DESIGN REPORT

FOR

EAGLE RANCH STORMDRAIN

JANUARY, 1985

PREPARED FOR

BELLAMAH COMMUNITY DEVELOPMENT
6121 INDIAN SCHOOL ROAD, NE
ALBUQUERQUE, NEW MEXICO 87110

PREPARED BY

EASTERLING AND ASSOCIATES, INC.
5643 PARADISE BOULEVARD, NW
ALBUQUERQUE, NEW MEXICO 87114

I, Charles M. Easterling, do hereby certify that this report was prepared by me or under my direction and that I am a duly registered Professional Engineer under the laws of the State of New Mexico.

CHARLES M. EASTERLING
NEW MEXICO
6411
REGISTERED PROFESSIONAL ENGINEER

Charles M. Easterling, P.E.
N.M.S.P.E. No. 6411

PROJECT SCOPE

The Eagle Ranch stormdrain and its component parts were proposed in the approved "Conceptual Drainage Plan for a Portion of Eagle Ranch," 1984, by Leverton-Easterling, Inc. The hydrologic basis for design was taken directly (with refinements) from that plan. (see Appendix)

The stormdrain system was designed to accommodate the ultimate developed runoff as well as the existing undeveloped runoff. All runoff will be desilted prior to entering the stormdrain, with the exception of that which will enter the few stormdrain inlets which can be built in the undeveloped condition within existing Irving Boulevard or in new Eagle Ranch Road.

Storm runoff from Congress Avenue will be detained and desilted in a permanent basin located approximately 700 feet west of the intersection of Congress Avenue and Irving Boulevard.

There are two outlets provided to the Calabacillas Arroyo from the Eagle Ranch area, the largest being located approximately 700 feet west of Coors Boulevard. A 100-year flow rate of 224 cfs will be discharged to the arroyo through an energy dissipator designed to direct both the flow downstream and to minimize the impact of the outlet on the arroyo. The second outlet is located near the point at which Irving Boulevard turns westward. The outlet directs runoff into the Calabacillas Arroyo through a Soil Conservation Service type cantilevered CMP outlet. The flow will be directed out into the arroyo in a downstream direction.

This type outlet was chosen in order to minimize the construction activity, within the arroyo, in an area which is very sensitive.

Hydrology

The hydrologic analyses performed for this design was based upon City of Albuquerque DPM, Chapter 22, methods as modified by C.M. Easterling, to account for partial on-site ponding within the contributing area.

Hydrographs were developed using a combination of rational formula for peak rate, SCS-CN method for volume, and by letting the time interval vary, the DPM dimensionless unit hydrograph. These basic hydrographs were routed through the stormdrain system, by means of the time transposition method, and added graphically at junctions. The results are shown in the Appendix.

The Congress Avenue Detention Basin was sized based on a modified convex routing of the Congress Avenue inflow hydrograph.

The sediment basins were sized such that the 10-year undeveloped flow rate would be detained for five minutes to allow for the majority of the sediment to settle out. Sediment storage was provided in addition to the detention storage. Sediment volumes were assumed to be 20% of the 10-year undeveloped runoff volume. The outlet pipes were sized to allow the 100-year undeveloped peak discharge to pass through the conduit at a level below the emergency spillway crest elevation. The emergency spillways were sized to pass the 100-year undeveloped discharge with freeboard.

Hydraulics

The Eagle Ranch stormdrain was designed to carry the 100-year developed condition flow in accordance with the "Conceptual Drainage Plan for a Portion of Eagle Ranch." The pipe was sized to flow full whenever possible. There are reaches of pressure flow, but due to low cover, the HGL generally does not get far above top of pipe in these areas. The DPM procedures were followed for calculating losses. A Manning's 'N' for 0.013 was used throughout. A complete set of hydraulic calculations and assumptions is provided in the Appendix.

Alternate Pipe Material

It has been brought to our attention that ARMCO, Inc. is manufacturing a concrete lined CMP that is gaining acceptance in the United States by state highway departments, as well as the U.S. Army Corps of Engineers.

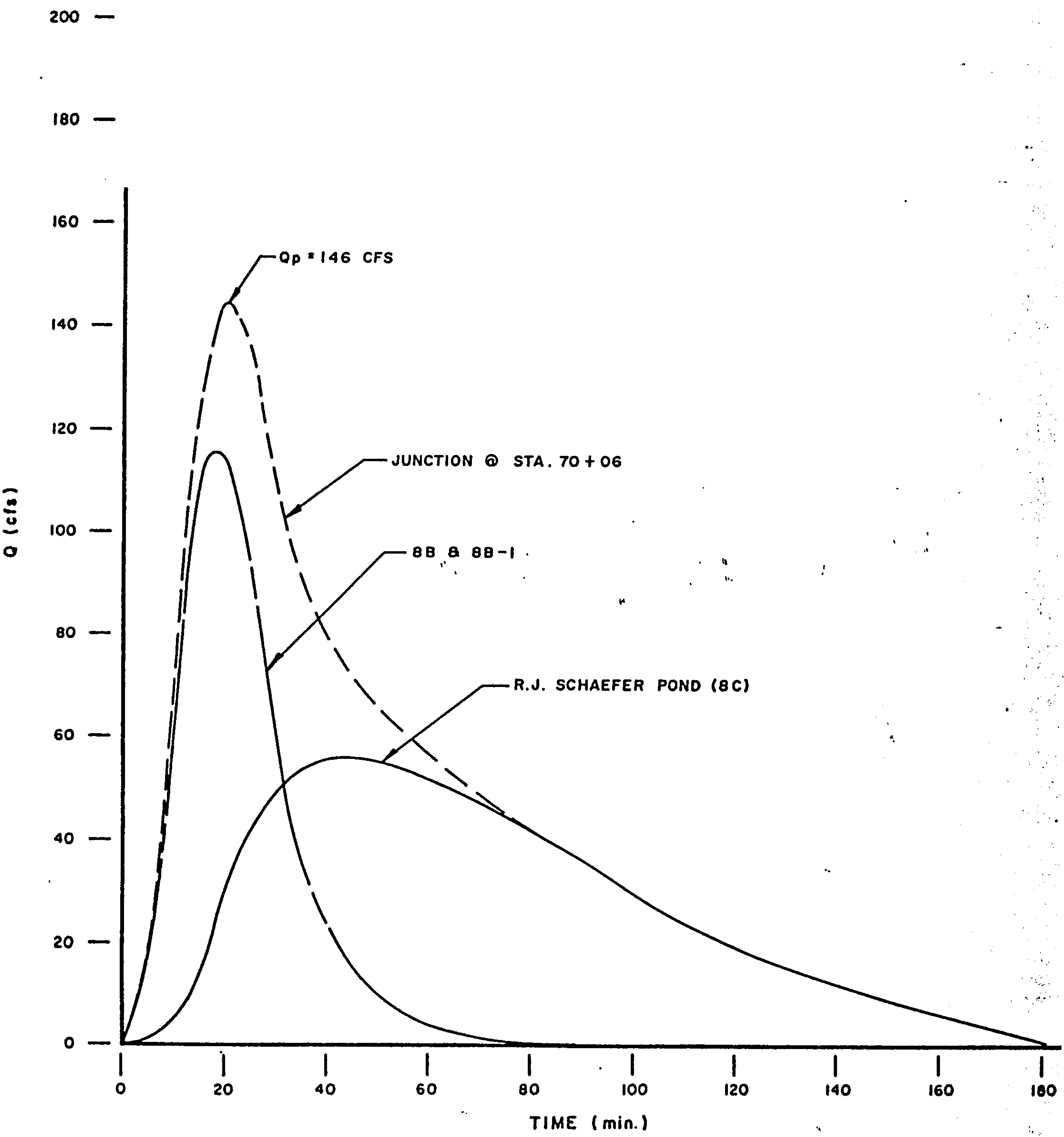
The material appears well suited for the reach of Eagle Ranch stormdrain which lies between Irving Boulevard and the outfall to the Calabacillas Arroyo. This reach follows a "cross-country" route and does not lie within city street rights-of-way. However, based upon the manufacturer's claims and the chemical reactivity of the in-place soils, a galvanized pipe should equal or exceed 100-years.

The lining material is placed in the pipe only to improve hydraulic smoothness and should result in a Manning's 'N' of 0.013 or less.

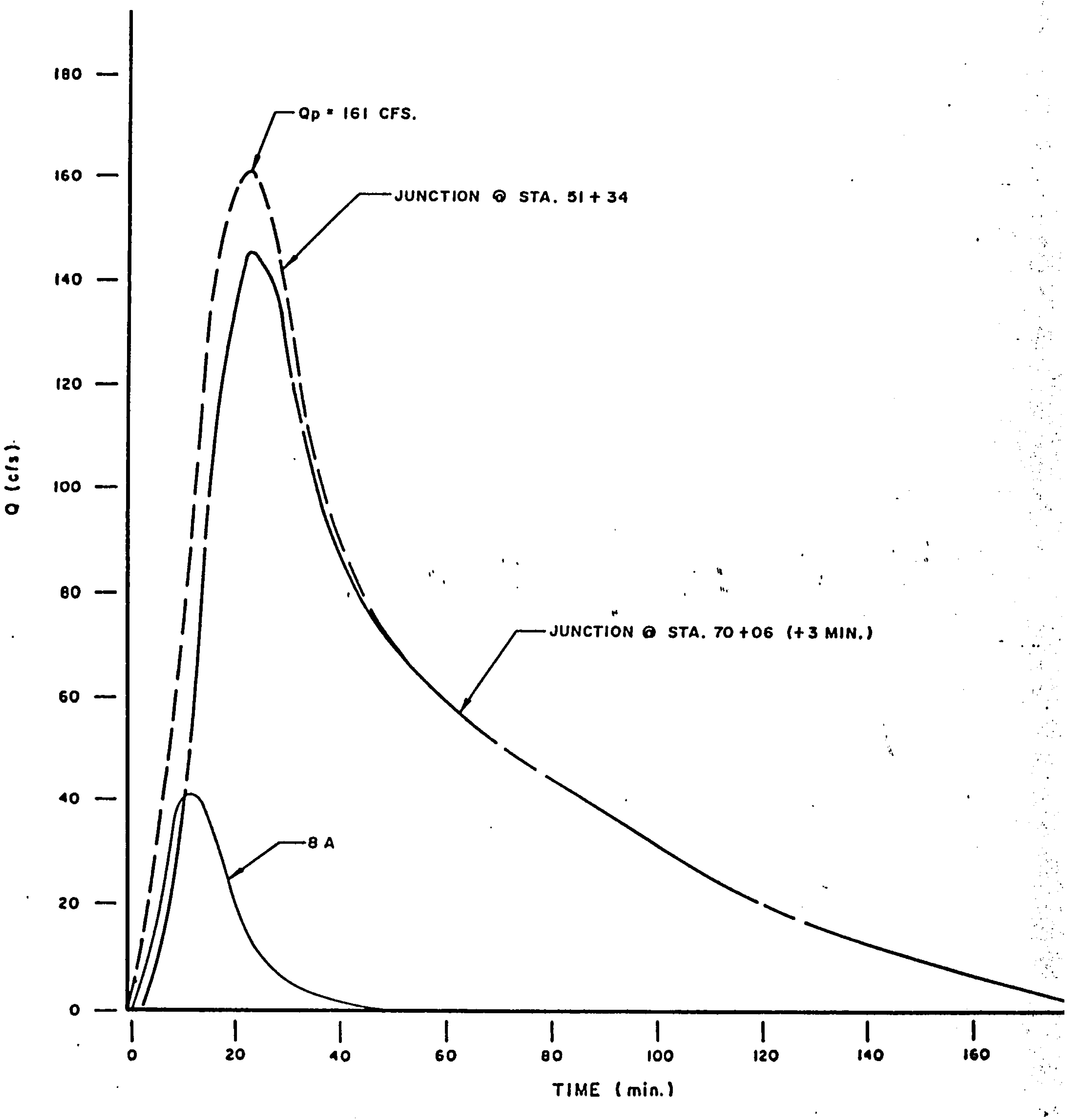
Local contractors familiar with handling and placing large diameter reinforced concete and corregated metal pipes should be able to easily meet the manufacturer's specifications for placement.

As there may be other similar substitutes for RCP available, we recommend that ARMCO's Hel-cor concrete lined CMP or an approved equal be allowed as a bid alternate for the reach of stormdrain between Irving Boulevard and the Calabacillas Arroyo (Sta. 29+50 to Sta. 10+24).

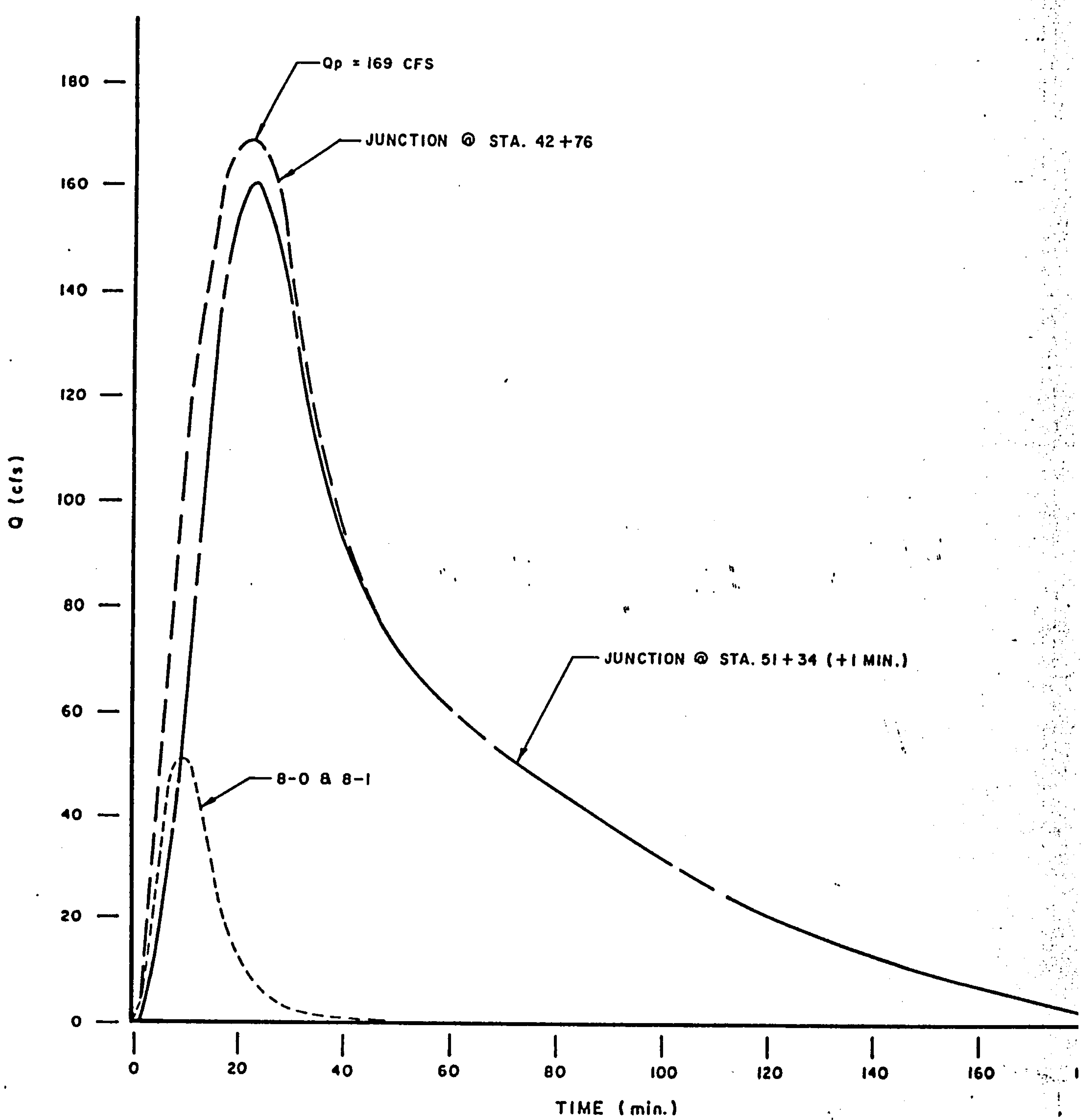
COMPOSITE HYDROGRAPH @ I



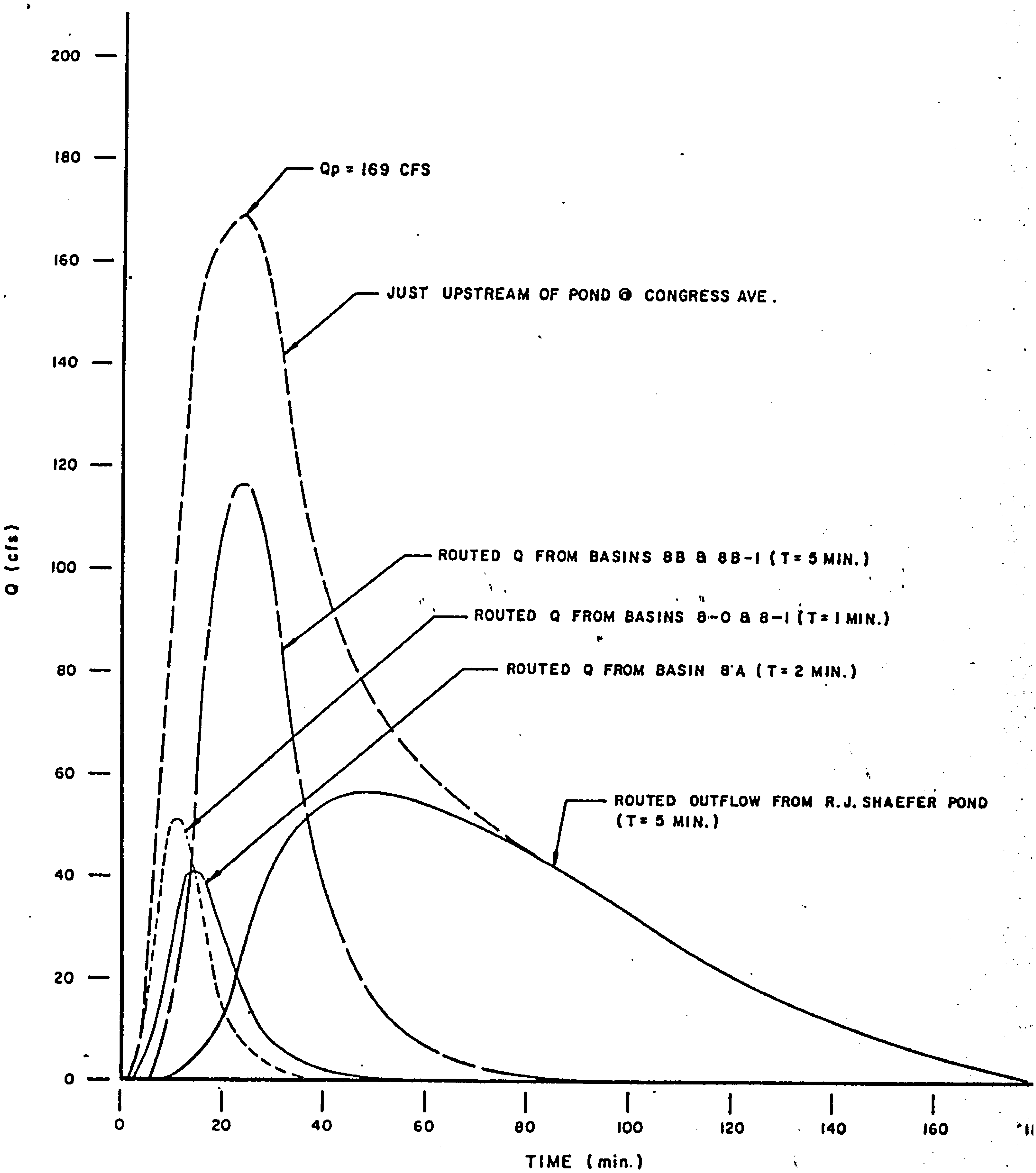
COMPOSITE HYDROGRAPH @ II



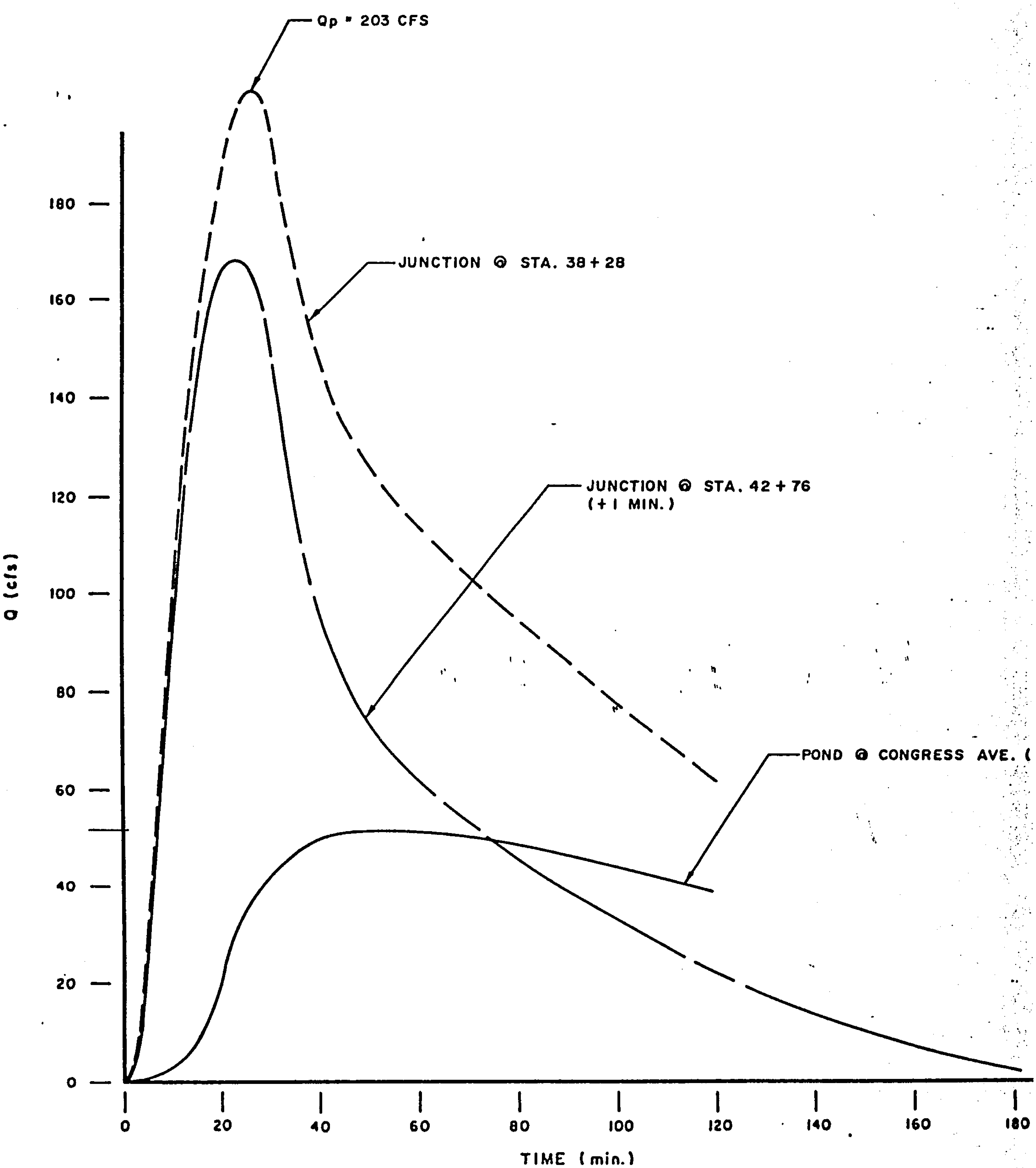
COMPOSITE HYDROGRAPH @ III



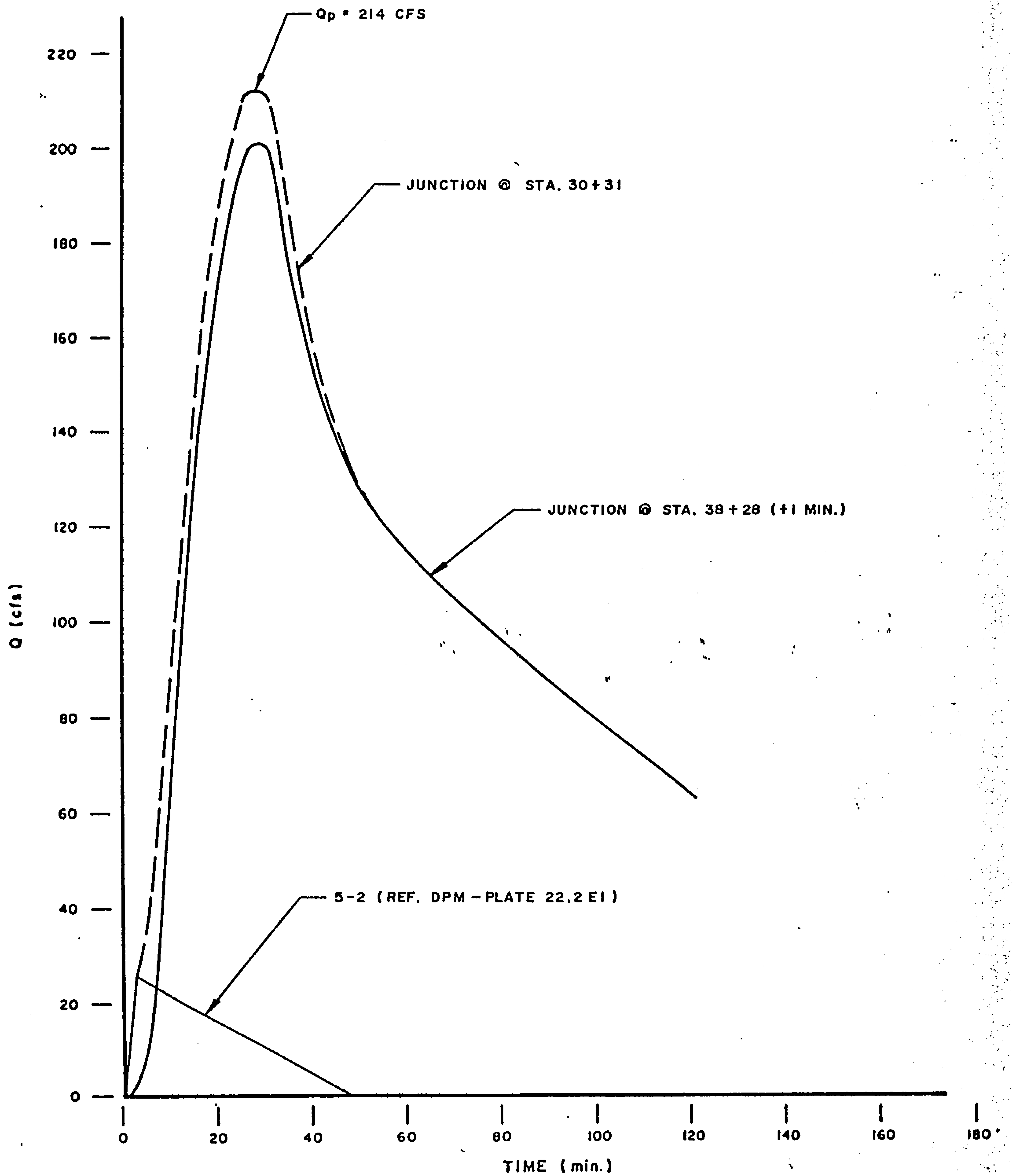
COMPOSITE HYDROGRAPH @ IV



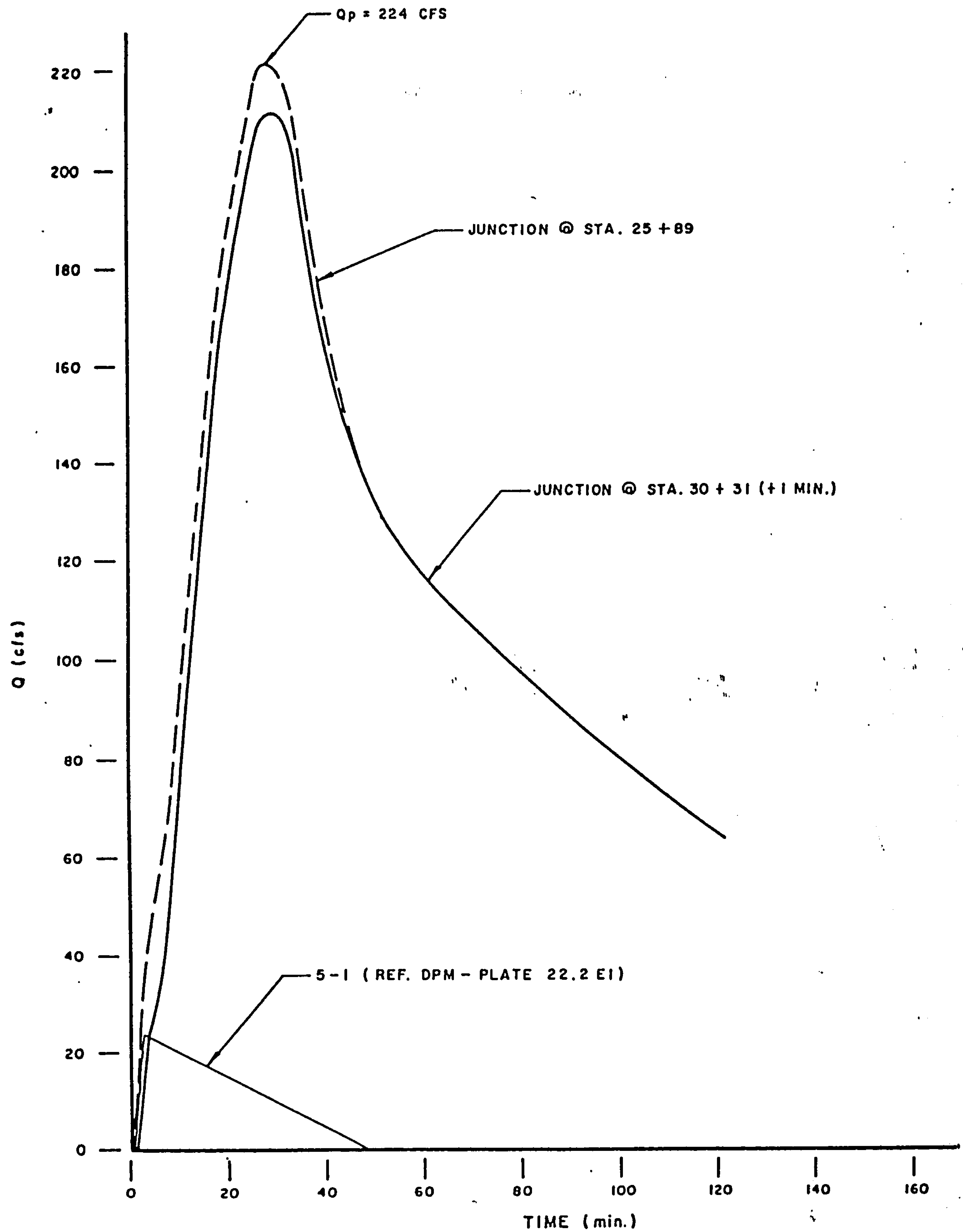
COMPOSITE HYDROGRAPH @ V



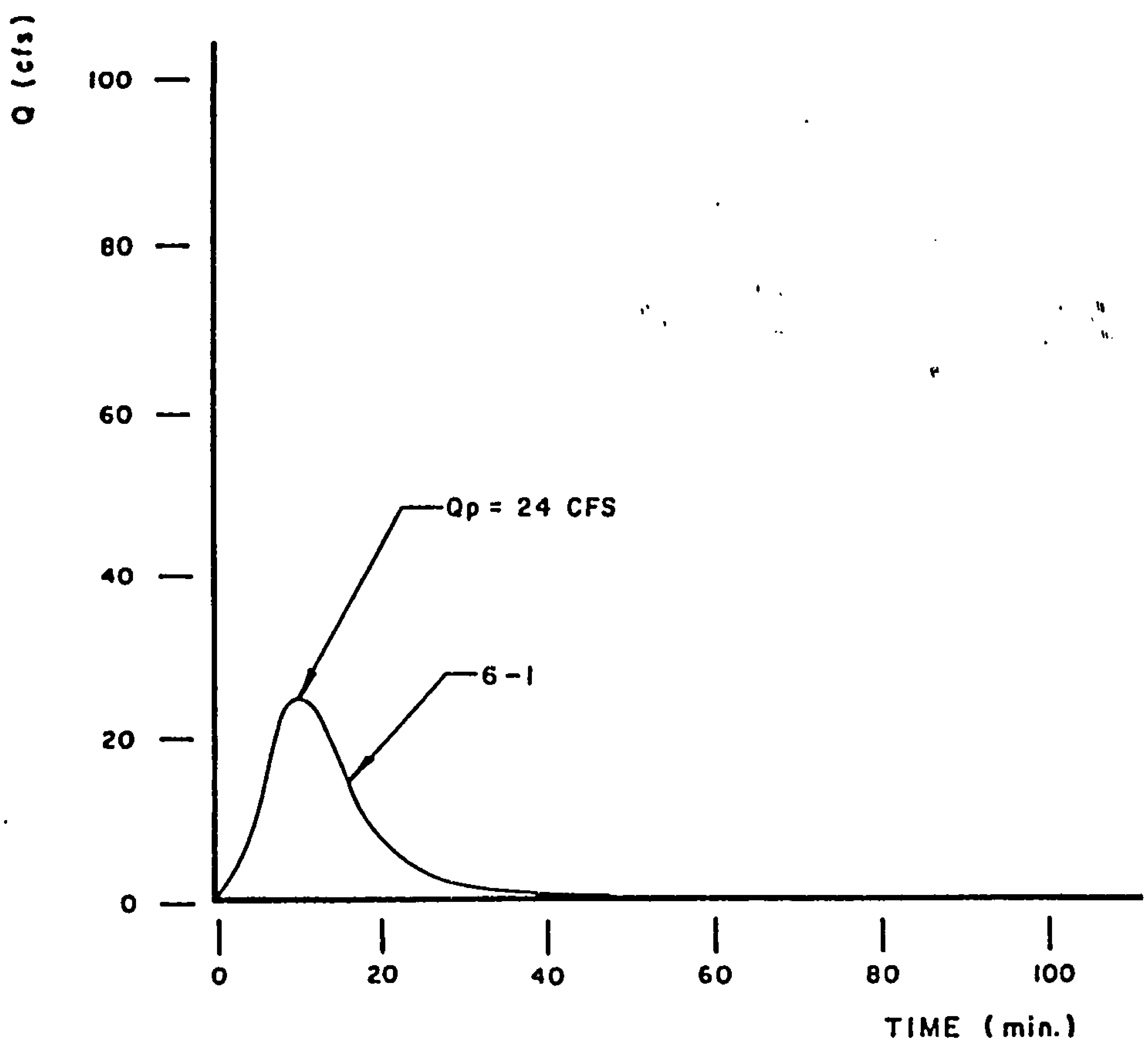
COMPOSITE HYDROGRAPH @ VI



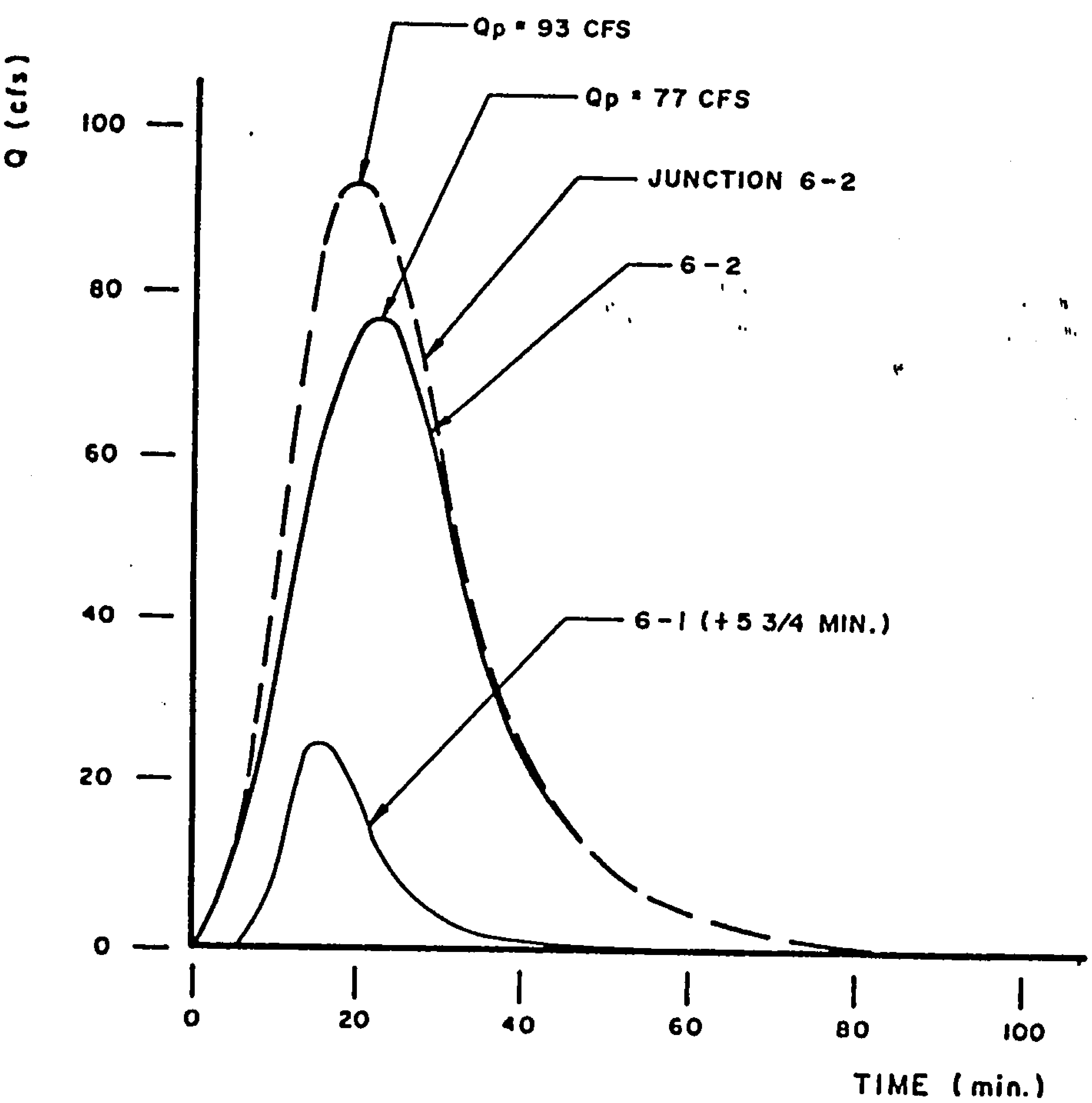
COMPOSITE HYDROGRAPH @ VII
(OUTFALL)



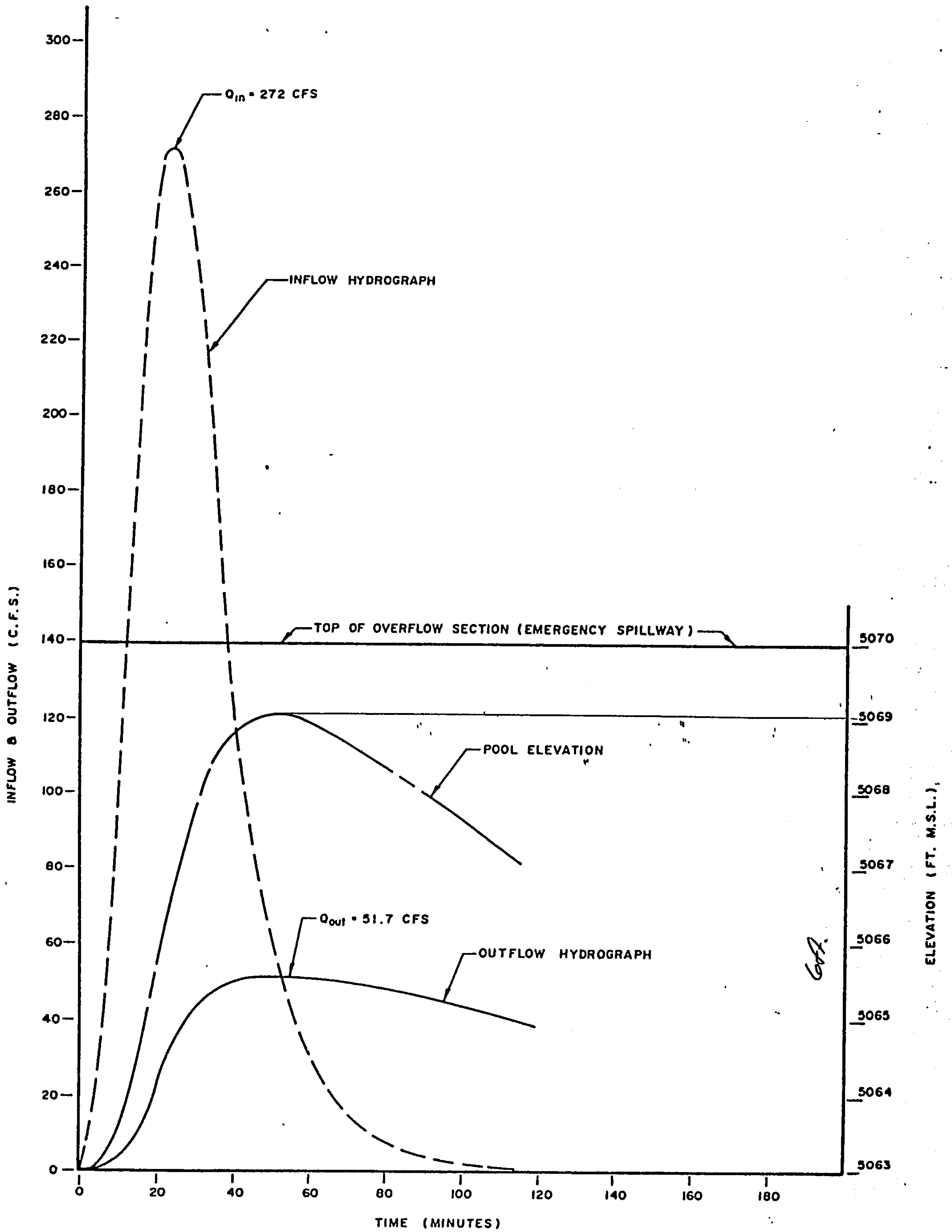
HYDROGRAPH @ A

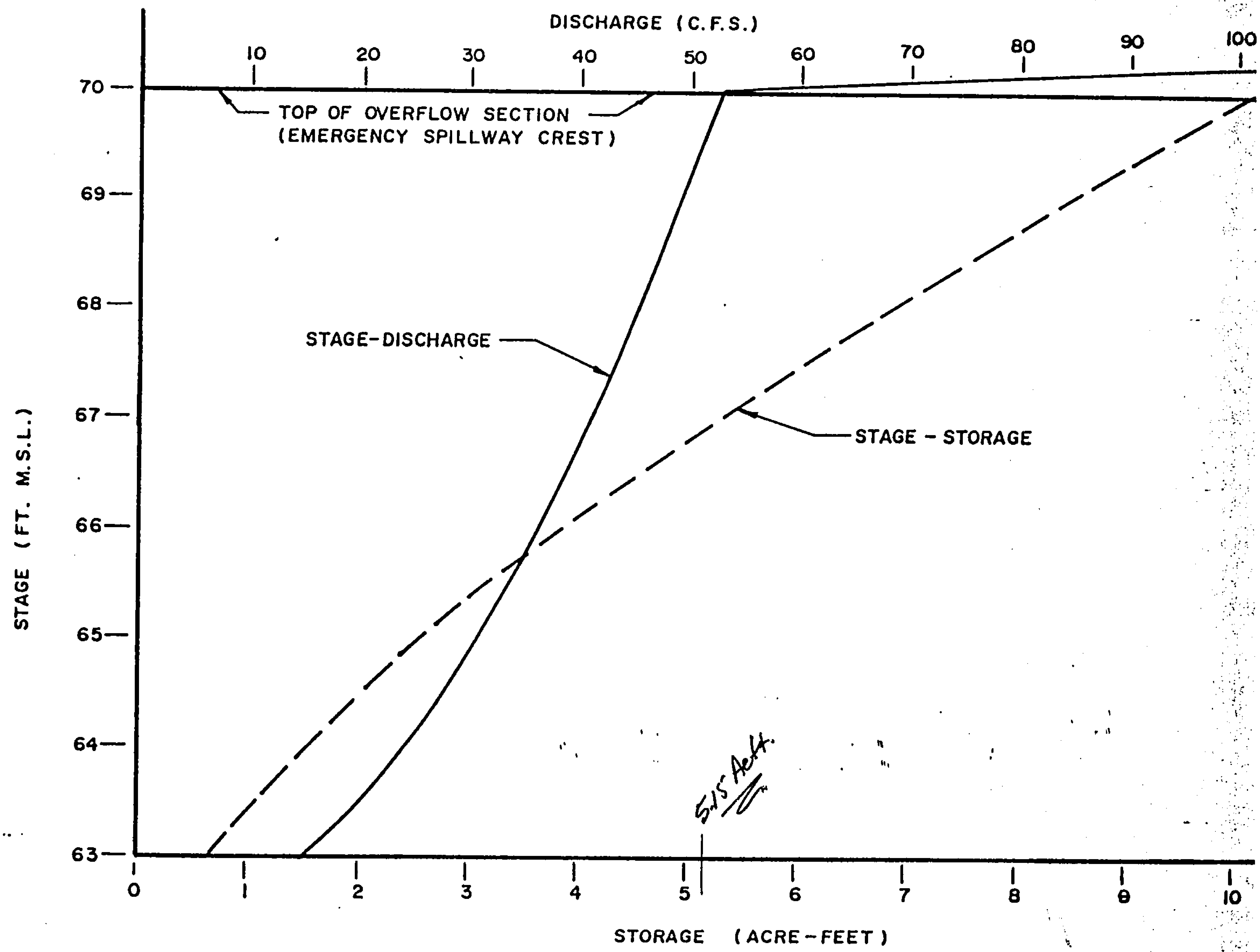


COMPOSITE HYDROGRAPH AT B
(OUTFALL)



HYDROGRAPHS @ CONGRESS AVENUE POND





DETENTION POND @ CONGRESS AVE.

HYDRAULIC CALCULATIONS

EAGLE RANCH STORMDRAIN

HYDRAULIC GRADE LINE COMPUTATIONS

Pipe losses were calculated as follows:

Curves: $h_b = 0.002 \times \Delta \times h_v$

Bends: $h_b = 0.2 \sqrt{\Delta/90} \times h_v$

Manholes: $h_{m.h.} = 0.05 \times h_{v\,outlet}$ (None applicable)

Transitions: $h_t = k_2 \times h_v$ sudden expansion
$h_t = K_3 \times h_v$ sudden contraction } full conduit

(K_2 & K_3 from King & Brater, Tables 6-6 to 6-10)

Junctions: $\Delta y = \dfrac{Q_2 V_2 - Q_1 V_1 - Q_3 V_3 \cos\theta}{\frac{1}{2}(A_1 + A_2) g} + \left(\dfrac{S_{f_1} + S_{f_2}}{2}\right) \times L$

$h_j = \Delta y + h_{v_1} - h_{v_2}$

Pond inlet losses were calculated as follows:

Sharp-edged weir @ top of inlet pipe:

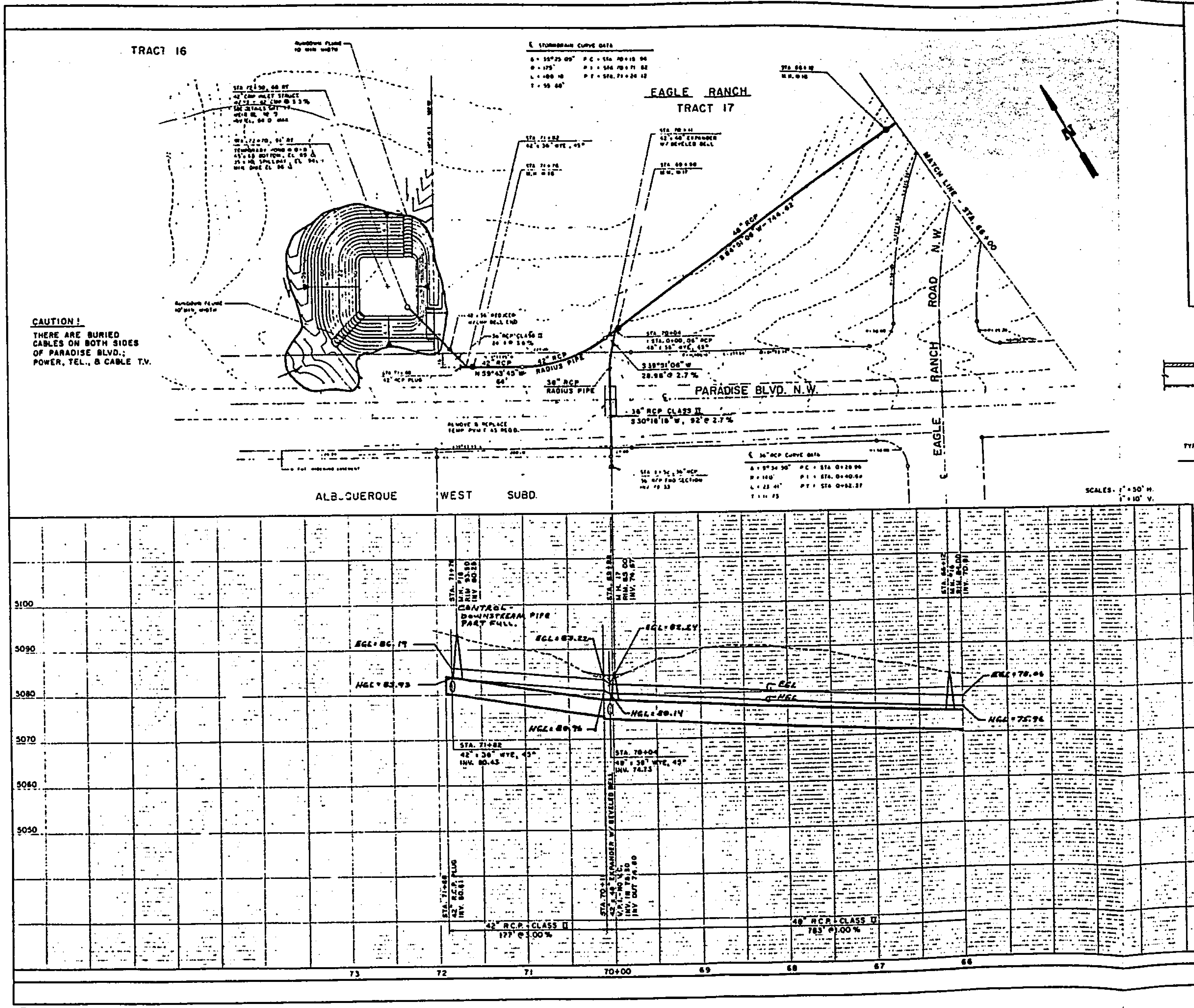
$Q = C \times L \times H^{3/2}$; $C = 2.5$, conservative for clogging

$\therefore H = \left(\dfrac{Q}{2.5 \times L}\right)^{2/3}$

Orifice @ bottom of inlet pipe:

$Q = C \times A \times \sqrt{2gh}$, $C = 0.6$

$\therefore h = \left(\dfrac{Q}{4.81 \times A}\right)^2$



AS BUILT INFORMATION	
CONTRACTOR	
WORK STAKED BY	DATE
INSPECTORS ACCEPTANCE BY	DATE
FIELD VERIFICATION BY	DATE
DRAWINGS CORRECTED BY	DATE

MICRO-FILM INFORMATION	
RECORDED BY	DATE
NO.	

BENCH MARKS
ACS BRASS CAP "NM448-NBA"
ELEV 5004.143, LOCATED AT THE
INTERSECTION OF COORS RD. AND
PARADISE BLVD N.W.

SURVEY INFORMATION

FIELD NOTES		
NO.	BY	DATE
	LEVERTON-EASTERLING INC.	9-10-84

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

REVISIONS

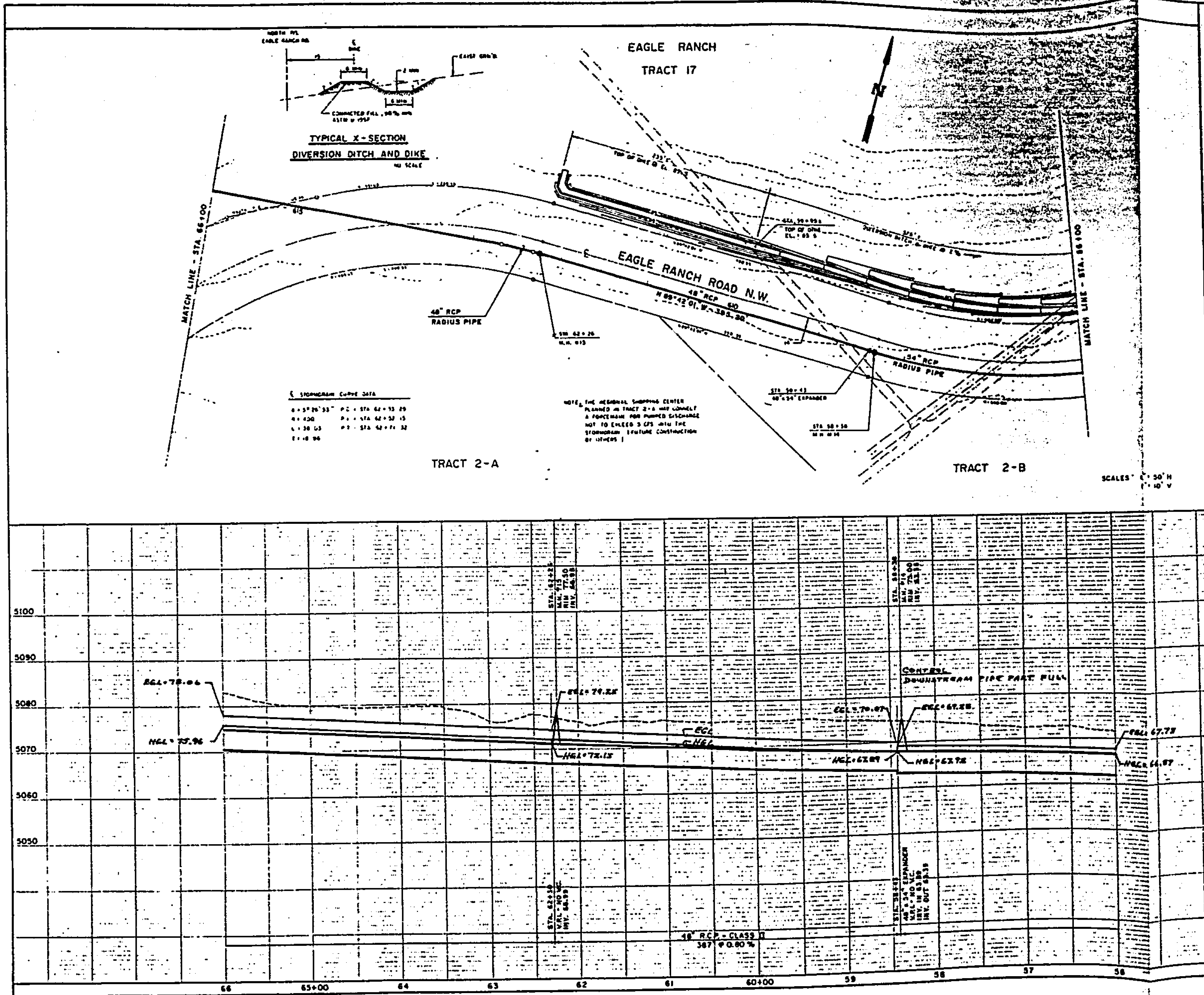
DESIGN	
DESIGNED BY	DATE
DRAWN BY M.A. ...	DATE 1-85
CHECKED BY	DATE

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

TITLE: EAGLE RANCH ROAD STORMDRAIN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO.	MAP NO. C-12	SHEET 4 OF 19



CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

TITLE: EAGLE RANCH ROAD STORMDRAIN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO. | MAP NO. C-13 | SHEET 5 OF 19

NO.	DATE	REMARKS	BY

REVISIONS

DESIGN

DESIGNED BY | DATE
DRAWN BY | DATE 1-85
CHECKED BY | DATE

ENGINEER'S SEAL

SURVEY INFORMATION

FIELD NOTES

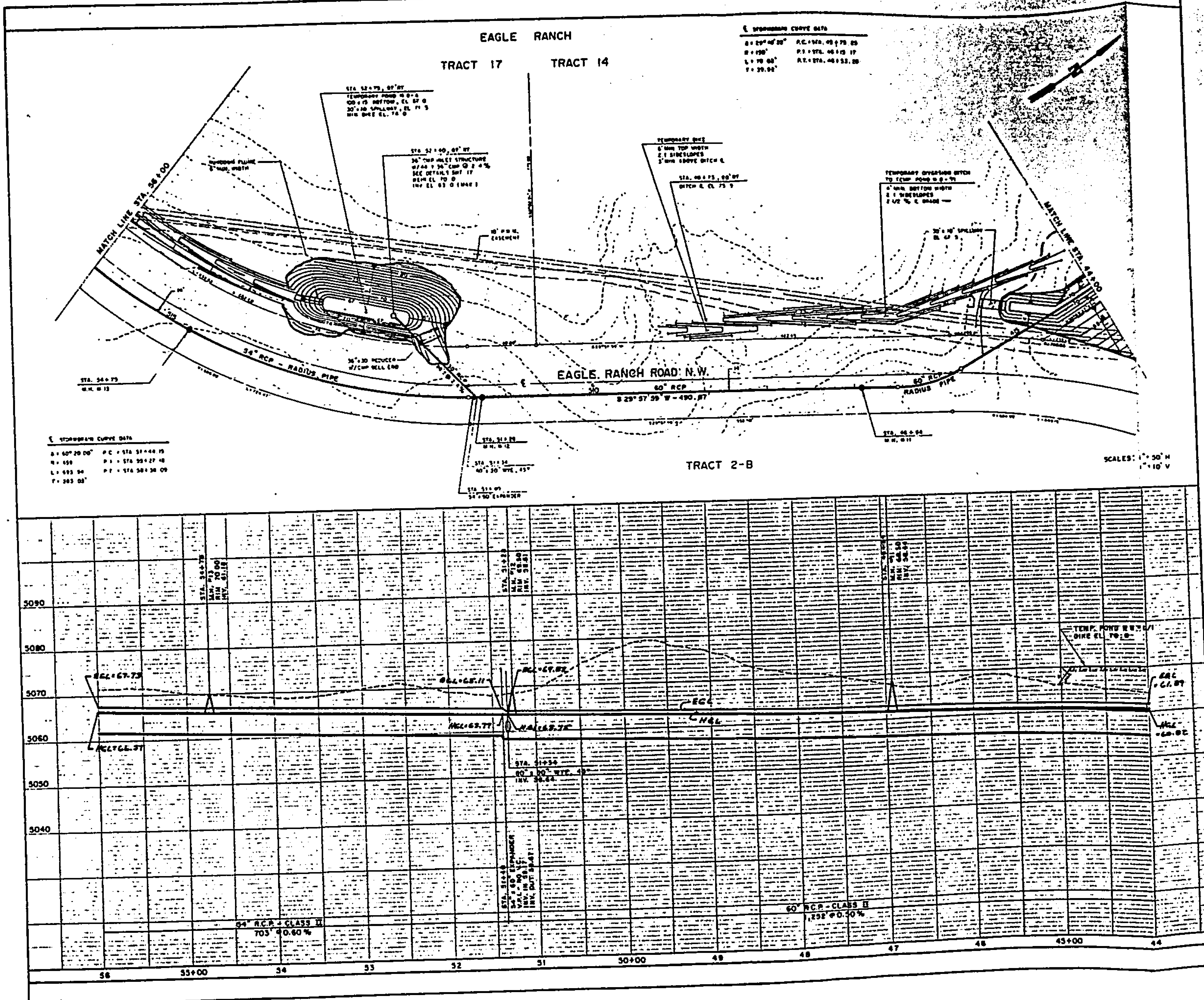
NO.	BY	DATE
	LEVERTON-EASTERLING INC	

BENCH MARKS

ACS BRASS CAP "NM448-N9A"
ELEV 5004.145, LOCATED AT THE
INTERSECTION OF COORS RD AND
PARADISE BLVD. N.W.

AS BUILT INFORMATION

MICRO-FILM INFORMATION



AS BUILT INFORMATION

BENCH MARKS

ACS BRASS CAP "NM 448 - N9A" LOCATED AT THE INTERSECTION OF COORS RD. AND PARADISE BLVD. N.W.

ELEV 5004.145

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

REVISIONS

DESIGN

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

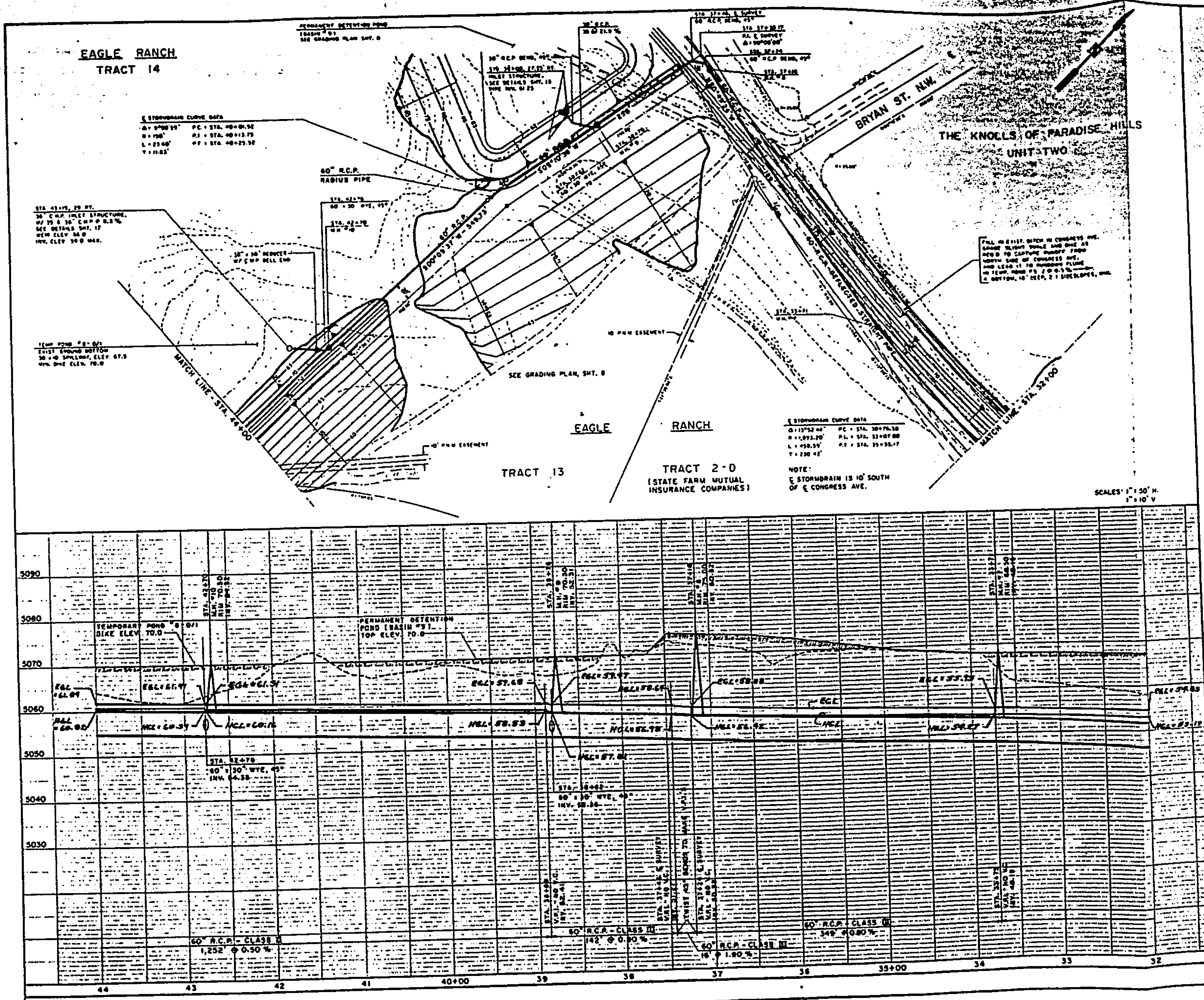
TITLE: EAGLE RANCH ROAD STORMDRAIN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO.

MAP NO. C-13

SHEET 6 OF 19



AS BUILT INFORMATION	
CONTRACTOR	
WORK STARTED BY	DATE
ACCEPTANCE BY	DATE
FIELD VERIFICATION BY	DATE
CORRECTED BY	DATE

BENCH MARKS
ACS BRASS CAP "NM 448-N9A" ELEV. 5004.145, LOCATED AT THE INTERSECTION OF COORS RD. AND PARADISE BLVD. N.W.

SURVEY INFORMATION		
FIELD NOTES		
NO.	BY	DATE
	LEVERTON - EASTERLING INC.	

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

REVISIONS

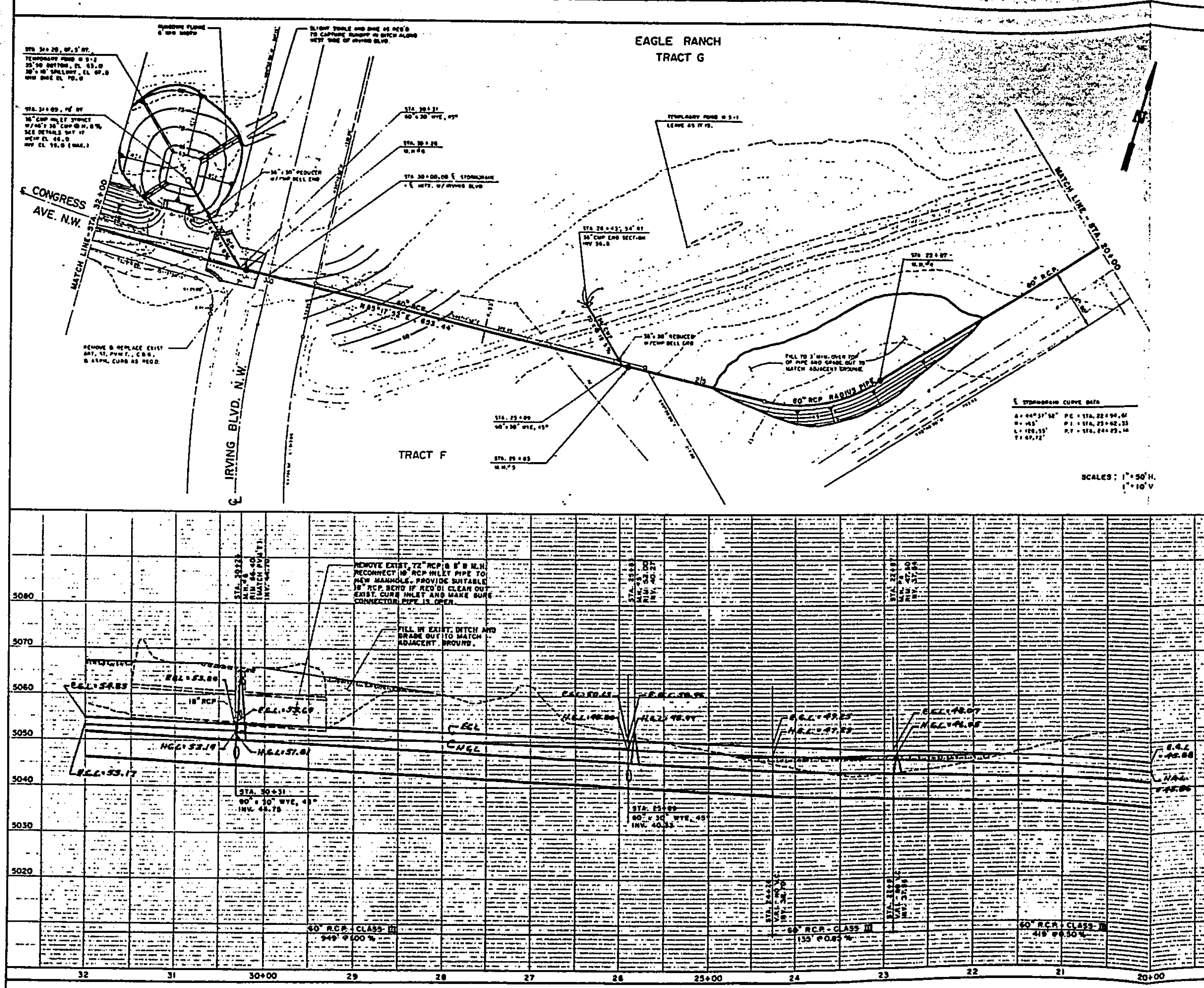
DESIGN	
DESIGNED BY	DATE
DRAWN BY m.A.	DATE 1-83
CHECKED BY	DATE

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

TITLE: EAGLE RANCH ROAD STORMDRAIN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO. | MAP NO. B & C-13 | SHEET 7 OF 19



AS BUILT INFORMATION	
CONTRACTOR	
MICRO-FILM INFORMATION	

BENCH MARKS

ACS BRASS CAP "NM448-N9A"
ELEV. 5004.145, LOCATED AT THE INTERSECTION OF COORS RD. AND PARADISE BLVD. N.W.

SURVEY INFORMATION

FIELD NOTES		
NO.	BY	DATE
	LEVERTON - EASTERLING INC	

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

REVISIONS

DESIGN

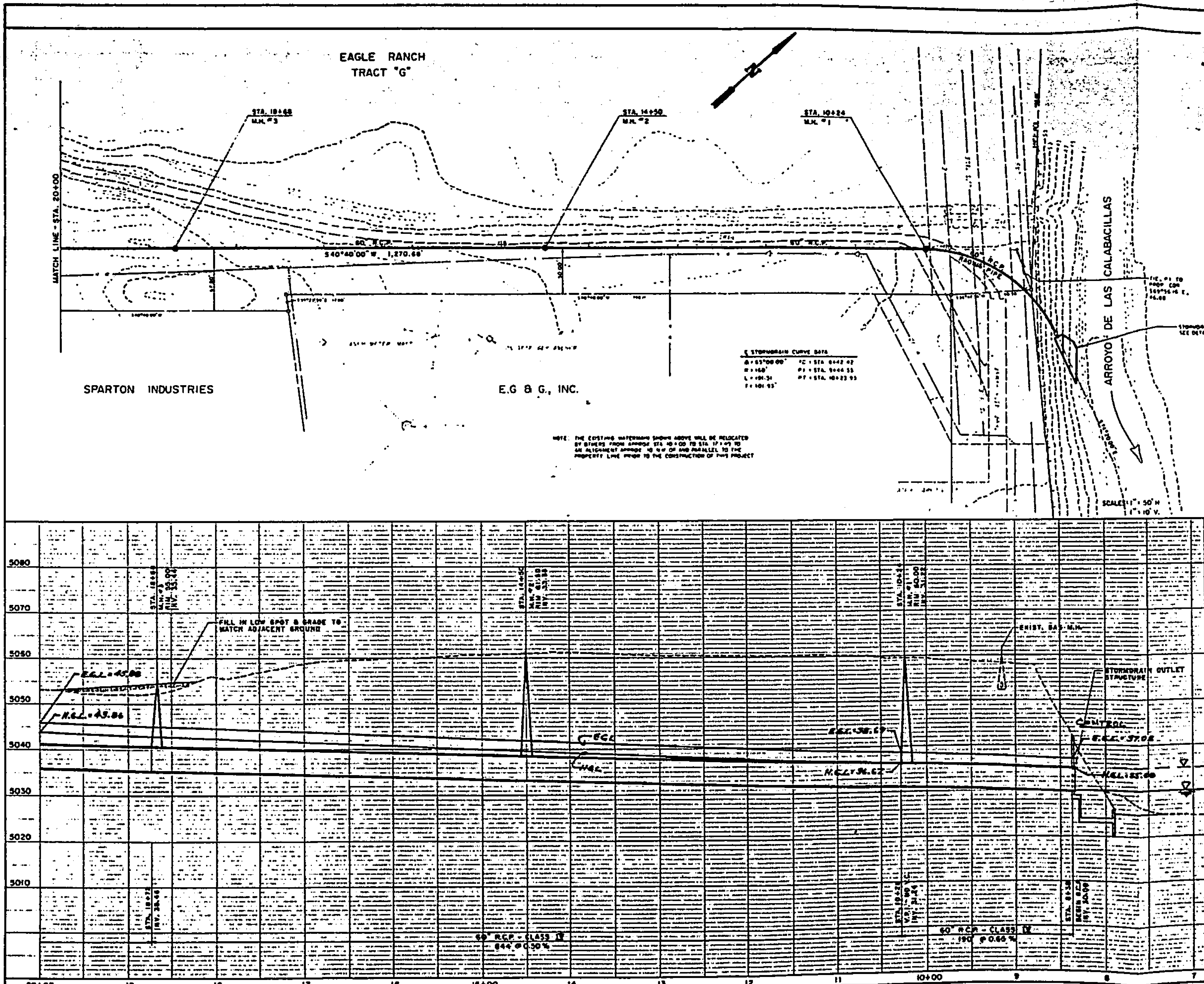
DESIGNED BY		DATE
DRAWN BY	M.A., O.J.N	DATE 1-85
CHECKED BY		DATE

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

TITLE: EAGLE RANCH ROAD STORMDRAIN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO.	MAP NO. B-13	SHEET 9 OF 19



NOTE: THE NEW REMOD UTILITIES CORP. SHALL RE-ALIGN THE EXISTING SAS WHERE IT CROSSES THE STORMDRAIN AND RELOCATE THE ADJACENT MANHOLE, PRIOR TO THE CONSTRUCTION OF THIS PROJECT. THIS CONTRACTOR SHALL MAINTAIN THE SANITARY SEWER IN OPERATION DURING THE CONSTRUCTION AND SHALL RESTORE ANY PORTION OF IT THAT HE DISTURBS WITH NO OPERATIONS, IN A MANNER SATISFACTORY TO THE ENGINEER.

AS BUILT INFORMATION	
CONTRACTOR	
STAKED BY	DATE
ACCEPTANCE BY	DATE
FIELD VERIFICATION BY	DATE
CORRECTED BY	DATE

MICRO-FILM INFORMATION	
RECORDED BY	DATE
NO.	

BENCH MARKS
ACS BRASS CAP "NM 448 - N9A"
ELEV. 5004.145, LOCATED AT THE
INTERSECTION OF COORS RD. AND
PARADISE BLVD. N.W.

SURVEY INFORMATION		
FIELD NOTES		
NO.	BY	DATE
	LEVERTON-EASTERLING INC.	8-10-84

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

REVISIONS

DESIGN

DESIGNED BY	DATE
DRAWN BY M.L., C.J.N.	DATE 1-85
CHECKED BY	DATE

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

TITLE: EAGLE RANCH ROAD STORMDRAIN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO.	MAP NO. B-13	SHEET 10 OF 19

C. M. EASTERLING
& ASSOCIATES
ALBUQUERQUE, N.M.

SUMMARY OF HYDRAULIC CALCULATIONS

CLOSED CONDUIT

BY: fle-a
DATE: 1-3-85
SHEET: 1 OF 2

PROJECT: EAGLE RANCH STORMDRAIN
LINE: EAGLE RANCH ROAD

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
											LOSSES									
STATION	STRUCT.	INV.	D	Q	A	V	K	S_F	L	Δ	H_F	H_B	H_J	H_{MH}	H_T	$H_{MISC.}$	ΣH_L	E.G.	h_v	H.G.
8+38	OUT-FALL	30.00	-CONTROL-															37.02	2.02	35.00
			60"	224	19.64	11.41	2604	0.0074	190'	65°00'	1.41	0.26					1.67			
10+28	VPI	31.24																38.69	2.02	36.67
			60"	224	19.64	11.41	2604	0.0074	1,263'	—	9.38						9.38			
22+91	VPI	37.56																48.07	2.02	46.05
			60"	224	19.64	11.41	2604	0.0074	135'	44°38'	1.00	0.18					1.18			
24+26	VPI	38.70																49.25	2.02	47.23
			60"	224	19.64	11.41	2604	0.0074	163'	—	1.21						1.21			
25+89	60"x30" WYE	40.33																50.46	2.02	48.44
													0.17				0.17	50.63	1.83	48.80
			60"	214	19.64	10.90	2604	0.0068	442		3.01						3.01			
30+31	60"x30" WYE	44.75																53.64	1.83	51.81
													0.16				0.16	53.80	1.66	52.14
			60"	203	19.64	10.34	2604	0.0061	344'	9°02'	2.10	0.03					2.13			
33+75	VPI	48.19															—	55.93	1.66	54.27
			60"	203	19.64	10.34	2604	0.0061	349'	4°51'	2.13	0.02					2.15			
37+24	VPI / 45°	50.98																58.08	1.66	56.42
										45°		0.23					0.23	58.31	1.66	56.65
			60"	203	19.64	10.34	2604	0.0061	16'		0.10						0.10			
37+46	VPI / 45°	51.27																58.41	1.66	56.75
										45°		0.23					0.23	58.64	1.66	56.98
			60"	203	19.64	10.34	2604	0.0061	136'	—	0.83						0.83			
38+82	60"x30" WYE	52.36																59.47	1.66	57.81
													0.19				0.19	59.66	1.15	58.51
			60"	169	19.64	8.61	2604	0.0042	6'		0.02						0.02			
38+88	VPI	52.41																59.68	1.15	58.53
			60"	169	19.64	8.61	2604	0.0042	388'	9°61'	1.63	0.02					1.65			
42+76	60"x30" WYE	54.35																61.31	1.15	60.16
													0.10				0.10	61.41	1.07	60.34

REMARKS:

C. M. EASTERLING
& ASSOCIATES
ALBUQUERQUE, N.M.

SUMMARY OF HYDRAULIC CALCULATIONS

CLOSED CONDUIT

BY: ℓC-a
DATE: 1-3-85

PROJECT: EAGLE RANCH STORMDRAIN LINE: EAGLE RANCH ROAD SHEET: 2 OF 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
STATION	STRUCT.	INV.	D	Q	A	V	K	S_F	L	Δ	LOSSES H_F	H_B	H_J	H_{MH}	H_T	$H_{MISC.}$	ΣH_L	E.G.	h_v	H.G.
42+76	60"X30" WYE	54.35																61.41	1.07	60.34
			60"	163	19.64	8.30	2604	0.0039	858'	29°48'	3.35	0.06					3.41			
51+34	60"X30" WYE	58.64																64.82	1.07	63.75
									6'				0.21				0.21			
51+40	VPI / EXP.	58.67 / 59.17																65.03	1.08	63.95
															0.08		0.08	65.11	1.34	63.77
			54"	149	15.90	9.37	1967	0.0057	703'	60°20'	4.01	0.16					4.17			
58+43	VPI / EXP.	63.39 / 63.89	— CONTROL —															69.28	1.36	67.92
											PART FULL PIPE				0.11	0.68	0.79	70.07	2.18	67.89
			48"	149	12.57	11.86	1436	0.0108	387'		4.18						4.18			
62+30	VPI	66.99																74.25	2.10	72.15
			48"	146	12.57	11.62	1436	0.0103	774'	5°27'	7.97	0.02					7.99			
70+04	48"X36" WYE	74.73																82.24	2.10	80.14
									7				0.82				0.82			
70+11	VPI / EXP.	74.80 / 75.30																83.06	2.26	80.80
															0.16		0.16	83.22	2.26	80.96
			42"	116	9.62	12.06	1006	0.0133	171	35°25	2.27	0.16	PIPE PART FULL			0.54	2.97			
71+82	42"X36" WYE	80.43	— CONTROL —															86.19	2.26	83.93
												0.30			0.17		0.47	86.66	2.10	84.56*

REMARKS: * IN 36"Ø PIPE TO DETENTION POND #B-B

YB-9
11-3-85

EAGLE RANCH STORMDRAIN

HYDRAULIC CALCULATIONS – EAGLE RANCH ROAD

BEGIN @ OUTFALL STA. 8+38

Inv. = 30.00 , D = 5.0' , S_o = 0.0065 , L = 190'
Q_p = 224 cfs , K = 2604 , n = 0.013 , V = 11.41 fps

$h_b = 0.002 \times 65°00' \times 2.02 = \underline{\underline{0.26'}}$

STA. 10+24 , VPI

Inv. = 31.24 , D = 5.0' , S_o = 0.0050 , L = 1,267'
Q_p = 224 cfs , K = 2604 , n = 0.013 , V = 11.41 fps

STA. 22+91 , VPI

Inv. = 37.56 , D = 5.0' , S_o = 0.0085 , L = 135'
Q_p = 224 cfs , K = 2604 , n = 0.013 , V = 11.41 fps

$h_b = 0.002 \times 44°37'52'' \times 2.02 = \underline{\underline{0.18'}}$

STA. 24+26 , VPI

Inv. = 38.70 , D = 5.0' , S_o = 0.0100 , L = 163'
Q_p = 224 cfs , K = 2604 , n = 0.013 , V = 11.41 fps

STA. 25+89 , 60"×30" WYE

Inv. = 40.33 , D = 5.0' , S_o = 0.0100 , L = 442'
Q_p = 224/213 cfs , K = 2604 , n = 0.013 , V = 11.41/10.85 fps

Junction 5-1

Q_1 = 213 cfs	Q_2 = 224 cfs	Q_3 = 11 cfs
D_1 = 5.0'	D_2 = 5.0'	D_3 = 2.5'
A_1 = 19.635 ft²	A_2 = 19.635 ft²	A_3 = 19.635 ft²
V_1 = 10.85 fps	V_2 = 11.41 fps	V_3 = 2.24 fps
S_{f_1} = 0.0067	S_{f_2} = 0.0074	θ = 45°
h_{v_1} = 1.83'	h_{v_2} = 2.02'	

$$\Delta y = \frac{\overset{Q_2}{224} \times \overset{V_2}{11.41} - \overset{Q_1}{213} \times \overset{V_1}{10.85} - \overset{Q_3}{11} \times \overset{V_3}{2.24} \cos 45°}{\tfrac{1}{2}(19.635 + 19.635)\, 32.2} = 0.36'$$

$h_j = 0.36 + 1.83 \mp 2.02 = \underline{\underline{0.17'}}$

STA. 30+31, 60"x30" WYE

INV. = 44.75 , $D = 5.0'$, $s_o = 0.0010$, $L = 344'$
Q_p = 214/203 cfs, $K = 2604$, $n = 0.013$, V = 10.90/10.34 fps

Junction 5-2

$Q_1 = 203$ cfs	$Q_2 = 214$ cfs	$Q_3 = 11$ cfs
$D_1 = 5.0'$	$D_2 = 5.0'$	$D_3 = 2.5'$
$A_1 = 19.635\ ft^2$	$A_2 = 19.635\ ft^2$	$A_3 = 4.909\ ft^2$
$V_1 = 10.34$ fps	$V_2 = 10.90$ fps	$V_3 = 2.24$ fps
$S_{f_1} = 0.0061$	$S_{f_2} = 0.0068$	$\Theta = 45°$
$h_{v_1} = 1.66'$	$h_{v_2} = 1.84'$	

$$\Delta y = \frac{214 \times 10.90 - 203 \times 10.34 - 11 \times 4.909 \cos 45°}{\frac{1}{2}(19.635 + 19.635)32.2} = 0.34'$$

$$h_j = 0.34 + 1.66 - 1.84 = \underline{\underline{0.16'}}$$

$$h_b = 0.002 \times 9°02' \times 1.84 = \underline{\underline{0.03'}}$$

NOTE: Δy contribution from the existing "double C" inlet on Irving Blvd. may be ignored since the maximum inlet capacity is ≈ 5 cfs and will peak before the mainline peak arrives.

STA. 33+75, VPI

Inv. = 48.79 , $D = 5.0'$, $s_o = 0.0080$, $L = 349'$
Q_p = 203 cfs , $K = 2604$, $n = 0.013$, $V = 10.34$ fps

$$h_b = 0.002 \times 4°51' \times 1.66 = \underline{\underline{0.02'}}$$

STA. 37+24, VPI & 45° BEND

Inv. = 50.98 , $D = 5.0'$, $s_o = 0.020$, $L = 16'$
Q_p = 203 cfs , $K = 2604$, $n = 0.013$, $V = 10.34$ fps

$$h_b = 0.20 \sqrt{45/90}\ 1.66 = \underline{\underline{0.23'}}$$

NOTE: An additional grade-drop is provided between the two 45° Bends to prevent concentrated silt deposits at low flows.

STA. 37+46, VPI & 45° BEND
(NOTE: stationing on survey ℄)

Inv. = 51.27 , D. = 5.0 , s_o = 0.0080 , L = 136'
Q_p = 203 cfs , K = 2604 , n = 0.013 , V = 10.34 fps

$h_b = 0.20 \sqrt{45/90} \times 1.66 = \underline{\underline{0.23'}}$

STA. 38+82, 60" x 30" WYE

Inv = 52.36 , D = 5.0 , s_o = 0.0080 , L = 6'
Q_p = 203/169 cfs , K = 2604 , n = 0.013 , V = 10.34/8.61 fps

Junction 9

Q_1 = 169 cfs	Q_2 = 206 cfs	Q_3 = 37 cfs
D_1 = 5.0'	D_2 = 5.0'	D_3 = 2.5'
A_1 = 19.635 ft²	A_2 = 19.635 ft²	A_3 = 4.909 ft²
V_1 = 8.61 fps	V_2 = 10.49 fps	V_3 = 7.54 fps
S_{f_1} = 0.0042	S_{f_2} = 0.0063	θ = 45°
h_{v_1} = 1.15'	h_{v_2} = 1.71'	

$$\Delta y = \frac{203 \times 10.49 - 169 \times 8.61 - 37 \times 7.54 \cos 45^\circ}{\frac{1}{2}(19.635 + 19.635) 32.2} = 0.75'$$

$h_J = 0.75 + 1.15 - 1.71 = \underline{\underline{0.19'}}$

STA. 38+88, VPI

Inv = 52.41 , D = 5.0' , s_o = 0.0050 , L = 388'
Q_p = 169 cfs , K = 2604 , n = 0.013 , V = 8.61 fps

$h_b = 0.002 \times 9°01' \times 1.15 = \underline{\underline{0.02'}}$

NOTE: 3 cfs added to all peak flows between sta 38+82 (Junction 9) and sta 62+30 to allow for pumping stormwater (5 cfs max.) from Tract 2-A up into the Eagle Ranch Road stormdrain if that should become desirable.

STA. 42+76, 60"x30" WYE

Inv. = 54.35 , D = 5.0' , S_o = 0.0050 , L = 858'
Q_p = 172/163 cfs , K = 2,604 , n = 0.013 , V = 8.61/8.15 fps

Junction 8-0/1

Q_1 = 163 cfs Q_2 = 172 cfs Q_3 = 9 cfs
D_1 = 5.0' D_2 = 5.0' D_3 = 2.5'
A_1 = 19.635' A_2 = 19.635' A_3 = 4.909'
V_1 = 8.30 fps V_2 = 8.76 fps V_3 = 1.83 fps
S_{f_1} = 0.0039 S_{f_2} = 0.0044 θ = 45°
h_{v_1} = 1.07' h_{v_2} = 1.19'

$$\Delta y = \frac{172 \times 8.76 - 163 \times 8.30 - 9 \times 1.83 \cos 45^\circ}{\tfrac{1}{2}(19.635 + 19.635)\,32.2} = 0.22'$$

$$h_j = 0.22 + 1.07 - 1.19 = \underline{\underline{0.10'}}$$

$$h_b = 0.002 \times 29^\circ 48' 22 \times 1.07 = \underline{\underline{0.06'}}$$

STA. 51+34/51+40, 60"x30" WYE/54"x60" EXPANDER, UPI

Sta. 51+34, Inv. = 58.64 D = 5.0 S_o = 0.0050 L = 6'
Sta 51+40, Inv. = 58.67/59.17 D = 5.0/4.5 S_o = 0.0060 L = 703'
Q_p = 164/148 cfs , K = 2604/1967 , n = 0.013 , V = 8.35/9.31 fps

Junction 8-A

Q_1 = 148 cfs Q_2 = 164 cfs Q_3 = 16 cfs
D_1 = 4.5' D_2 = 5.0' D_3 = 2.5'
A_1 = 15.904 ft² A_2 = 19.635 ft² A_3 = 4.909 ft²
V_1 = 9.31 fps V_2 = 8.35 fps V_3 = 3.26 fps
S_{f_1} = 0.0057 S_{f_2} = 0.0040 θ = 45°
h_{v_1} = 1.34' h_{v_2} = 1.08

$$\Delta y = \frac{164 \times 8.35 - 148 \times 9.31 - 16 \times 3.26 \cos 45^\circ}{\tfrac{1}{2}(15.904 + 19.635)\,32.2} + \left(\frac{0.0057 + 0.0040}{2}\right) 6$$

$$= -0.08' + 0.03' = -0.05'$$

$$h_j = -0.05 + 1.34 - 1.08 = \underline{\underline{0.21'}}$$

$$h_t = 0.06 \times 1.34 = \underline{\underline{0.08'}}$$

$$h_b = 0.002 \times 60^\circ 20' \times 1.34 = \underline{\underline{0.16'}}$$

STA. 58+43, 48"x54" EXPANDER, VPI

Inv. = $^{63.39}/_{63.89}$, D = $^{4.5}/_{4.0}$, s_o = 0.0080 , L = 387'
Q_p = 149 cfs , K = $^{1967}/_{1436}$, n = 0.013 , V = $^{9.37}/_{11.86}$ fps

h_t = 0.05 x 2.18 = 0.11'

STA. 62+30, VPI

Inv. = 66.99 , D = 4.0 , s_o = 0.0100 , L = 774'
Q_p = 146 cfs , K = 1436 , n = 0.013 , V = 11.62 fps

h_b = 0.002 x 5°27' x 2.10 = 0.02'

STA. 70+04, 70+11, 48"x36" WYE, 42"x48" EXPANDER, VPI

Sta. 70+04, Inv. = 74.73 D = 4.0 , s_o = 0.0100 , L = 7'
Sta. 70+11, Inv. = $^{74.80}/_{75.30}$, D = $^{4.0}/_{3.5}$, s_o = 0.0300, L = 171'
Q_p = $^{146}/_{116}$ cfs , K = $^{1436}/_{1006}$, n = 0.013 , V = $^{11.62}/_{12.06}$ fps

Junction 8-C

Q_1 = 116 cfs	Q_2 = 146 cfs	Q_3 = 30 cfs
D_1 = 3.5'	D_2 = 4.0'	D_3 = 3.0'
A_1 = 9.621 ft²	A_2 = 12.566 ft²	A_3 = 7.069 ft²
V_1 = 12.06 fps	V_2 = 11.62 fps	V_3 = 4.24 fps
S_{f_1} = 0.0133	S_{f_2} = 0.0103	θ = 45°
h_{v_1} = 2.26'	h_{v_2} = 2.10	

$$\Delta y = \frac{146 \times 11.62 - 116 \times 12.06 - 30 \times 4.24 \cos 45°}{\frac{1}{2}(9.621 + 12.566)32.2} + \left(\frac{0.0133 + 0.0103}{2}\right)7$$

= 0.58 + 0.08 = 0.66'

h_j = 0.66 + 2.26 − 2.10 = 0.82'

h_t = 0.07 x 2.26 = 0.16'

h_b = 0.002 x 35°25'09" x 2.26 = 0.16'

STA. 71+82, 42" X 36" WYE

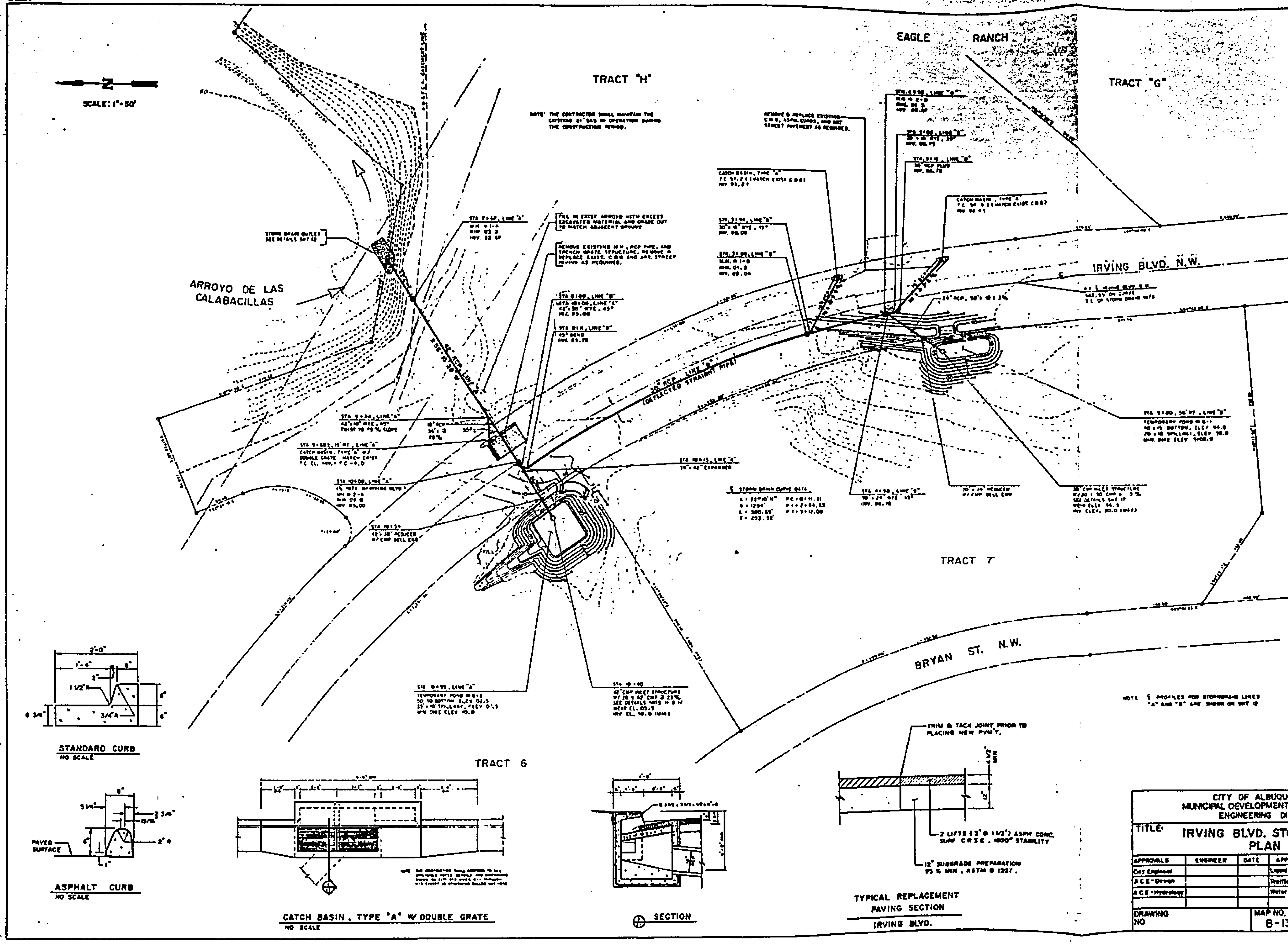
Inv. = 80.43 D = 3.5' S_o = 0.0300, L = ?
Q_p = 116 cfs (future), K = 1,006 n = 0.013, V = 12.06 (future)
= 82 cfs (temp.) = 8.52 (temporary)

The hydraulic gradeline computations up to this point indicate that the downstream pipe is part full even with the estimated future flow rate.
All that is wanted for this project is then the headloss for turning the temporary flow through the wye.

Q_3 = 82 cfs
D_3 = 3.0'
A_3 = 7.069 ft²
V_3 = 11.60 fps
S_{f_3} = 0.0152
h_{v_3} = 2.10'

$h_b = 0.20\sqrt{45/90} \times 2.10 = \underline{\underline{0.30'}}$

$h_t = 0.08 \times 2.10 = \underline{\underline{0.17'}}$



AS BUILT INFORMATION	
CONTRACTOR	
WORK STAKED BY	DATE
INSPECTOR'S ACCEPTANCE BY	DATE
FIELD VERIFICATION BY	DATE
DRAWINGS CORRECTED BY	DATE

MICRO-FILM INFORMATION	
RECORDED BY	DATE
NO	

BENCH MARKS

ACS BRASS CAP "NM 448-N9A"
ELEV. 5004.145, LOCATED AT THE INTERSECTION OF COORS RD. AND PARADISE BLVD. N.W

SURVEY INFORMATION

FIELD NOTES		
NO.	BY	DATE
	LEVERTON-EASTERLING INC.	5-10-84

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

REVISIONS

DESIGN

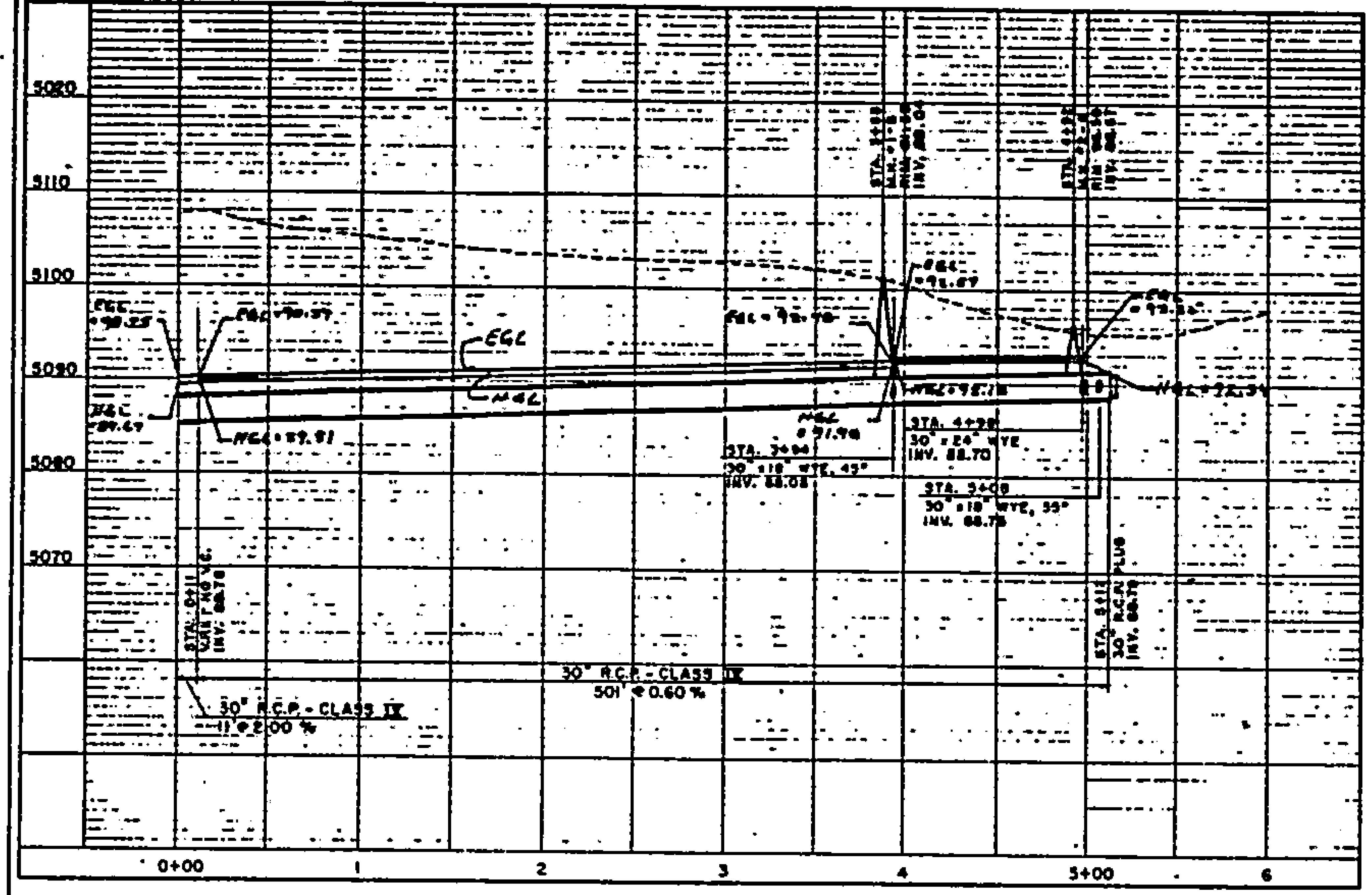
DESIGNED BY		DATE	
DRAWN BY	M.A. G.P.N	DATE	1-85
CHECKED BY		DATE	

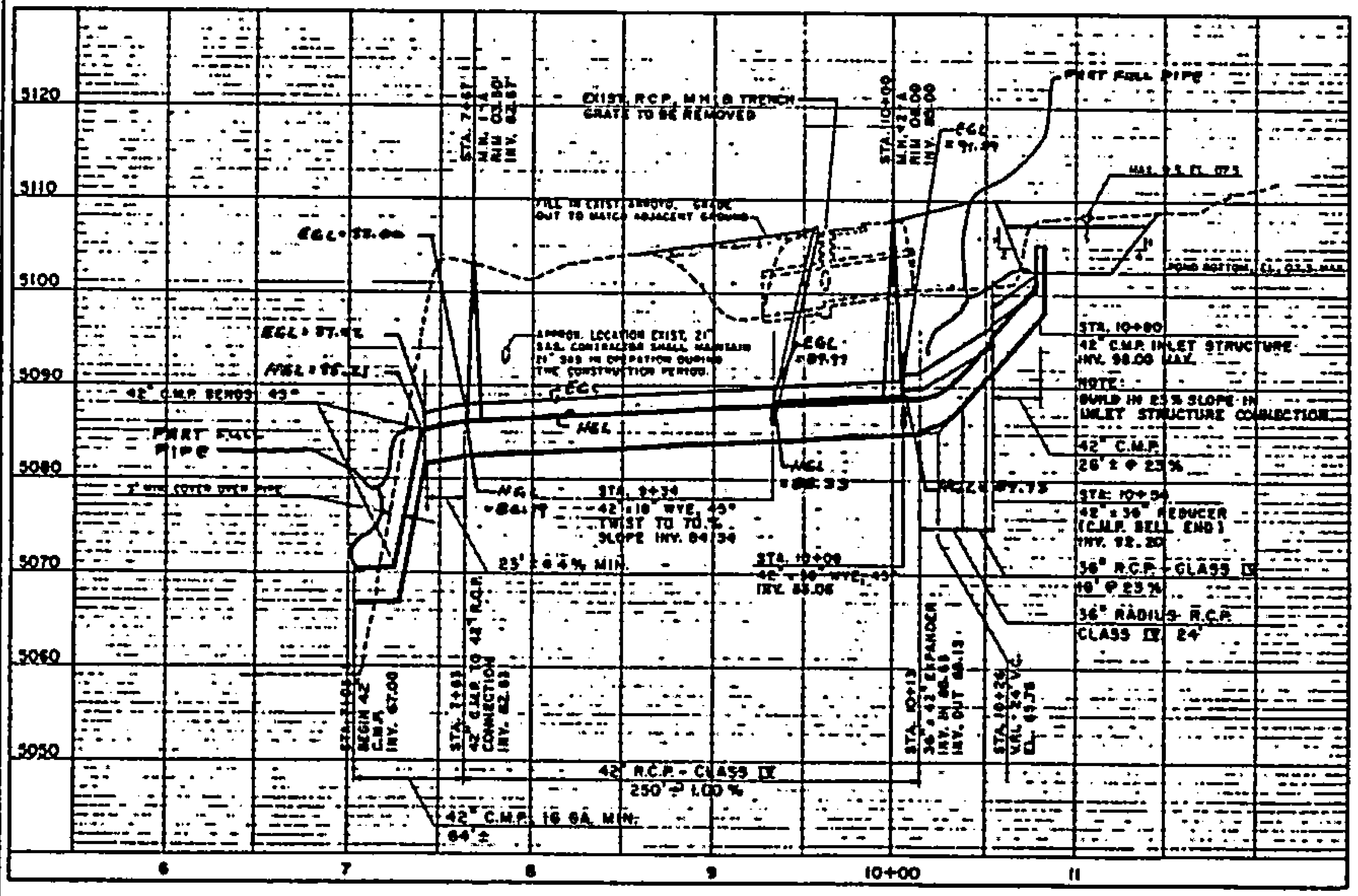
CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

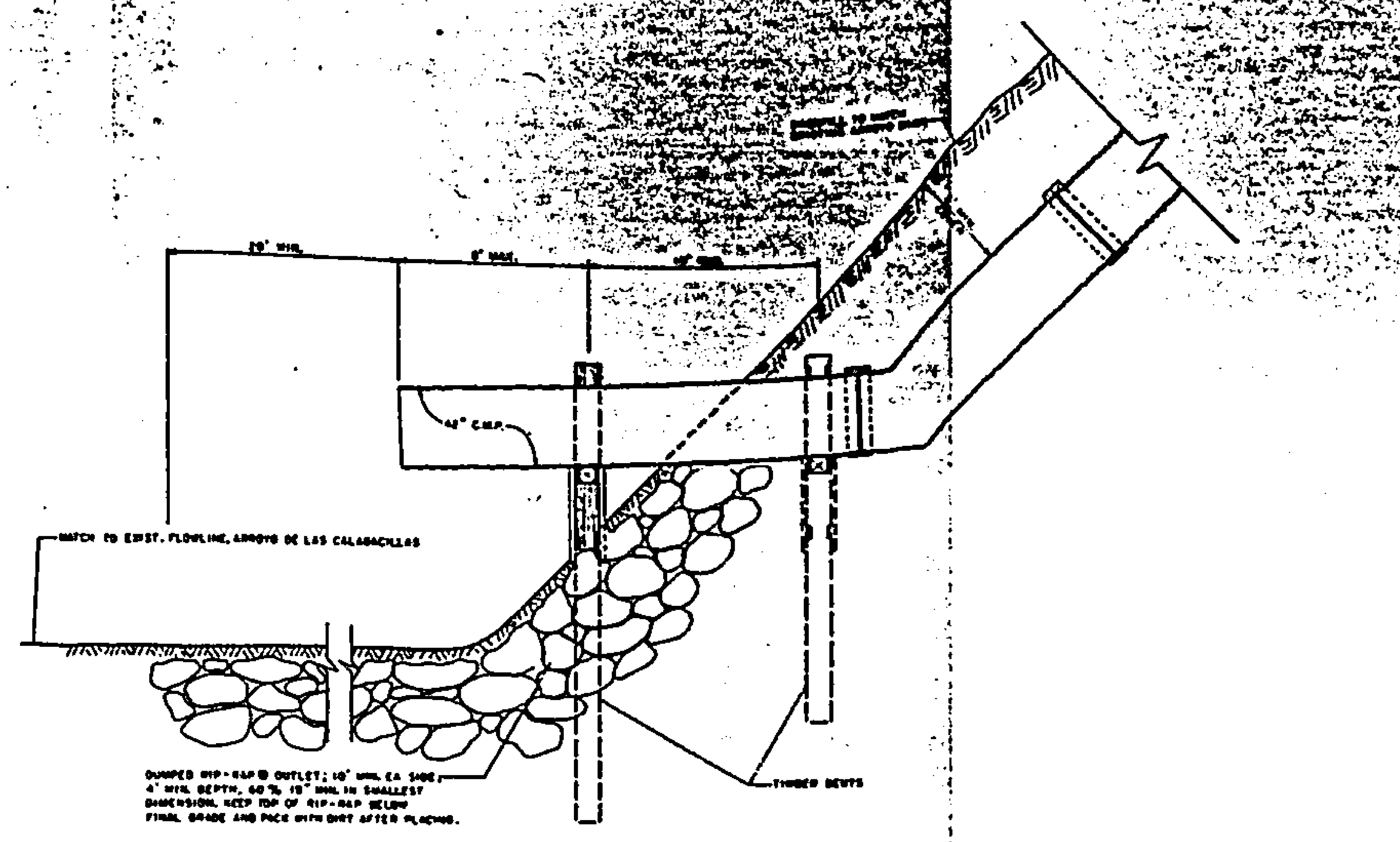
TITLE: IRVING BLVD. STORMDRAIN PLAN

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E.-Design			Traffic		
A.C.E.-Hydrology			Water		

DRAWING NO	MAP NO.	SHEET	OF
	B-13	11	19

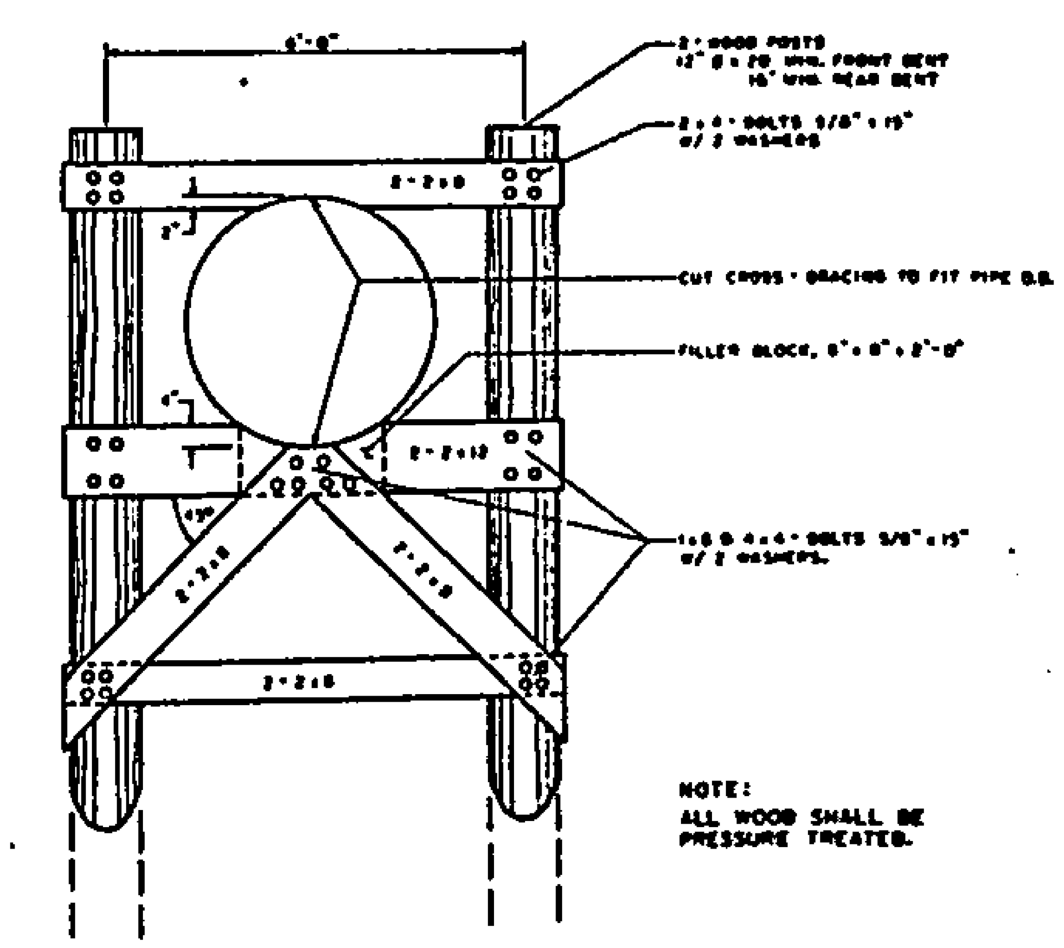




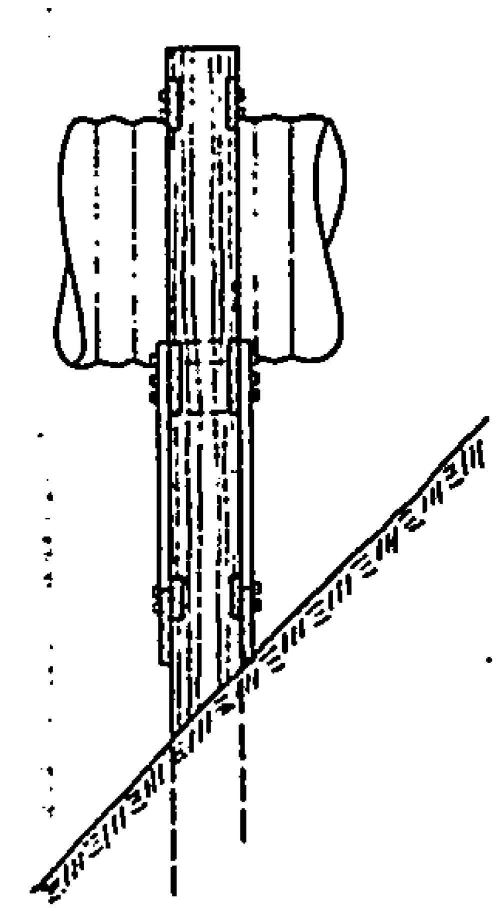


STORMDRAIN OUTLET

FROM IRVING BLVD. TO ARROYO DE LAS CALABACILLAS



FRONT VIEW



SIDE VIEW

TIMBER BENT DETAILS

NO SCALE

AS BUILT INFORMATION
MICRO-FILM INFORMATION

BENCH MARKS
ACS BRASS CAP "NM 448-N9A"
ELEV. 5004.145, LOCATED AT THE
INTERSECTION OF COORS RD. AND
PARADISE BLVD. N.W.

SURVEY INFORMATION		
NO.	FIELD NOTES BY	DATE
	LEVERTON - EASTERLING INC.	

ENGINEER'S SEAL

NO	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY ___ DATE ___
DRAWN BY m.a., GAH DATE 1-85
CHECKED BY ___ DATE ___

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

TITLE: IRVING BLVD. STORMDRAIN PROFILES & OUTLET DETAILS

APPROVALS	ENGINEER	DATE	APPROVALS	ENGINEER	DATE
City Engineer			Liquid Waste		
A.C.E. - Design			Traffic		
A.C.E. - Hydrology			Water		

DRAWING NO | MAP NO B-13 | SHEET 12 OF 19

C. M. EASTERLING
& ASSOCIATES
ALBUQUERQUE, N.M.

SUMMARY OF HYDRAULIC CALCULATIONS

CLOSED CONDUIT   IRVING BLVD.

BY: fc-a
DATE: 12-13-84
SHEET: 1 OF 1

PROJECT: EAGLE RANCH STORMDRAIN   LINE: LINE A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
STATION	STRUCT.	INV.	D	Q	A	V	K	S_F	L	Δ	LOSSES H_F	H_B	H_J	H_{MH}	H_T	$H_{MISC.}$	ΣH_L	E.G.	h_V	H.G.
LINE "A"																				
7+40	45° VERT. BEND	81.71	-CONTROL-																	
			42"	104	9.62	10.81	503	0.0427	23'	—	0.98						0.98	87.02	1.81	85.21
7+63	CMP TO RCP	82.63																88.00	1.81	86.19
			42"	104	9.62	10.81	1,006	0.0107	171'	—	1.83						1.83			
9+34	42"x18" WYE	84.34											0.14				0.14	89.83	1.81	88.02
			42"	99	9.62	10.29	1006	0.0097	72'		0.70						0.70	89.97	1.64	88.33
10+06	42"x30" WYE	85.06											0.72				0.72	90.67	1.64	89.03
10+13	V.C. / EXP.	85.13 / 85.63													0.12		0.12	91.39	1.66	89.73
			36"	77	7.07	10.89	666	0.0134	49'		0.66	-PART	FULL	PIPE-				91.51	1.66	89.85
10+62	42"x36" REDUCER	93.82	-CONTROL-												0.11		0.11	98.66	1.84	96.82
			42"	77	9.62	8.00	503	0.0234	18'		0.42						0.42	98.77	0.99	97.78
10+80	Inlet	98.0	Bottom Orifice													2.76	2.76	99.19	0.99	98.20
			Top weir								OK	-PART	FULL-			2.0	2.0	01.95	0.99	00.96
																		03.95	0.99	02.96

REMARKS:

[redacted] ASSO[redacted]ATES [redacted]

ALBUQUERQUE, N.M.

SU[redacted]MA[redacted]Y [redacted] H[redacted]DRA[redacted]LI[redacted] [redacted]CA[redacted]UL[redacted]TIO[redacted]S [redacted]

BY: [redacted] /C [redacted]

CLOSED CONDUIT

DATE: 12-13-84

PROJECT: EAGLE RANCH STORMDRAIN

LINE: IRVING BLVD. LINE B

SHEET: 1 OF 1

1 STATION	2 STRUCT.	3 INV.	4 D	5 Q	6 A	7 V	8 K	9 S_F	10 L	11 Δ	12 H_F	13 H_B	14 H_J	15 H_{MH}	16 H_T	17 $H_{MISC.}$	18 ΣH_L	19 E.G.	20 h_V	21 H.G.
0+06 A 0+00 B	42"x30" WYE	85.56																90.25	0.58	89.67
			30"	30	4.91	6.11	410.1	0.0054	11'		0.06						0.06	90.31	0.58	89.73
0+11	VPI / 45°	85.78										0.08					0.08	90.39	0.58	89.81
			30"	30	4.91	6.11	410.1	0.0054	383'	17°41'	2.07	0.02					2.09	92.48	0.58	91.90
3+94	30"x18" WYE	88.08											0.09				0.09	92.57	0.47	92.10
			30"	27	4.91	5.50	410.1	0.0043	104'	4°48'	0.45	0.01					0.46	93.03	0.47	92.56
4+98	30"x24" WYE	88.70										0.13			0.09		0.22	93.25	0.91	92.34
			24"	24	3.14	7.64	226.2	0.0113	60'	—	0.68						0.68	93.93	0.91	93.02
RCP/CMP	30"x24" REDUCER	89.55													0.06		0.06	93.99	0.37	93.62
			30"	24	4.91	4.89	205	0.0137	20'	-	0.27						0.27	94.26	0.37	93.89
POND 6-1	INLET	89.75	BOTTOM ORIFICE													1.03		95.29	0.37	94.92
			WEIR OVER TOP													1.14		96.43	0.37	96.06
																		—	OK	—

REMARKS:

JCa
12-13-84

EAGLE RANCH STORMDRAIN

IRVING BLVD - LINES "A" & "B"

Curb inlets are provided on Irving Blvd. to alleviate the existing street drainage problems, though this is not a requirement for the current project. Assume 5 cfs for the Double "A" inlet and 3 cfs for each of the single "A" inlets co-incident with the peak in the mainline.

BEGIN @ OUTLET, LINE "A" STA. 7+03

42" CMP on 100% slope - Part full pipe.

STA. 7+40 ±, VPI - CONTROL

Inv. = 81.71 MAX., $D = 3.5'$, $S_o = 0.0400$, $L = 23'$
$Q_p = 104$ cfs, $K = 503$, $n = 0.026$, $V = 10.81$ fps

STA. 7+63, 42" CMP TO RCP CONNECTION

Inv. = 82.63, $D = 3.5'$, $S_o = 0.0100$, $L = 171'$
$Q_p = 104$ cfs, $K = 1{,}006$, $n = 0.013$, $V = 10.81$ fps

STA 9+34, 42"x18" WYE

Inv. = 84.34, $D = 3.5'$, $S_o = 0.0100$, $L = 72'$
$Q_p = 104/99$ cfs, $K = 1{,}006$, $n = 0.013$, $V = 10.81/10.29$ fps

Junction - Dbl. "A", Irving Blvd

$Q_1 = 99$ cfs	$Q_2 = 104$ cfs	$Q_3 = 5$ cfs
$D_1 = 3.5'$	$D_2 = 3.5'$	$D_3 = 1.5'$
$A_1 = 9.621\ ft^2$	$A_2 = 9.621\ ft^2$	$A_3 = 1.767\ ft^2$
$V_1 = 10.29$ fps	$V_2 = 10.81$ fps	$V_3 = 2.83$ fps
$S_{f_1} = 0.0097$	$S_{f_2} = 0.0107$	$\theta = 45°$
$h_{v_1} = 1.64'$	$h_{v_2} = 1.81'$	

$$\Delta y = \frac{104 \times 10.81 - 99 \times 10.29 - 5 \times 2.83 \cos 45°}{1/2\,(9.621 + 9.621)\,32.2} = 0.31'$$

$$h_j = 0.31 + 1.64 - 1.81 = \underline{0.14'}$$

STA. 10+06, 42" X 30" WYE, 36" X 42" EXPANDER

Inv = 85.06 , $D = 3.5/3.0$, $S_o = 0.0100$, L ,
$Q_p = 99/77$, $K = 1006/666$, $n = 0.013$, $V_1 = 10.29/10.89$

Junction Line "B"

$Q_1 = 73$ cfs	$Q_2 = 99$ cfs	$Q_3 = 26$ cfs
$D_1 = 3.0'$	$D_2 = 3.5'$	$D_3 = 2.5'$
$A_1 = 7.069\ ft^2$	$A_2 = 9.621\ ft^2$	$A_3 = 4.909\ ft^2$
$V_1 = 10.33$ fps	$V_2 = 10.29$ fps	$V_3 = 5.30$ fps
$S_{f_1} = 0.0120$	$S_{f_2} = 0.0097$	$\theta = 45°$
$h_{v_1} = 1.66'$	$h_{v_2} = 1.64'$	

$$\Delta y = \frac{99 \times 10.29 - 73 \times 10.33 - 26 \times 5.30 \cos 45°}{\frac{1}{2}(7.069 + 9.621)\,32.2} + \left(\frac{0.0120 + 0.0097}{2}\right) 7$$

$$= 0.62' + 0.08' = 0.70'$$

$$h_j = 0.70 + 1.66 - 1.64 = \underline{\underline{0.72'}}$$

$$h_t = 0.07 \times 1.66 = \underline{\underline{0.12'}}$$

STA. 10+62, 42" X 36" REDUCER

Inv. = 93.82 , $D = 3.0/3.5'$, $S_o = 0.224$, $L = 18'$
$Q_p = 77$ cfs , $K = 666/503$, $n = 0.013/0.026$, $V = 10.89/8.00$ fps

$$h_t = 0.06 \times 1.84 = 0.11'$$

STA. 10+80, INLET 6-2

Inv. = $98^{\underline{0}}$, $D = 3.5$
$Q_p = 77$ cfs , $K = 503$, $n = 0.026$, $V = 8.00$ fps

STA. 0+00 LINE B = STA 10+06 LINE A, 42" x 30" WYE

Assume downstream H.G. @ El. 89.03 (Peak flow)
Re-compute h_j @ junction w/ Line "A"

$Q_1 = 69$ cfs
$D_1 = 3.0'$
$A_1 = 7.069$ ft²
$V_1 = 9.76$ fps
$S_{f1} = 0.0107$
$h_{v1} = 1.48'$

$Q_2 = 99$ cfs
$D_2 = 3.5'$
$A_2 = 9.621$ ft²
$V_2 = 10.29$ fps
$S_{f2} = 0.0097$
$h_{v2} = 1.64'$

$Q_3 = 30$ cfs
$D_3 = 2.5'$
$A_3 = 4.909$ ft²
$V_3 = 6.11$ fps
$\theta = 45°$

$$\Delta y = \frac{99 \times 10.29 - 69 \times 9.76 - 30 \times 6.11 \cos 45°}{\frac{1}{2}(7.069 + 9.621)\, 32.2} = 0.80'$$

$$h_j = 0.80 + 1.48 - 1.64 = \underline{0.64'}$$

∴ H.G. to match = 89.03 + 0.64 = $\underline{\underline{89.67}}$

Inv = 85.56, D = 2.5', s_o = 0.0200, L = 11'
Q_p = 30 cfs, k = 410.1, n = 0.013, V = 6.11 fps

STA. 0+11, VPI & 45° BEND

Inv. = 85.78, D = 2.5', s_o = 0.0060', L = 383'
Q_p = 30 cfs, k = 410.1, n = 0.013, V = 6.11 fps

$$h_b = 0.20 \sqrt{45/90} \times 0.58 = 0.08'$$

STA. 3+94, 30" x 18" WYE

Inv. = 88.08, D = 2.5', s_o = 0.0060, L = 104'
Q_p = 30/27 cfs, k = 410.1, n = 0.013, V = 6.11/5.50 fps

Junction w/ sgl "A" Inlet

$Q_1 = 27$ cfs
$D_1 = 2.5'$
$A_1 = 4.909$ ft²
$V_1 = 5.50$ fps
$S_{f1} = 0.0043$
$h_{v1} = 0.47'$

$Q_2 = 30$ cfs
$D_2 = 2.5'$
$A_2 = 4.909$ ft²
$V_2 = 6.11$ fps
$S_{f2} = 0.0054$
$h_{v2} = 0.58'$

$Q_3 = 3$ cfs
$D_3 = 1.5'$
$A_3 = 1.767$ ft²
$V_3 = 1.70$ fps
$\theta = 45°$

$$\Delta y = \frac{30 \times 6.11 - 27 \times 5.50 - 3 \times 1.70 \cos 45°}{\frac{1}{2}(4.909 + 4.909)\, 32.2} = 0.20'$$

$$h_j = 0.20 + 0.47 - 0.58 = 0.09'$$

$$h_b = 0.002 \times 17°40'58" \times 0.58 = 0.02'$$

STA. 4+98, 30" X 24" WYE

$Inv = 88.70$, $D = {}^{2.5}/_{2.0}$, $S_o = 0.0100$, $L = 60'$
$Q_p = {}^{27}/_{24}$ cfs, $K = {}^{410.1}/_{226.2}$ $n = 0.013$, $V = {}^{5.50}/_{7.64}$ fps

CONSIDER AS 45° BEND w/ EXPANSION SINCE 90% OF THE FLOW COMES FROM POND 6-1.

$h_b = 0.20 \sqrt{45/90} \times 0.91 = \underline{\underline{0.13'}}$

$h_t = 0.10 \times 0.91 = \underline{\underline{0.09'}}$

+ 60', 30" X 24" REDUCER

$Inv. = 89.55$, $D = {}^{2.0}/_{2.5}$ $S_o = 0.0100$, $L = 20'$
$Q_p = 24$ cfs, $k = {}^{226.2}/_{205}$ $n = {}^{0.013}/_{0.026}$, $V = {}^{7.64}/_{4.89}$

$h_t = 0.07 \times 0.91 = \underline{\underline{0.06'}}$

+ 20, POND 6-1 INLET

$Inv. = 89.75$ $D = 2.5$
$Q_p = 24$ cfs $K = 205$ $n = 0.026$ $V = 4.89$ fps

EAGLE RANCH STORMDRAIN

DESILTING PONDS

GENERAL:

See Hydrology for discussion of capacities required.

Avoid head on pipe to minimize leakage & other problems.

Seep collars not required since all ponds are excavated rather than dammed, and in any case outlet pipes lead to the stormsewer, not free air.

Provide 6" φ holes in inlet riser sufficient to take care of all or most of discharge. However, consider holes to be clogged tight, when calculating head required to discharge over the top of the inlet riser.

Provide depth from spillway level to top of standpipe sufficient for head to discharge flood volume into top of pipe.

Provide approx. 2± ' freeboard over spillway level.

Avoid having steep slopes that might erode back into the pond on the downstream side.

Provide stabilized control section in spillway opening.

Provide stabilized rundown flumes into ponds where concentrated inflows are likely to avoid excessive rapid silting and unsightly erosion.

Provide trashracks designed to minimize clogging and prevent children from getting into the pipes.

EAGLE RANCH STORMDRAIN

DESILTING PONDS

POND # 5-2

The existing dike retains approximately 4 ac-ft. The dike is in fairly good condition and both it and the pond area has some grass and other vegetation. There is nothing to be gained at this time by removing the existing dike and building a new temporary pond.

Therefore just put in a 30" wye for future use and run 36" CMP with standard end section up into the existing pond area. Standpipe for desilting is not required since the existing pond is so large as it is and flat with fairly decent grass cover.

According to ARMCO, a 36" end section will admit 35 cfs with the water surface at crown of pipe. Spillway elevation is @ 59±; therefore set invert of end section @ 56±.

Connector pipe slope =(56.50 - 40.33 - 1.25) 76.37 = **19.54%** OK

POND # 5-1

Required: Sed. Vol. 25 C.Y. = 675 ft³
Flood Vol. = 12,000 ft³
Tot. storage 12,675 ft³

Outlet : 40 cfs (temp.), 40 cfs (future)

Use 30" wye , 36" standpipe

Top of dam El. 70.0, spillway 30' wide @ El. 67.5

Bottom @ El. 63.0 , H to spillway = 1.5'

$H = (40/2.5 \times 9.42)^{2/3} = \underline{1.42'}$ OK

Bottom orifice, $h = (40/4.81 \times 7.07)^2 = \underline{1.38'}$ OK

Connector pipe slope = (59.00 - 44.75 - 1.25) / 110.31 = **11.8%** OK

$\sim Vol. = \left(\frac{(35^2-(4-\pi)5^2+(35+8\times 4.5)^2-(4-\pi)23^2)}{2}\right) 4.5 = \underline{13,028\ ft^3}$ OK

Use: 35' sq. bottom, 4:1 slopes except 2:1 @ spillway.

POND # 9

Required: $\leq$ 1.0 Ac-ft. storage, $\leq$ 10' depth
Max. discharge ~ 52 cfs

Set spillway elev. @ 70°, use whole front of pond. 4:1 side slopes all around, keep 0.5 to 1% slope in pond bottom. (Jim Fink)

Cut & try. Storage vol. by planimetering contours.
∴ 10 Ac-ft with pond bottom @ 62°±,
Use 61.25 @ inlet, 63° @ upper end to average 62°

Use 30" wye and structure w/ 27"φ orifice plate.

Discharge $Q = 0.6 \times 3.976 \sqrt{2g(70.0 - 61.25 - 1.13)} = \underline{52.9\text{ cfs}}$ OK

Connector pipe slope = $(61.25 - 52.36 - 1.25)/34.79 = \underline{\underline{21.96\%}}$ OK

Keep approach velocity to trash rack $\lessapprox$ 1 fps

Then $53\text{ cfs} / \left(\frac{5+12}{2}\right) \times 6 \times \frac{1}{3}\sqrt{10} = \underline{\underline{0.99\text{ fps}}}$ OK

POND # 8-0/1

Required: Sed. Vol.: 2 x 25 C.Y. = 1,350 ft³
Flood Vol.: 4,500 ft³ + 8,700 ft³ = 13,200 ft³
Total Storage: 14,550 ft³

Outlet: 44 cfs (temp.), 27 cfs (future)

Use 30" wye, 36" standpipe

Top of dam El. 70°, spillway 30' wide @ El. 67.5

Bottom El ~ 63° (natural), H to spillway 1.5'

$H = (44/2.5 \times 9.42)^{2/3} = \underline{1.52'}$ OK.

Bottom orifice, $h = (44/4.81 \times 7.07)^2 = \underline{1.67'}$ OK

Connector pipe slope: $(59 - 54.35 - 1.25)/41.01 = \underline{\underline{8.3\%}}$ OK

Actual storage (by planimetering contours) ~ 31,500 ft³

This is more than twice what is required, but the dike is built with excess excavation and the depth is required for standpipe, weirhead, and freeboard.

POND # 8-A

Required: Sed. vol.: 56 C.Y. = 1,512 ft^3
Flood vol.: 12,300 ft^3
Tot. storage 13,812 ft^3

Outlet: 41 cfs (temp.), 41 cfs (future)

Use 30" wye, 36" standpipe

Top of dam El. $74^{\underline{0}}$, spillway 30' wide @ El. $71^{\underline{5}}$

Bottom el. $67^{\underline{0}}$, H to spillway 1.5'

$H = (41/2.5 \times 9.42)^{2/3} = \underline{1.45'}$ OK

Bottom orifice; $h = (41/4.81 \times 7.07)^2 = \underline{1.45'}$ OK

Connector pipe slope: $(63.0 - 58.64 - 1.25)/132 = \underline{2.4\%}$ OK
(More head in standpipe if needed)
Use 100' x 15' bottom, 3:1 backslope, 5:1 sides, 2:1 in front

$$\sim Vol. = \left(\frac{100 \times 15 - (4-\pi)5^2 + (100+45)(15+22.5) - (4-\pi)20^2}{2}\right) 4.5$$

$= \underline{\underline{14,789\ ft^3}}$ OK

POND # 8-B

Req'd: Sed. Vol.: 287 C.Y. 7,749 ft^3
Flood Vol.: = 24,600 ft^3
Tot. storage 32,349 ft^3

Outlet: 82 cfs (temp.), 161 cfs (future)

Use 36" wye, 42" standpipe. ($S_{f\,fut.} = (161/1006)^2 = 2.56\%$ OK)

Top of dam $96^{\underline{0}}$, spillway 35' wide @ el. $94^{\underline{0}}$

Bottom el. $89^{\underline{0}}$, H to spillway = 2.0'

$H = (82/2.5 \times 11.0)^{2/3} = \underline{2.07'}$ OK

Orifice bottom, $h = (82/4.81 \times 9.62)^2 = \underline{3.14'}$ OK $1^{\underline{0}}$' over pipe

Connector pipe slope: $(84.0 - 80.43 - 0.25)/96.17 = 3.5\%$ OK

Use 65' square bottom, 4:1 sideslopes, except 2:1 in front

$$\sim Vol. = \left(\frac{65^2 - (4-\pi)5^2 + 105 \times 95 - (4-\pi)25^2}{2}\right) 5 = \underline{34,105\ ft^3} \text{ OK}$$

POND # 6-1

Req'd.: Sed. Vol : 25 C.Y. = 675 ft^3
Flood Vol. : = 7,200 ft^3
Tot. Storage 7,875 ft^3

Outlet: 24 cfs (temp.), 24 cfs (future)

Use 24" Wye, 30" standpipe

Top of dam 5100⁰, spillway 20' wide @ El. 98⁰

Bottom El. 94⁰, H to spillway 1.5'

$H = (24/2.5 \times 7.85)^{2/3} = \underline{1.14'}$ ok

Orifice bottom, $h = (24/4.81 \times 3.14)^2 = \underline{2.52'}$ ok 1.27' over pipe

Connector pipe slope $= (90.0 - 88.70 - 0.25)/80 = \underline{1.3\%}$ ok

Use 60'×15' bottom, 4:1 sideslopes, except 2:1 in front

$\sim Vol. = \left(\frac{60 \times 15 - (4-\pi)5^2 + 92 \times 39 - (4-\pi)21^2}{2}\right) 4.0 = \underline{8,176\ ft^3}$ ok

POND # 6-2

Req'd: Sed. Vol: 170 C.Y. = 4,590 ft^3
Flood Vol.: = 18,000 ft^3
Tot. Storage = 22,590 ft^3

Outlet: 60 cfs (temp.), 77 cfs (fut.)

Use 36" RCP, 42" standpipe

Top of dam, El. 10⁰, spillway @ 07⁵, 35' wide

Bottom El. 02⁵, H to spillway 2.0'

$H = (77/2.5 \times 11.0)^{2/3} = \underline{1.99'}$ ok

Orifice bottom, $h = (77/4.81 \times 9.62)^2 = \underline{\underline{2.77'}}$ ok 1' over pipe

Connector pipe slope, see plans 2390

Use 50' square bottom, 4:1 sideslopes, except 2:1 in front

$\sim Vol = \left(\frac{50^2 - (4-\pi)5^2 + 80 \times 90 - (4-\pi)25^2}{2}\right) 5 = \underline{\underline{22,855\ ft^3}}$ ok