1.00	14.41	0.34	0.36	2.89	2.64	4.99	26.25	0.47	1.17	0.50
MEADOWBROOK	13+00	25 MOUNT	2.42	8.06	[illegible]	0.29	3.10	2.21	2.60	23.67	0.40	1.65	0.38
STONECREEK	SUNSTONE	25 MOUNT	0.60	9.90	0.33	0.32	2.12	2.33	4.67	26.25	0.40	0.89	
FIELDSTONE	SUNSTONE	25 MOUNT	2.34	7.75	0.25	0.29	3.03	2.13	2.56	23.47	0.39	1.62	0.38
WESTBROOK	CREEKWOOD	25 MOUNT	2.00	3.67	0.20	0.23	2.38	1.81	1.54	18.10	0.29	1.44	0.29
OAKBROOK	20+00	25 MOUNT	2.24	12.47	0.29	0.35	3.49	2.48	3.57	25.87	0.48	1.66	0.47
OAKBROOK	CREEKWOOD	25 MOUNT	1.07	12.47	0.33	0.35	2.77	2.48	4.50	26.21	0.45	1.18	0.47
CREEKWOOD	OAKBROOK	25 MOUNT	2.95	9.38	0.26	0.31	3.47	2.30	2.71	24.15	0.44	1.83	0.41
LAVA BLUFF	PARKWEST	25 MOUNT	3.00	4.10	0.20	0.24	2.85	1.85	1.44	17.47	0.32	1.75	0.31
SMOKERISE	STONEWOOD	25 MOUNT	1.50	14.41	0.32	0.36	3.26	2.64	4.43	26.18	0.49	1.40	0.50
CREEKWOOD	STONEWOOD	25 MOUNT	1.04	12.05	0.32	0.34	2.71	2.46	4.44	26.19	0.44	1.16	0.46
SADDLEBROOK	STONEWOOD	25 MOUNT	2.95	12.69	0.28	0.35	3.82	2.53	3.32	25.77	0.51	1.88	0.47
WEDGEWOODE AVE	WINDWARD DR	26 STAND	1.80	21.27	0.41	0.48	3.99	2.97	5.33	26.21	0.66	1.56	0.65
MEADOWBROOK	14+00	26 STAND	0.50	22.47	0.52	0.49	2.77	3.05	8.12	26.26	0.64	0.88	
MEADOWBROOK	PARKWEST	26 STAND	0.50	27.31	0.55	0.53	3.01	3.26	9.08	26.28	0.70	0.90	
SUNSTONE	FIELDSTONE	26 STAND	0.60	23.23	0.51	0.50	2.96	3.09	7.84	26.26	0.64	0.95	
CREEKWOOD	PARKWEST	26 STAND	0.50	30.98	0.58	0.56	3.16	3.38	9.81	26.30	0.74	0.91	
WINDWARD	18+00	28 STAND	1.00	54.61	0.63	0.71	4.74	3.97	11.53	28.32	[illegible]	1.31	1.02
WINDWARD	PARKWEST	28 STAND	2.82	64.07	0.55	0.76	6.87	4.21	9.33	28.28	1.28	2.11	1.10
PARKWEST	S. CHANNEL	36 MOUNT	0.50	14.84	[illegible]	0.37	2.06	2.38	7.20	37.25	0.46	0.83	
PARKWEST	CREEKWOOD	36 MOUNT	0.55	8.82	0.34	0.31	1.76	2.14	5.01	32.93	0.38	0.80	
LAVA BLUFF	PHASE LINE U5	36 MOUNT	2.50	9.91	[illegible]	0.32	3.31	2.19	2.99	25.42	0.44	1.70	0.41
LAVA BLUFF	SUMP	36 MOUNT	2.50	12.33	0.29	0.35	3.49	2.29	3.53	27.64	0.48	1.72	0.45
LAVA BLUFF	25+50	36 MOUNT	6.54	9.13	0.22	0.31	4.64	2.16	1.97	20.53	0.56	2.64	0.40
LAVA BLUFF	OURAY	36 MOUNT	1.82	9.13	[illegible]	0.31	2.86	2.16	3.19	26.26	0.40	1.45	0.40
PARKWEST	N. CHANNEL	36 STAND	0.55	55.66	0.69	0.68	3.60	3.69	15.47	36.34	0.89	0.97	

* POOL DEPTH = Dc + (1.25Vc^2)/(2g)

9032221 TEMPORARY EASEMENT 3060 #34

This grant of Temporary Easement, between [state the name of the present real property owner exactly as shown on the real estate document coveying title to the present owner and state the legal status of the owner, for example, "single person," "husband and wife," "corporation of the State of X," "partnership":] LAURELWOOD II JOINT VENTURE, a Joint Venture, ("Grantor"), whose address is 4520 Montgomery Boulevard NE, Suite 4-A, Albuquerque, NM 87109, and the City of Albuquerque, a New Mexico municipal corporation ("City"), whose address is P. O. Box 1293, Albuquerque, New Mexico 87103, is made in Albuquerque, Bernalillo County, New Mexico and is entered into as of the date Grantor signs this Temporary Easement.

RECEIVED
MAY 2 1990
HYDROLOGY DIVISION

File with report

1. Recital. Grantor is the owner of certain real property located at [give general description, for instance, subdivision, lot and block or street address:] El Rancho Atrisco Phase IV
UPC No. 1-009-059-340-400-20150
Replatted as Laurelwood II, Tracts I, II, III & IV
Located at the NW Quadrant of Unser Boulevard & 98th Street NW
in Bernalillo County, New Mexico (the "Property").

2. Grant of Easement. The Grantor grants to the City a temporary easement ("Temporary Easement") in, over, upon and across the Property for [state the kind of easement, for example, "public street and highway purposes (including all utilities)," "water line," "sewer line," etc.:] Drainage.
The Temporary Easement is more particularly described in the attached Exhibit A. [State on the exhibit either the metes and bounds description of the Temporary Easement or state the exact dimensions and location in a manner which would enable a surveyor to locate the Temporary Easement on the ground.]

The grant of the Temporary Easement includes the right of the City to enter upon the Temporary Easement at any time for inspection, installation, maintenance, repair or modification and the right to remove trees, bushes, undergrowth and any other obstacles if the City determines they interfere with the appropriate use of the Temporary Easement. This grant includes the right of access to the easement across the Grantor's adjoining property.

Grantor agrees for itself and its successors in interest that it has been paid in valuable consideration and that the grant of this Temporary Easement is not a gift or donation.

This Temporary Easement is worded pursuant to the provisions of §§47-1-27 to 47-1-44, NMSA 1978 or successor statutes.

3. Ownership Offer. Grantor states that it is the owner in fee simple of the Property and that it has a good lawful right to convey the Property or any part thereof.

(Approved by Legal Dept. as to form only- 5/15/86)

4. Binding on Grantor's Property. The grant and other provisions of this Temporary Easement constitute covenants running with the land for the benefit of the City and its successors and assigns until terminated.

5. Termination of Temporary Easement. This Temporary Eastment shall remain in effect until [state date of termination or event which will cause Temporary Easement to end:] released by the City ("Termination"). Upon Termination and demand by the Grantor the City will execute and deliver to Grantor a release of this Temporary Easement.

6. Indemnification. As a part of the consideration for this grant, subject to the provisions of the New Mexico Tort Claims Act and all other applicable New Mexico laws, the City agrees to save Grantor harmless from any and all liability arising from the City's negligent use of the Temporary Easement for the purposes set forth herein. The City does not agree to save Grantor harmless from any liability which may arise from Grantor's use of the Temporary Easement and the Property.

7. Form Not Changed. Grantor agrees that changes to this form are not binding upon the City unless initialed by the Grantor and approved and signed by the City Legal Deparment in writing on this form.

CITY OF ALBUQUERQUE

Approved:

By: Russell B. Smith
Title: City Engineer
Dated: 4-24-90

GRANTOR:

By: Max Lee Kiehne
Its: Managing Partner
Dated: Feb 23, 1990

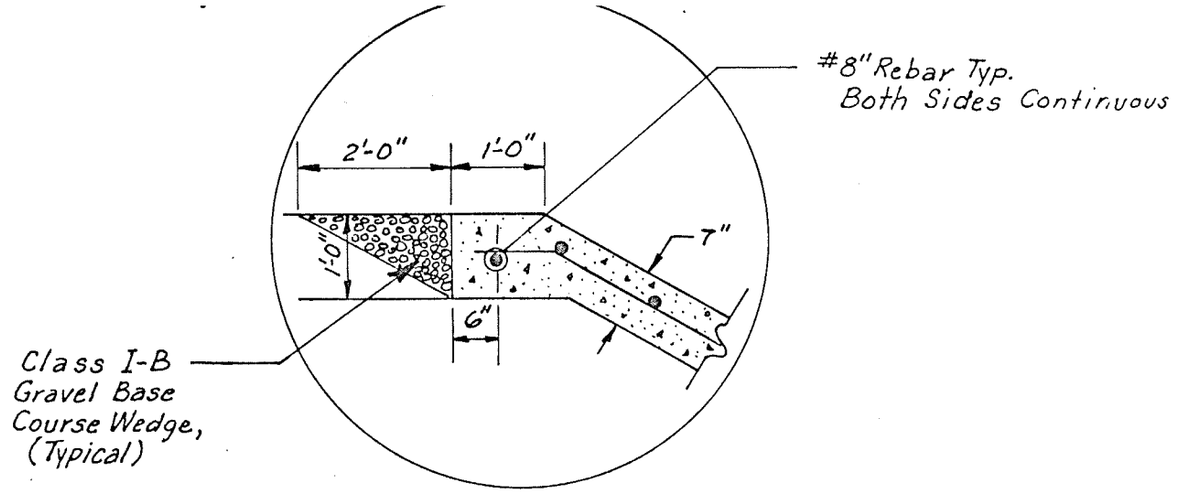
STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

The foregoing instrument was acknowledged before me this 23rd day of February, 19 90, by [name of person signing:] Max Lee Kiehne [title or capacity, for instance, "President" or "Owner":] Managing Partner of [name of the entity which owns the Property if other than the individual signing, for instance, the name of the corporation, partnership, or joint venture:] Laurelwood II Joint Venture.

Jane E. Jensen
Notary Public

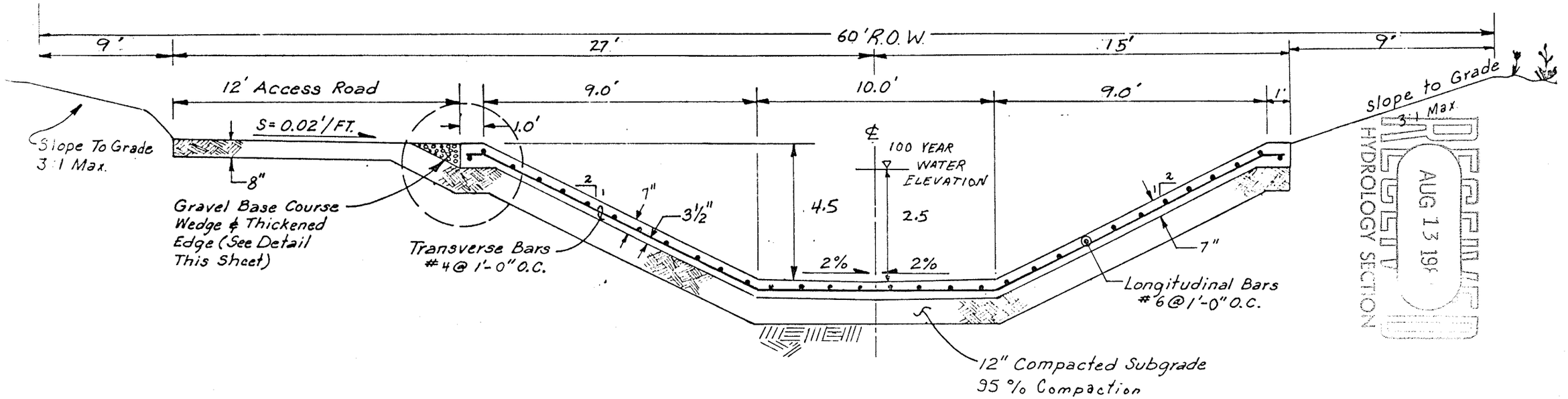
My Commission Expires:
December 6, 1992

(Approved by Legal Dept.
as to form only-6/15/86)

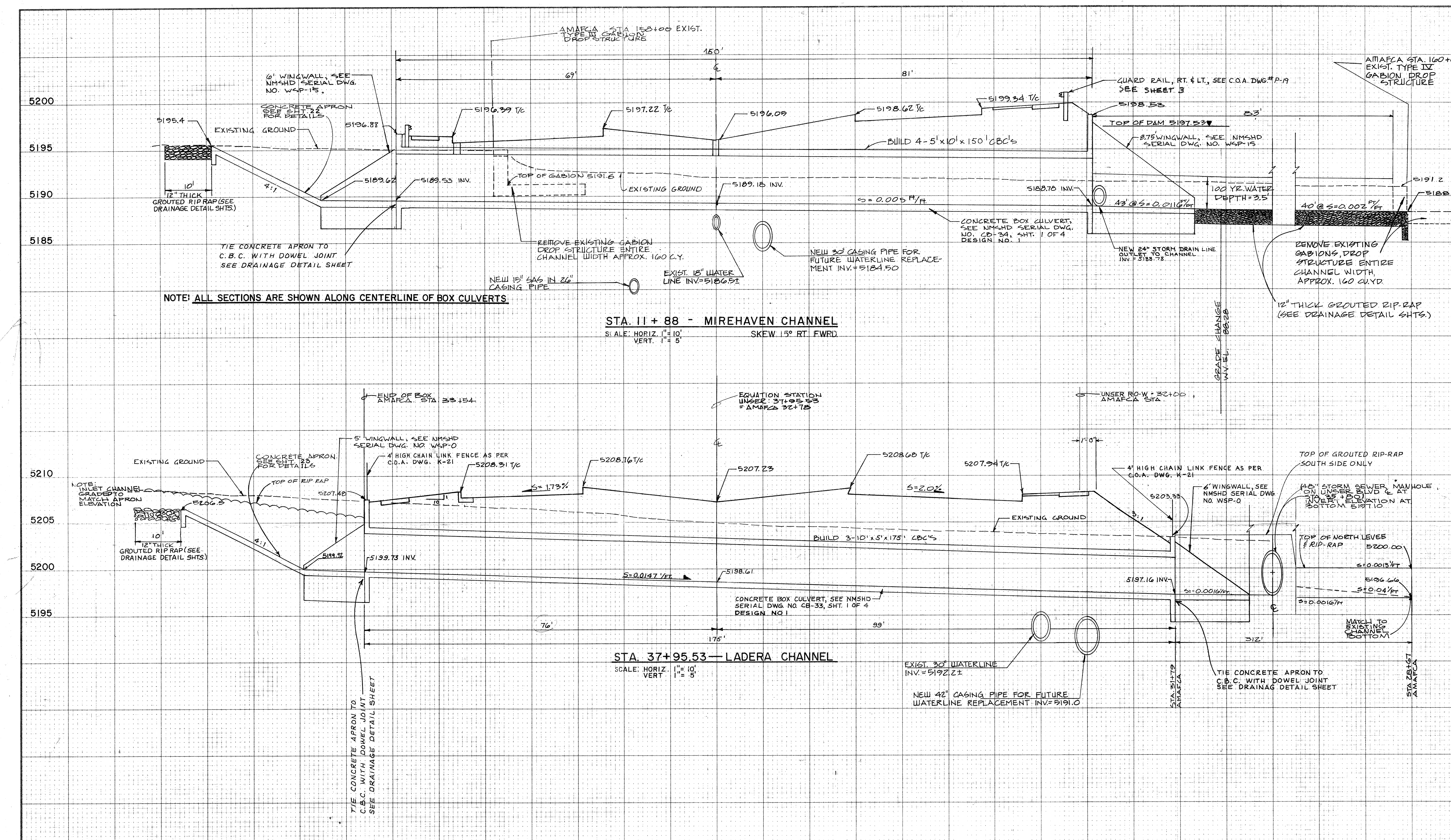


CHANNEL EDGE DETAIL

NTS



TYPICAL CHANNEL SECTION



GREINER ENGINEERING
2601 Wyoming NE
Albuquerque, New Mexico 87112
(505) 292-1936

Greiner J.N. 0690585

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPT.

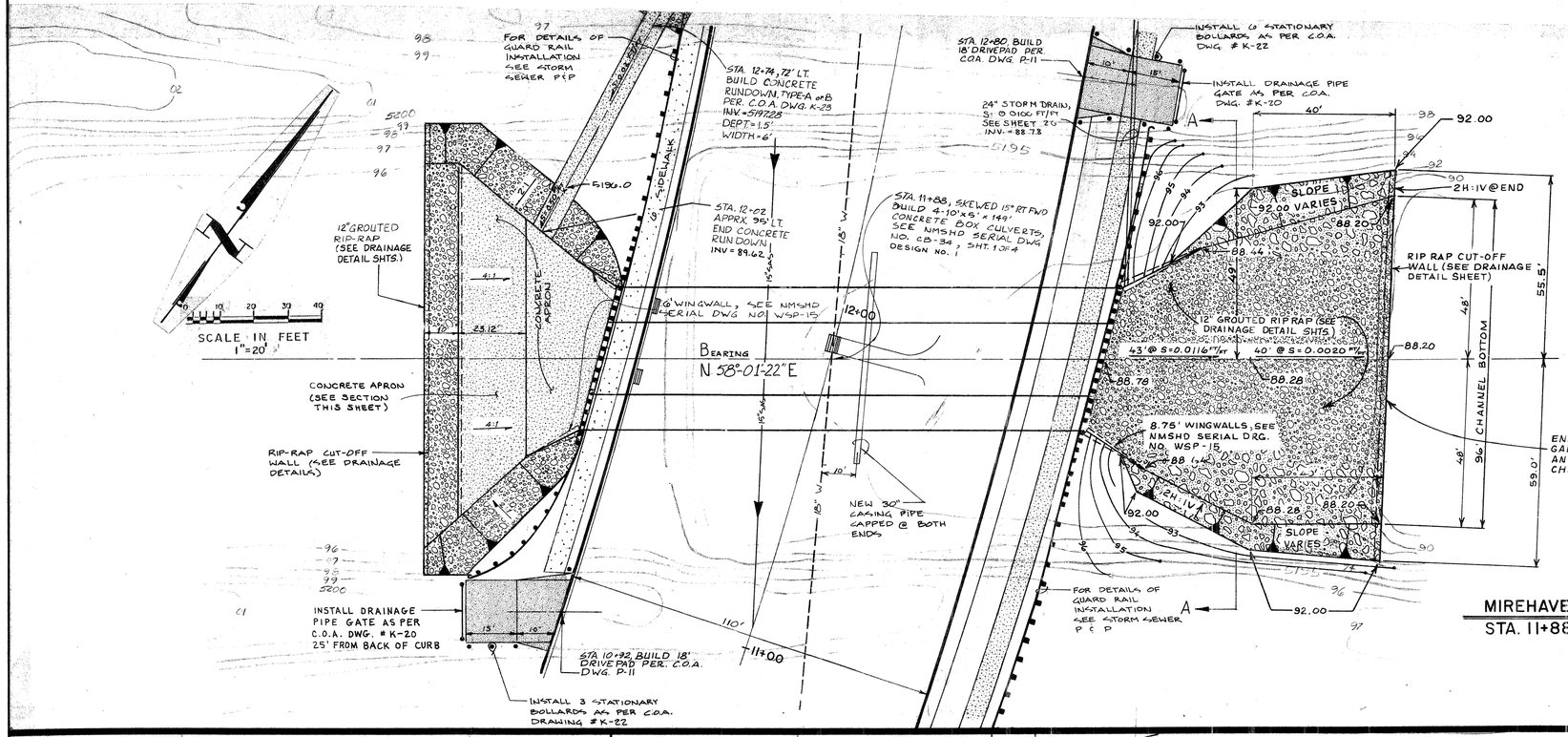
RECEIVED AUG 24 1987 HYDROLOGY SECTION

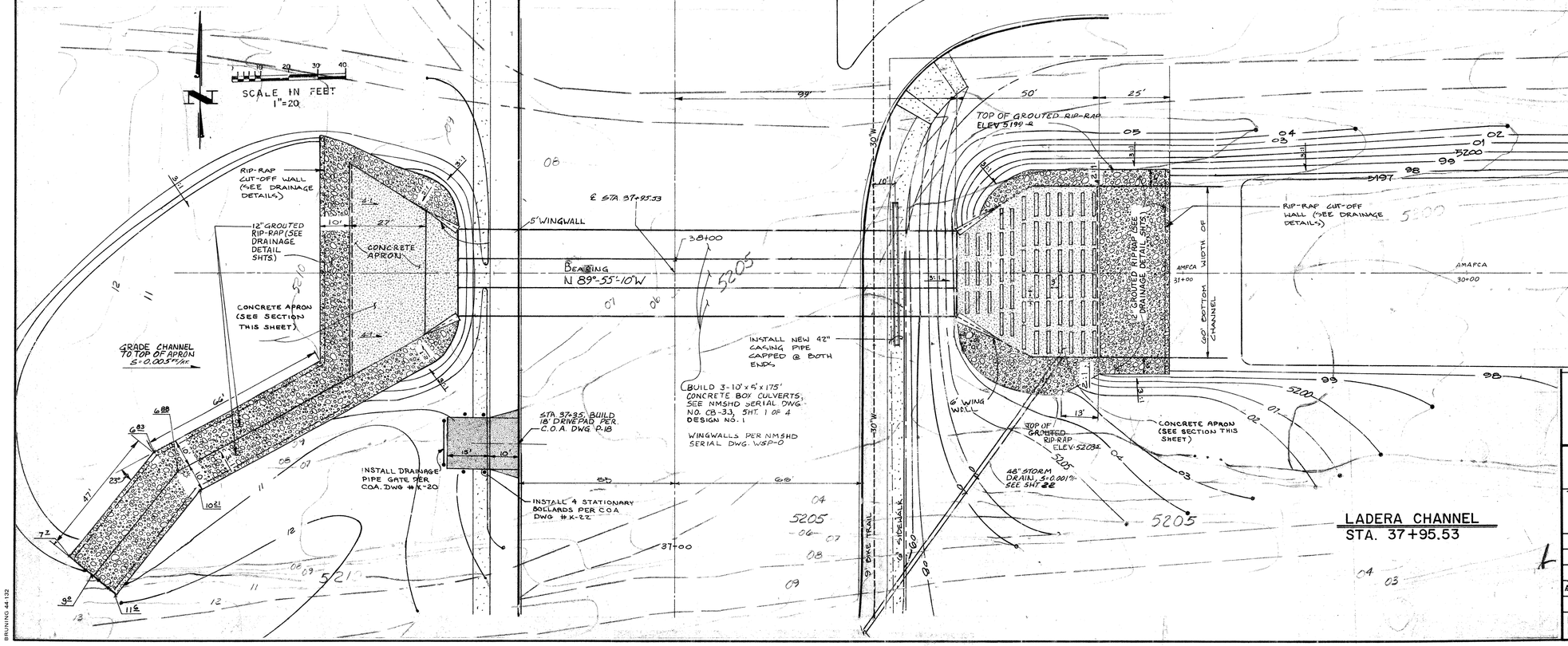
TITLE: **SAD 215**
MAJOR DRAINAGE STRUCTURES

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer	[signature]	1/8/87	Liquid Waste	WW	12/29/86
~~A.C.E.~~ Design	[signature]	1-8-87	Traffic	NA DWH	12/29/86
~~A.C.E.~~ Hydrology	[signature]	1/9/87	Water	WW	12/29/86

SCALE:
HORIZ. 1" = 10'
VERT. 1" = 5'

DRAWING NO. 2803 | MAP NO. G-H9 | SHEET 26 OF 43





SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

BENCH MARKS

"BH-39" B&H BRASS. CAP GO NORTH 0.4 MILES FROM THE INTERSECTION OF I-40 & COORS RD. TO OURAY RD. GO WEST APPROX. 0.7 MILES TO THE END OF PAVEMENT, CONTINUE WEST 0.9 MILES ON THE DIRT ROAD TO THE TOP OF THE DAM, ALONG THE BANK OF THE DAM, PAST THE POWER SUB STATION TO A DIRT ROAD, GO SOUTH 0.4 MILES TO A DIRT ROAD, GO N.E. FOR 0.1 MILES TO THE STATION ON THE RIGHT.

ELEVATION = 5195.46

AS BUILT INFORMATION

CONTRACTOR — DATE
WORK PERFORMED BY — DATE
INSPECTOR'S FIELD CHANGES BY — DATE
VERIFICATION BY FIELD INSPECTOR — DATE
DRAWING CORRECTED BY — DATE

MICRO-FILM INFORMATION

RECORDED BY — DATE
NO.

ENGINEER'S SEAL

PROJECT NO.

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY — DATE 1-87
DRAWN BY — DATE 1-87
CHECKED BY — DATE 1-87

Greiner Engineering
2601 Wyoming NE
Albuquerque, New Mexico 87112
(505) 292-1936

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

RECEIVED AUG 24 1987 HYDROLOGY SECTION

TITLE: SAD 215
MIREHAVEN & LADERA PLANS

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer		1/9/87	Liquid Waste	WW	12/29/86
~~A.C.E.~~ Design		1-8-87	Traffic	NA Dwtt	12/23/86
~~A.C.E.~~ Hydrology		1/9/87	Water	WW	12/29/86

DRAWING NO. 2803 | MAP NO. | SHEET 27 OF 43

BRUNING 44-132