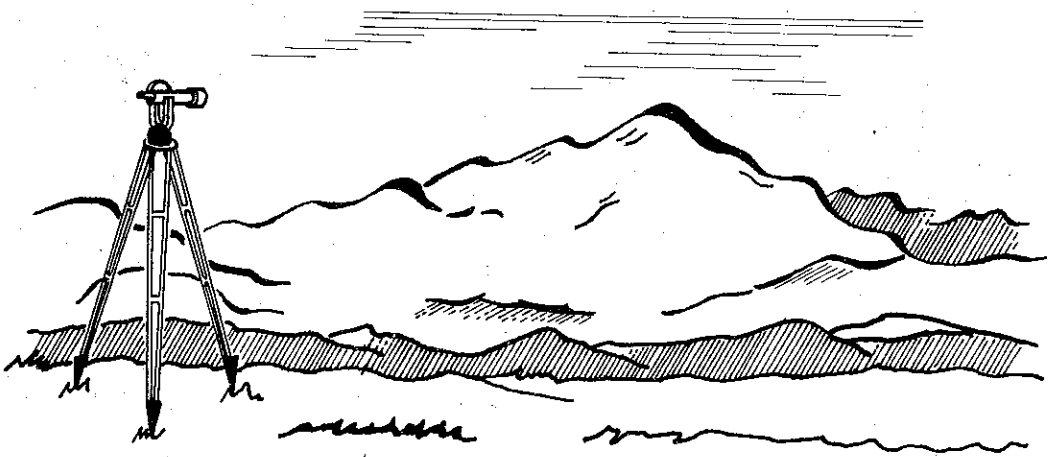
DRAINAGE PLAN

PARADISE VALLEY SUBDIVISION

Colorado Springs, Colorado



KARCICH & WEBER INC.
Engineers · Planners · Consultants
Colorado Springs, Colorado

DRAINAGE PLAN
FOR
PARADISE VALLEY SUBDIVISION
COLORADO SPRINGS, COLORADO

JULY 1966

KARCICH & WEBER, INC.
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ENGINEERS — PLANNERS — CONSULTANTS

2630 AIRPORT ROAD
COLORADO SPRINGS, COLORADO

Director of Public Works
City of Colorado Springs
Colorado Springs, Colorado

Re: Blocks 1 thru 5 of Paradise Valley Subdivision, Drainage Report

Dear Sir:

Transmitted herewith is the report outlining the drainage plan for Blocks 1 thru 5, Paradise Valley Subdivision, Colorado Springs, Colorado.

Very truly yours,

KARCICH & WEBER, INC.

Matthew F. Karcich

Matthew F. Karcich

INDEX

A. SCOPE OF WORK:

It is the intent of this report to form the basis for an overall plan for drainage appurtenances in the Paradise Valley Subdivision.

The study does not establish the exact design of any drainage channel or drainage appurtenances but does establish the general size and location of such storm drainage structures. It also establishes those natural channels which must remain as water carrying channels. Final design of any storm drainage appurtenances should be included as a part of the final street design.

Natural existing channels which are to be utilized for drainage purposes should be so reserved and encroachments on them must not be allowed. The development of Paradise Valley Subdivision shall essentially retain the natural state of the terrain as it now exists.

B. BASIN DESCRIPTION:

Paradise Valley Subdivision has an area of 182 acres and lies Northwest of the City of Colorado S prings, East of Wilson Road and South of Woodman Valley. (See Figure I)

The basin is drained by 1 major channel which has some minor distributing branches. Except after a storm the entire channel is dry. The Subdivision lies within the major drainage basin of Rockrimmon South. It is on terrain that has a general Southeasterly slope and the overall plan is designed to accommodate this slope and to retain the existing drainage channels in their natural state.

The Outfall Points 1 thru 5 are located on the existing dry creek bed that runs thru the subdivision.

C. RAINFALL PATTERN:

Average annual rainfall in this area is about 14,5" per year. The major portion of this rainfall are in the months June, July and August as indicated by the graph in Figure II. Both mountain type storms and plains type storms fall on this basin. The amount of annual moisture from snowfall is not high enough to lead to excessive runoff.

Storms in this area fall in two (2) categories.

1. Short intense storms lasting two (2) hours or longer, and usually local in nature, and

2. Long term storms lasting six (6) hours or more, and being spread over a large area.

The long term storms last a relatively long period of time, having a greater volume of runoff, but have a relatively low flood peak.

The short storm produces less runoff having a higher flood peak.

D. RUNOFF CRITERIA:

In the absence of measured data a synthetic hydrograph was adapted to the soil conditions of Paradise Valley Subdivision.

This report is compiled from the procedures as outlined by the Soil Conservation Service and modified by the Bureau of Reclamation. The method of computation of flows utilized the Unitgraph to determine the runoff hydrograph.

The following criteria forms the basis for the computation of the runoff hydrograph.

1. RAINFALL - 2" intensity, 1 hour duration, 50 year frequency.
2. SOIL TYPE - Soil Group C, Comprising Shallow Soils.
3. RUNOFF CURVE NO. - Weighted No. from the hydrologic soil-cover complexes.
4. WATER SHED CONDITIONS II- $I_a = 0.2S$

The Paradise Valley Subdivision is divided into three (3) drainage basins with thirty one (31) subdivisions as shown in the drawings. (See Figure III). Outfall Points was assigned to each basin and sub-basin and a synthetic hydrograph constructed for these points. The hydrographs for each sub-basin were combined to form hydrographs for the Outfall Points of each of the basins. (See Figure IX).

E. MAIN DRAINAGE CHANNELS:

The most economical method of removing flood runoff from the developed area is to improve and use existing ditches of the drainage channe. Since Paradise

Valley Subdivision, Blocks 1 thru 5 is subdivided into two (2) acre tracts the general area will remain essentially as it is today. The natural existing drainage channels should be maintained as they now exist. Roads or Streets can span the channel by typical box culverts or RCP with headwalls and wingwalls as shown on Figures IV and V. Care should be taken that stream flow is neither impeded or diverted. Some minor channel stabilization will be required as the area fully develops.

F. OUTFALL POINTS: (Refer to Figure III at end of report)

The Subdivision is so divided that eight (8) Outfall Points are noted.

1. Outfall Point No. 1 is located at the North end of the Subdivision at Paint Brush Lane and is the point of natural drainage to the Southeast. Water contained on the North side of Paint Brush Lane will flow in the natural channel to this Outfall Point. The peak flow for the design storm is 67.52 cfs. and the culvert size is No. 1 Figure IV and Figure V.

2. Outfall Point No. 2 is located at the West side of Paradise Valley Blvd. where the natural drainage channel intersects the thoroughfare. Water flows from the East and West side to the natural drainage channel. Runoff is contained in either V-shaped ditches or asphalt curbs on Paradise Valley Blvd. and Jack Rabbit Lane to discharge into the existing channel. The peak flow for the design storm is 96.96 cfs. and the culvert size is No. II, Figure IV and Figure V.

3. Outfall Point No. 3 is located Southeast from Outfall Point No. 2 on the same major existing channel and also crosses Paradise Valley Blvd., collecting runoff from both East and West and from either V-shaped ditches or asphalt curbs on Paradise Valley Blvd., and part of Sunburst Circle. The peak flow for the design storm is 120.88 cfs. and the culvert size is No. III, Figure IV and Figure V.

4. Outfall Point No. 4 is located South of Outfall Point No. 3 and crosses Paradise Valley Blvd., South of the intersection with Prairie Dog Circle. Runoff collects from the East and is contained in either V-shaped ditches or asphalt curbs along Prairie Dog Circle and Paradise Valley Blvd. Water from the West is collected in the natural drainage channel and flows Southeasterly. The peak flow for the design

storm is 138.47 cfs. and the culvert size is No. IV, Figure IV and Figure V.

5. Outfall Point No. 5 is located South of the Southeast corner of the Subdivision and collects runoff from the North and South sides of the natural drainage channel flowing Southeasterly also collecting runoff from a V-shaped ditch along Prairie Dog Circle. Outfall Point No. 5 is located at the extremity of Paradise Valley Subdivision. The peak flow for the design storm is 155.75 cfs.

6. Outfall Point No. 6 is located on the West side of Sunburst Circle and collects runoff from the South and West and in either a V-shaped ditch or asphalt curb along the West side of Sunburst Circle. The peak flow for the design storm is 10.00 cfs. and the culvert size is 18".

7. Outfall Point No. 7 is located along the East line of the Subdivision and collects runoff from the East and West sides of Sunburst Circle and in either V-shaped ditches or asphalt curbs, and from natural drainage into the existing low area flowing Easterly. The peak flow for the design storm is 27.48 cfs.

8. Outfall Point No. 8 is located Southeast of Chipmunk Circle and collects runoff flowing South in a natural drainage ditch South of Paint Brush Lane. The peak flow for the design storm is 8.01 cfs.

9. Outfall Point No. 9 is located at the Northeast extremity of the Subdivision, and generally collects runoff flowing to the Northeast. The peak flow for the design storm is 5.37 cfs.

G. INDIVIDUAL RECOMMENDATIONS FOR IMPROVEMENTS.

1. GENERAL.

The minimum size of drainage channel, width and depth, from Outfall Point to Outfall Point, is shown on Figure VI. The noted minimum sizes are only intended to verify that the existing natural channel is adequate to handle the anticipated runoff.

The culvert locations as noted on Figure III can use either RCP or box culverts as noted on Figures IV and V.

2. STREET DESIGN.

Street design should conform to the requirements of the City of Colorado

Springs. Final street design should accommodate the typical road cross section as on Figure VII, or asphalt curb as shown on Figure VIII. The improvement decided upon is not a part of this report, but remains a part of street design.

Cross Gutters required to carry runoff across streets are to be a part of final street design with one exception. The cross gutter across Sunburst Circle on Paradise Valley Blvd. is to be eight (8) feet in width rather than a nominal five (5) feet.

Outlet structures to carry runoff to the main drainage channel from streets or roadways are considered in this report.

Access to individual lots having to cross side ditches of any street should plan to use approved culverts of the City of Colorado Springs.

Peak flows have been computed on the basis of all streets being paved.

H. SUMMARY AND CONCLUSION:

Drainage channels should be wide and shallow to minimize channel erosion. Channel erosion is basically a function of the specific weight of the fluid, slope of the channel and depth of flow. Maintainence of the existing natural channels is a must. Street ditches or asphalt curbs should be designed by applying existing slopes and recommended peak flows. Table I summarizes the runoff discharge for all pertinent points in the Subdivision.

It is recommended that the design features of this study be followed, making minor revisions as necessary as the subdivision becomes developed.

I. SUMMARY OF COST ESTIMATES:

OUTFALL POINT NO. 1

Box culvert or RCP (with wingwalls & headwalls)	
180 L.F.	$6960.00
4 Outlet Structures	920.00
Sub-total	$7880.00

OUTFALL POINT NO. 2

Box culvert or RCP (with wingwalls & headwalls)	
125 L.F.	$5620.00
3 Outlet Structures	690.00
Sub-total	$6310.00

OUTFALL POINT NO. 3

Box culvert or RCP (with wingwalls & Headwalls)	
80 L.F.	$4255.00
1 Outlet Structure	230.00
Sub-total	$4485.00

OUTFALL POINT NO. 4

Box culvert or RCP (with wingwalls & headwalls)	
135 L.F.	$6215.00
4 Outlet Structures	920.00
Sub-total	$7135.00

CULVERT ACROSS PARADISE VALLEY BLVD.
(3B to 6B)

50 L.F. 18" RCP (with FES)	$ 286.00

SPECIAL CROSS GUTTER - SUNBURST CIRCLE ON PARADISE VALLEY BLVD.

8' wide x 40' long	$ 300.00

OUTFALL POINT NO. 6

50 L.F. 18" RCP (with FES)	$ 286.00

DRAINAGE SWALE (Outfall for 22B & 23B)

300 L.F.	$ 200.00
Total Estimated Cost	$26882.00

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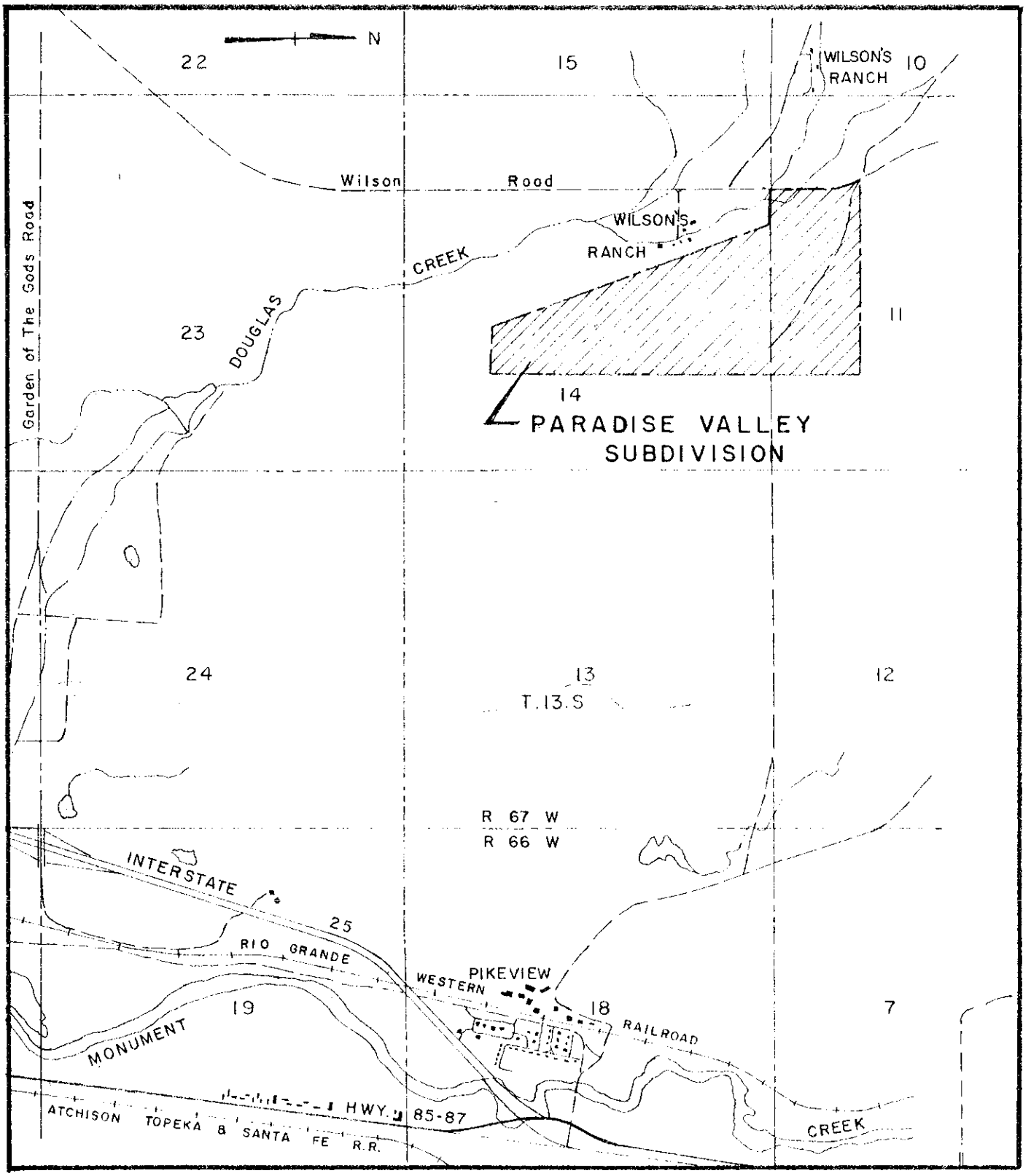


LOCATION MAP FOR PARADISE VALLEY SUBDIVISION

FIG. 1

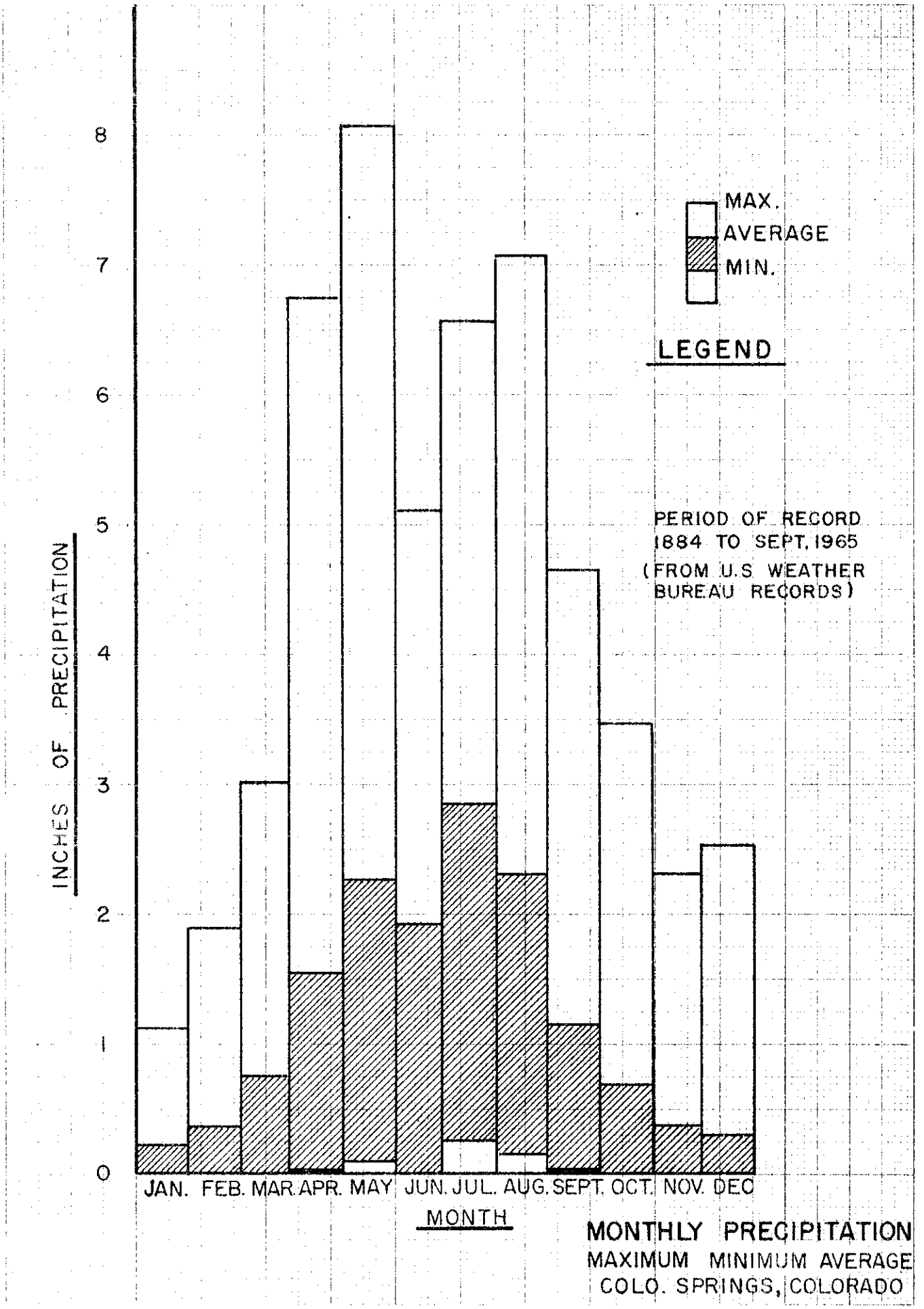

MAX.
AVERAGE
MIN.
LEGEND
PERIOD OF RECORD
1884 TO SEPT. 1965
(FROM U.S WEATHER
BUREAU RECORDS)
INCHES OF PRECIPITATION
0
1
2
3
4
5
6
7
8
JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEPT. OCT. NOV. DEC
MONTH
MONTHLY PRECIPITATION
MAXIMUM MINIMUM AVERAGE
COLO. SPRINGS, COLORADO

FIG. 11

OUTFALL POINT NO.9
5.37 C.F.S.

OUTFALL POINT NO. 7
27.98 C.F.S.

OUTFALL POINT
NO.5 65.75
C.F.S.

OUTFALL POINT NO. 6
10.0 C.F.S.
18" R.C.P.

DRAINAGE SWALE

CIRCLE 25B

CIRCLE 27B

CIRCLE 22B

DOG PRAIRIE 19B

BLVD 20B

SUNBURST 12B

PARADISE 4B

VALLEY 14B

LANE 10B

RABBIT

JACK 7B

BRUSH 5B

PAINT

SWALE

NO. 1
50' at 2.0%

18" R.C.P.
50' at 4.0%

NO. 2
50' at 2.0%

NO. 3
50' at 2.0%

NO. 4
50' at 2.0%

3 OUTLET STRUCTURES

4 OUTLET STRUCTURES

1 OUTLET STRUCTURE

4 OUTLET STRUCTURES

OUTFALL POINT
NO. 2. 96.96 C.F.S.
CULV II FIG 4.85

OUTFALL POINT
NO. 3 120.88 C.F.S.
CULV III FIG 4.85

OUTFALL POINT
NO. 4 138.47 C.F.S.
CULV IV FIG 4.85

OUTFALL POINT
NO. 1 67.52 C.F.S.
CULV. I FIGS 4.85

OUTFALL POINT NO. 8
8.01 C.F.S.

13.9 ACRES DOUGLAS CREEK BASIN

DRAINAGE BASIN B EXTENDS 3955' TO NORTH & INCLUDES 1B & 2B

WILSON PROPERTY
31.90 ACRES ±

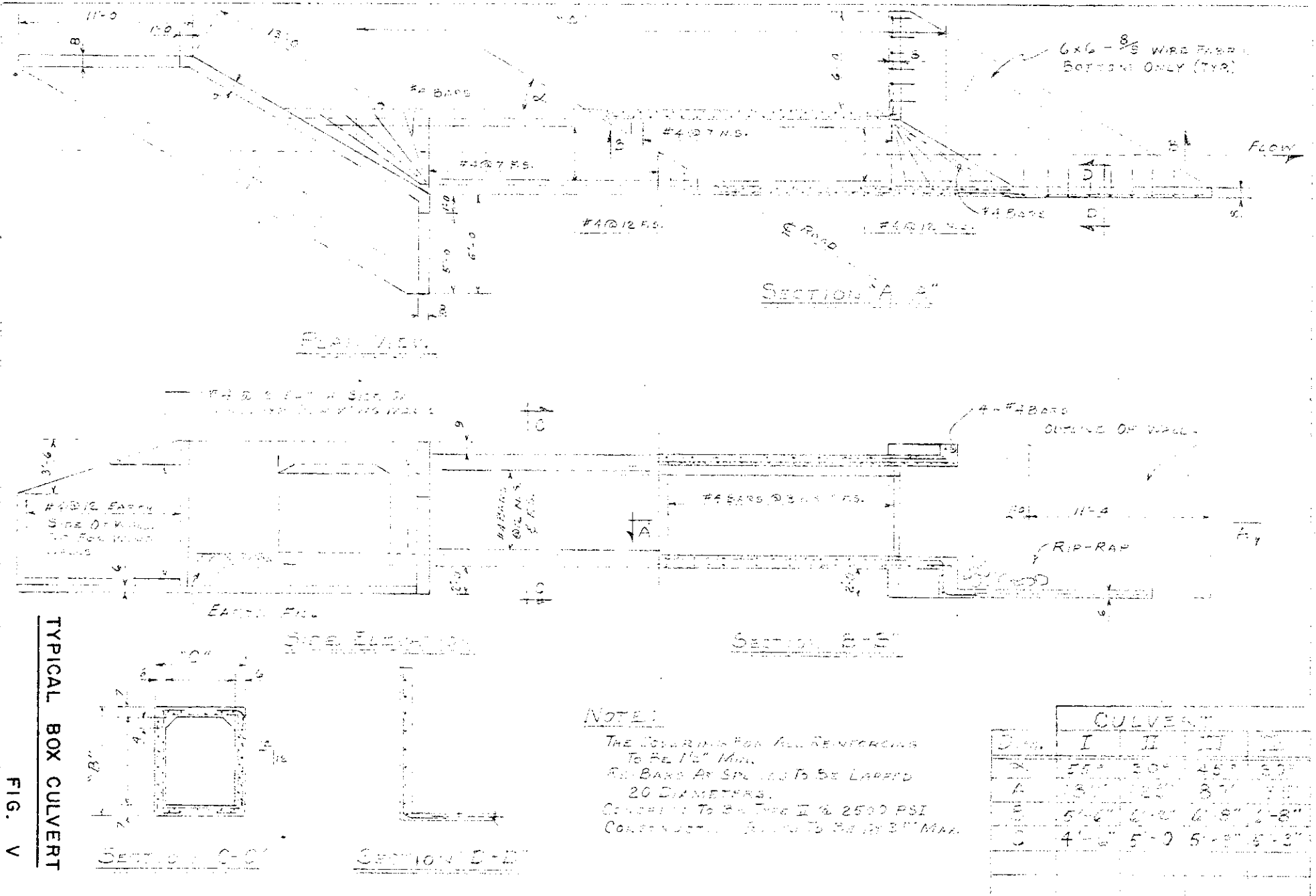
Scale 1" = 100

PARADISE VALLEY SUBDIVISION
DRAINAGE PLAN

LEGEND

- SUBDIVISION BOUNDARY
- DRAINAGE BASIN BOUNDARY
- 2 B SUB BASIN NO.
- DRAINAGE FLOW
- 5 LOT NO.
- DRAINAGE CROSSING
- OUTLET STRUCTURES

FIG III.
Page 10



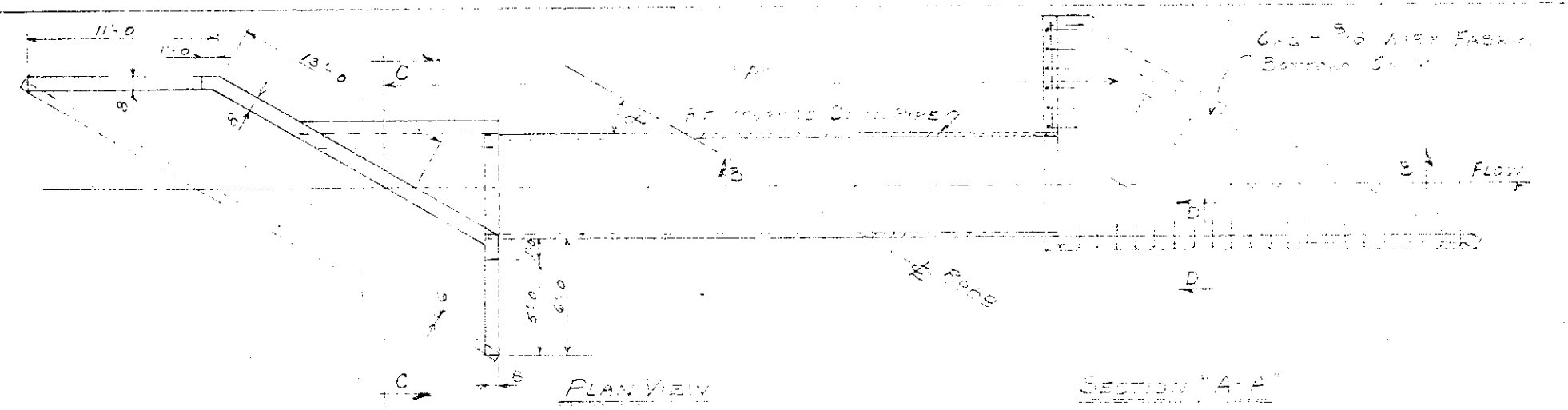
NOTE:

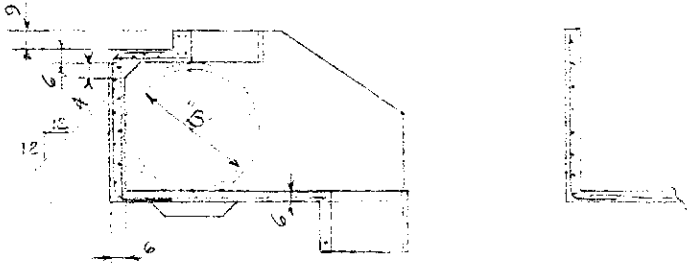
THE COVERING FOR ALL REINFORCING TO BE 1½" MIN.
ALL BARS AT SPLICES TO BE LAPPED 20 DIAMETERS.
CONCRETE TO BE TYPE II @ 2500 PSI
CONCRETE SLUMP TO BE (3" MAX.

DIM.	CULVERT I	II	III	IV
A	5'-6"	6'-2"	6'-8"	7'-8"
B	4'-6"	5'-0	5'-6"	6'-3"

TYPICAL BOX CULVERT

FIG. V





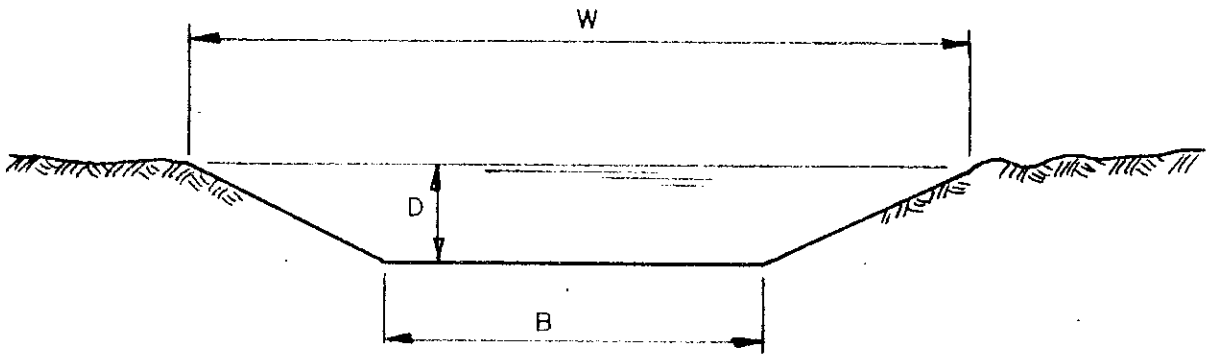
NOTE:

THE COVERING FOR ALL REINFORCING TO BE 1½" MIN.
RE-BARS AT SPLICES TO BE LAPPED 20 DIAMETERS.
CONCRETE TO BE TYPE II @ 2500 PSI
CONSTRUCTION JOINTS TO BE AT 35' MAX.

CULVERT				
α	55°	30°	45°	30°
A	180'	125'	80'	35'
B	48"	54"	60"	60"

TYPICAL R.C.P WITH WINGWALLS & HEADWALL

FIG. IV

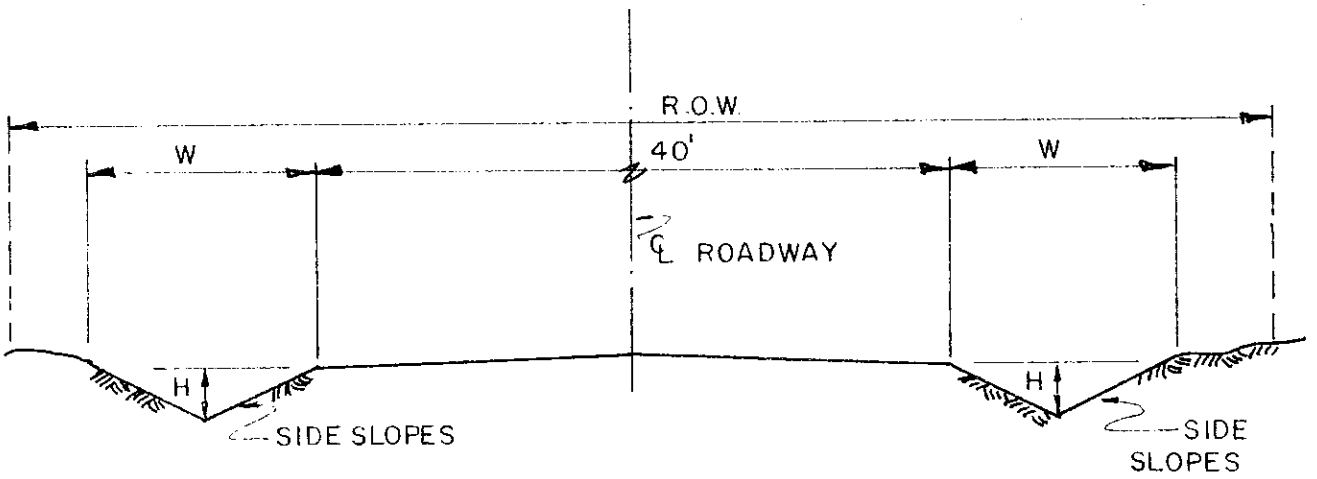


TYPICAL CHANNEL SECTION

OUTFALL TO OUTFALL	FT. W	FT. D	FT. B
1 — 2	9	1.5	3
2 --- 3	9	1.5	3
3 --- 4	11	2	3
4 ---- 5	11	2	3

MINIMUM DRAINAGE CHANNELS

FIG. VI.

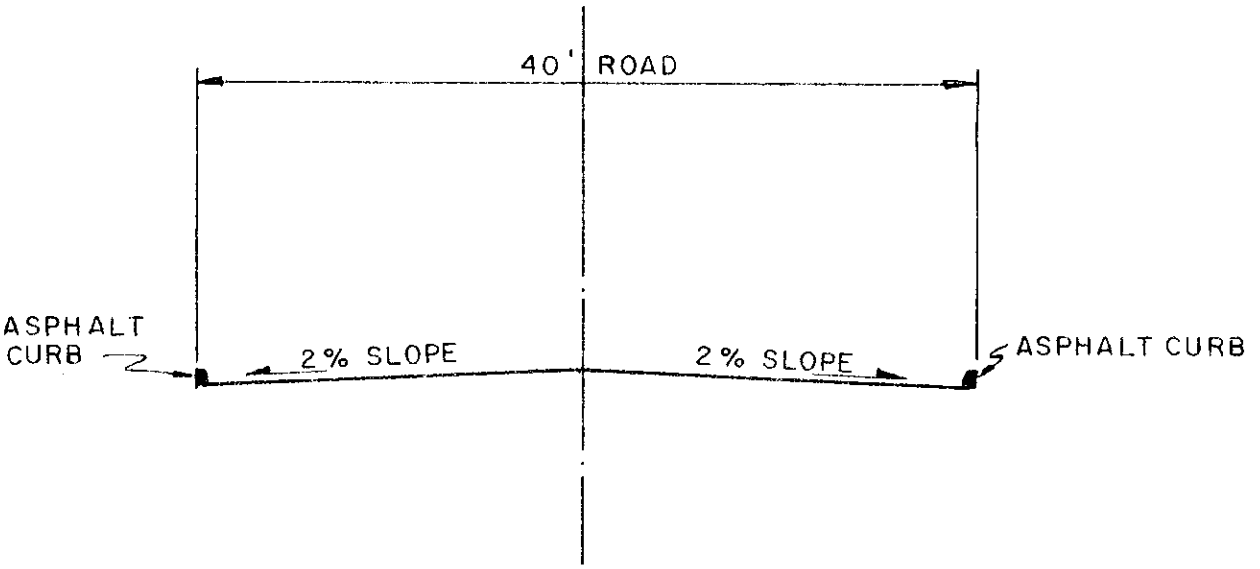


TYPICAL ROAD CROSS SECTION

DITCH AREA	FT. W	FT. H	SIDE SLOPE		DITCH AREA	FT. W	FT. H	SIDE SLOPE
1Ba	4	1	2 : 1		16 B	4	1	2 : 1
1Bb	4	1	2 : 1		17B	4	1	2 : 1
2B	6	1	3 : 1		18B	6	1	3 : 1
3B	6	1	3 : 1		19B	4	1	2 : 1
4B	4	1	2 : 1		20B	4	1	2 : 1
5B	4	1	2 : 1		22B	4	1	2 : 1
7B	4	1	2 : 1		24B	4	1	2 : 1
8B	4	1	2 : 1		25B	4	1	2 : 1
9B	4	1	2 : 1		26B	4	1	2 : 1
10B	4	1	2 : 1		27B	4	1	2 : 1
11B	6	1	3 : 1		1C	4	1	2 : 1
12B	6	1	3 : 1		2C	4	1	2 : 1
14B	4	1	3 : 1					
15B	4	1	2 : 1					

DITCH SCHEDULE

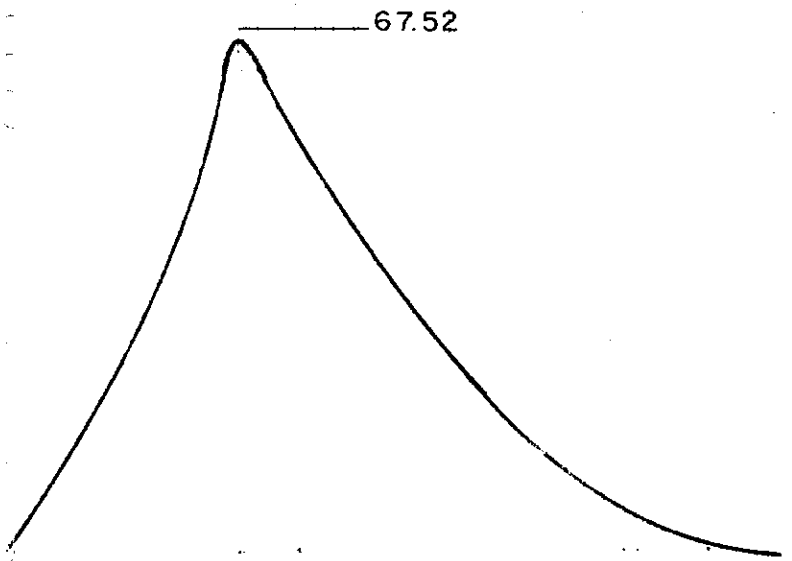
FIG. VII.

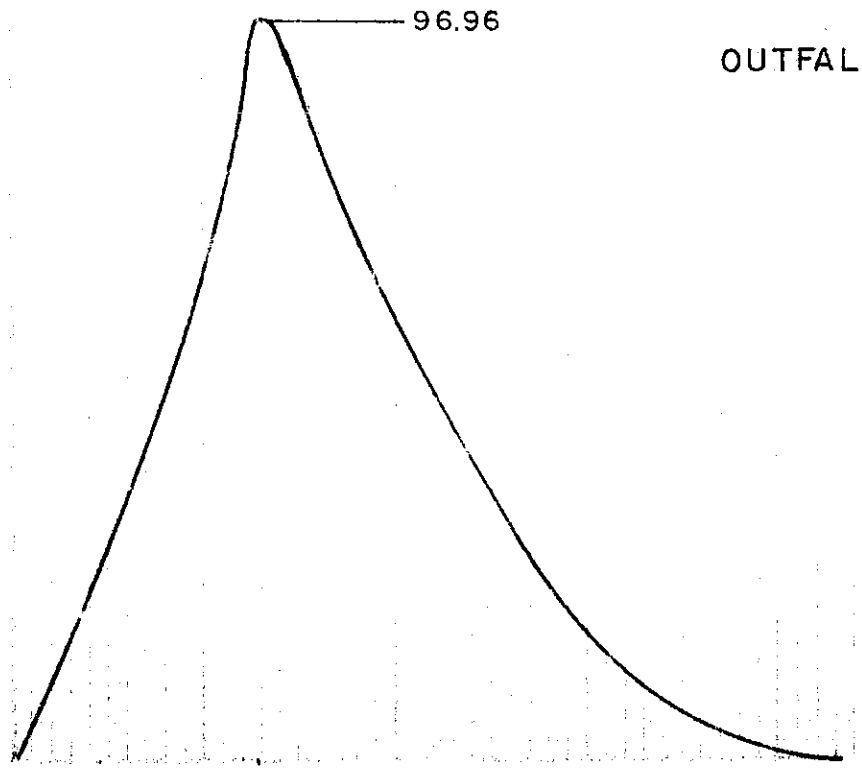


TYPICAL ROAD SECTION
WITH ASPHALT CURB

FIG. VIII

OUTFALL POINT NO. 1





OUTFALL POINT NO. 2

FIG IX

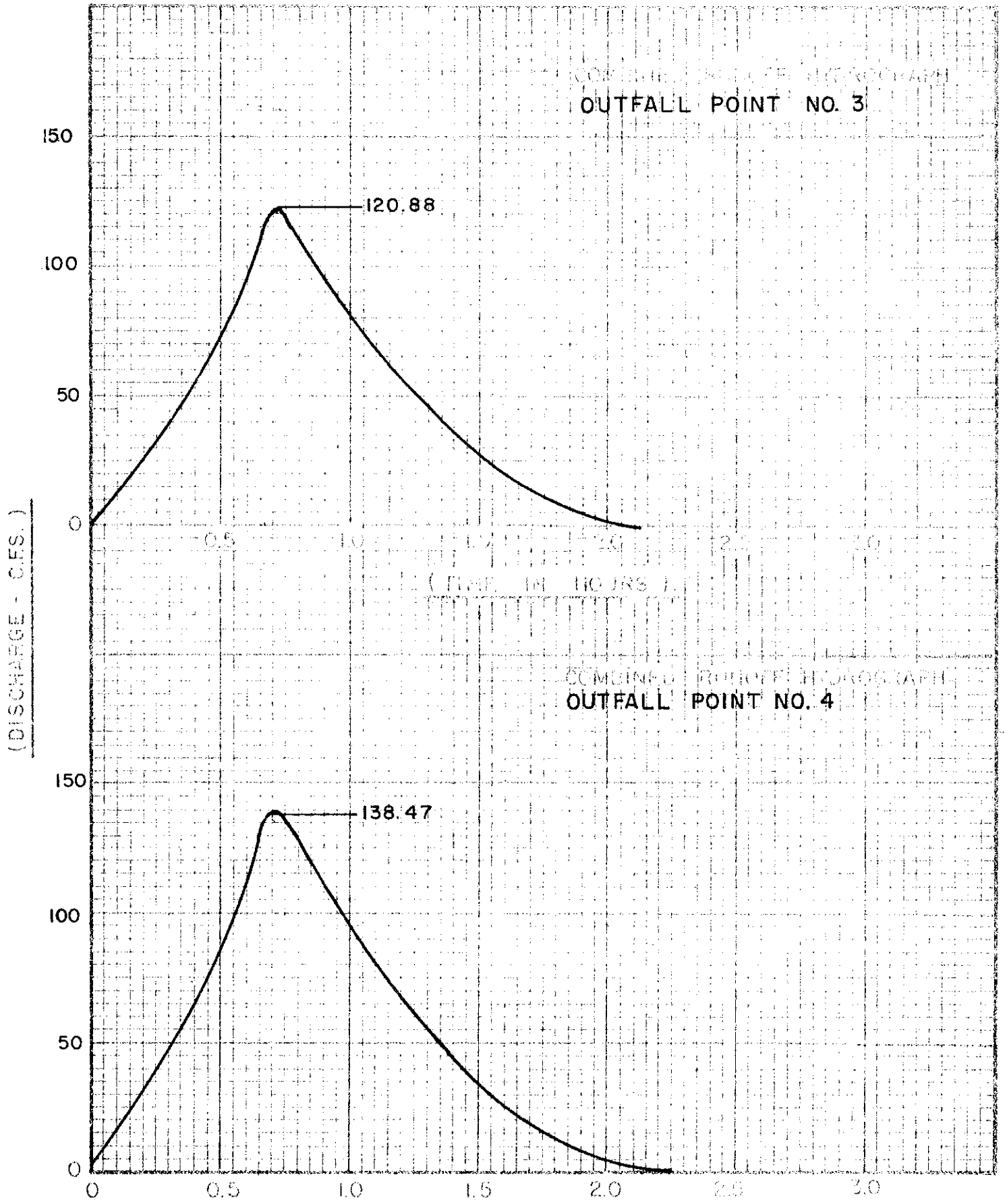

COMBINED ROUTED HYDROGRAPH
OUTFALL POINT NO. 3
120.88
150
100
50
0
0.5
1.0
2.0
(TIME IN HOURS)
COMBINED ROUTED HYDROGRAPH
OUTFALL POINT NO. 4
138.47
150
100
50
0
0
0.5
1.0
1.5
2.0
2.5
3.0
(TIME IN HOURS)
(DISCHARGE - C.F.S.)

FIG IX

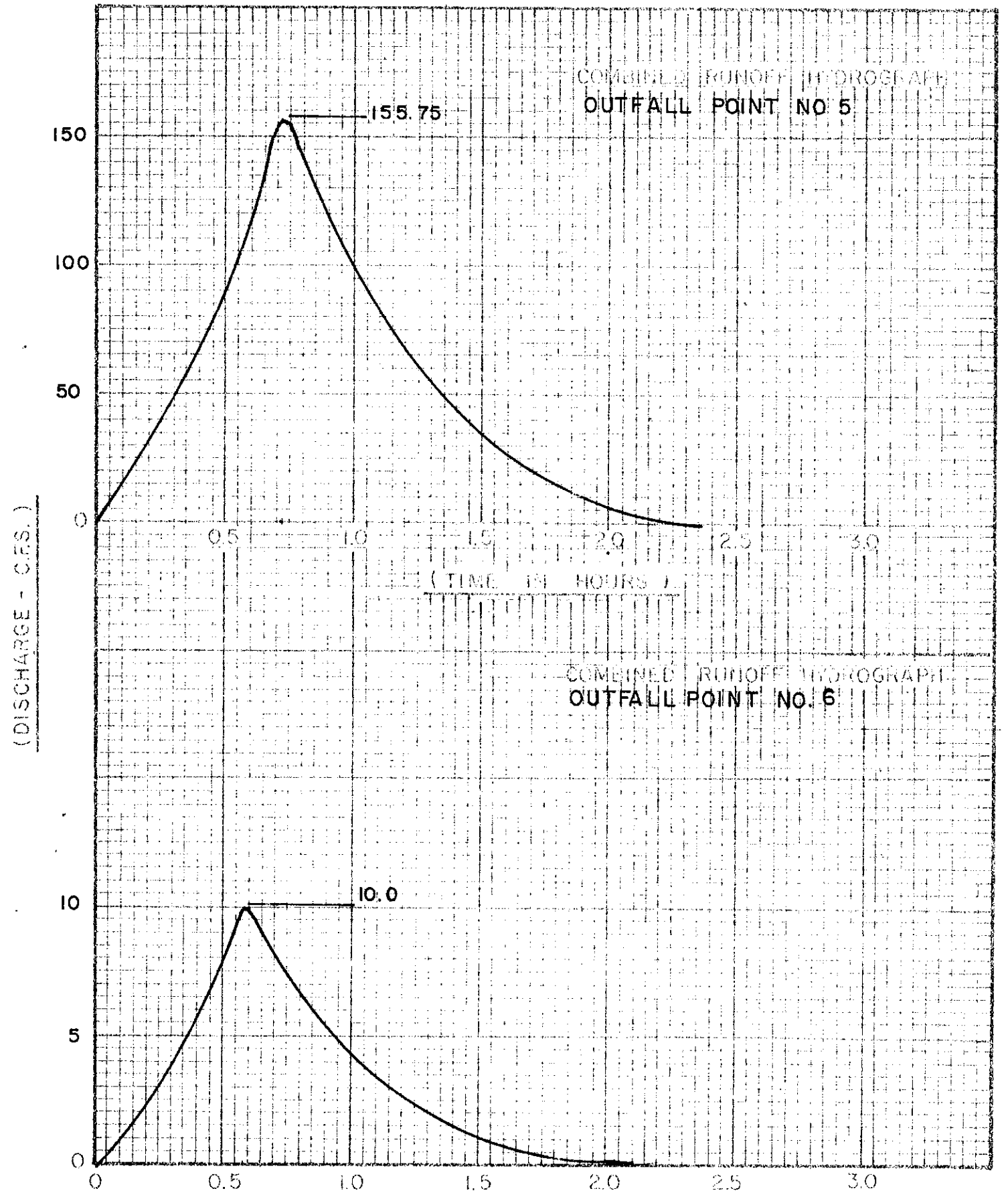

COMBINED RUNOFF HYDROGRAPH
OUTFALL POINT NO 5
155.75
150
100
50
0
0.5
1.0
1.5
2.0
2.5
3.0
(TIME IN HOURS)
COMBINED RUNOFF HYDROGRAPH
OUTFALL POINT NO. 6
10.0
10
5
0
0
0.5
1.0
1.5
2.0
2.5
3.0
(TIME IN HOURS)
(DISCHARGE - C.F.S.)

FIG IX

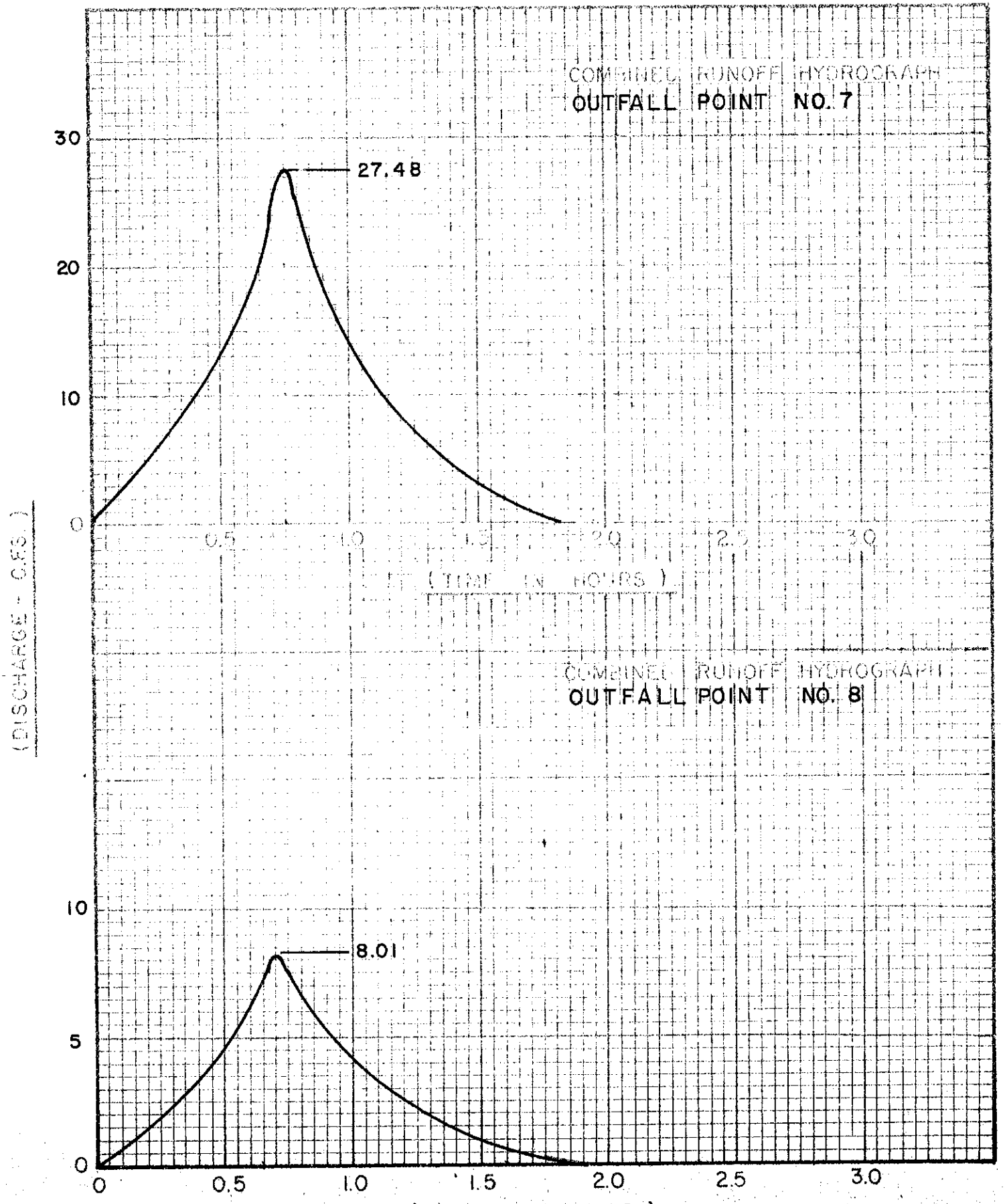

COMBINED RUNOFF HYDROGRAPH
OUTFALL POINT NO. 7
27.48
30
20
10
0
0.5
1.0
1.5
2.0
2.5
3.0
(TIME IN HOURS)
COMBINED RUNOFF HYDROGRAPH
OUTFALL POINT NO. 8
8.01
10
5
0
0
0.5
1.0
1.5
2.0
2.5
3.0
(DISCHARGE - C.F.S.)
(TIME IN HOURS)

FIG IX

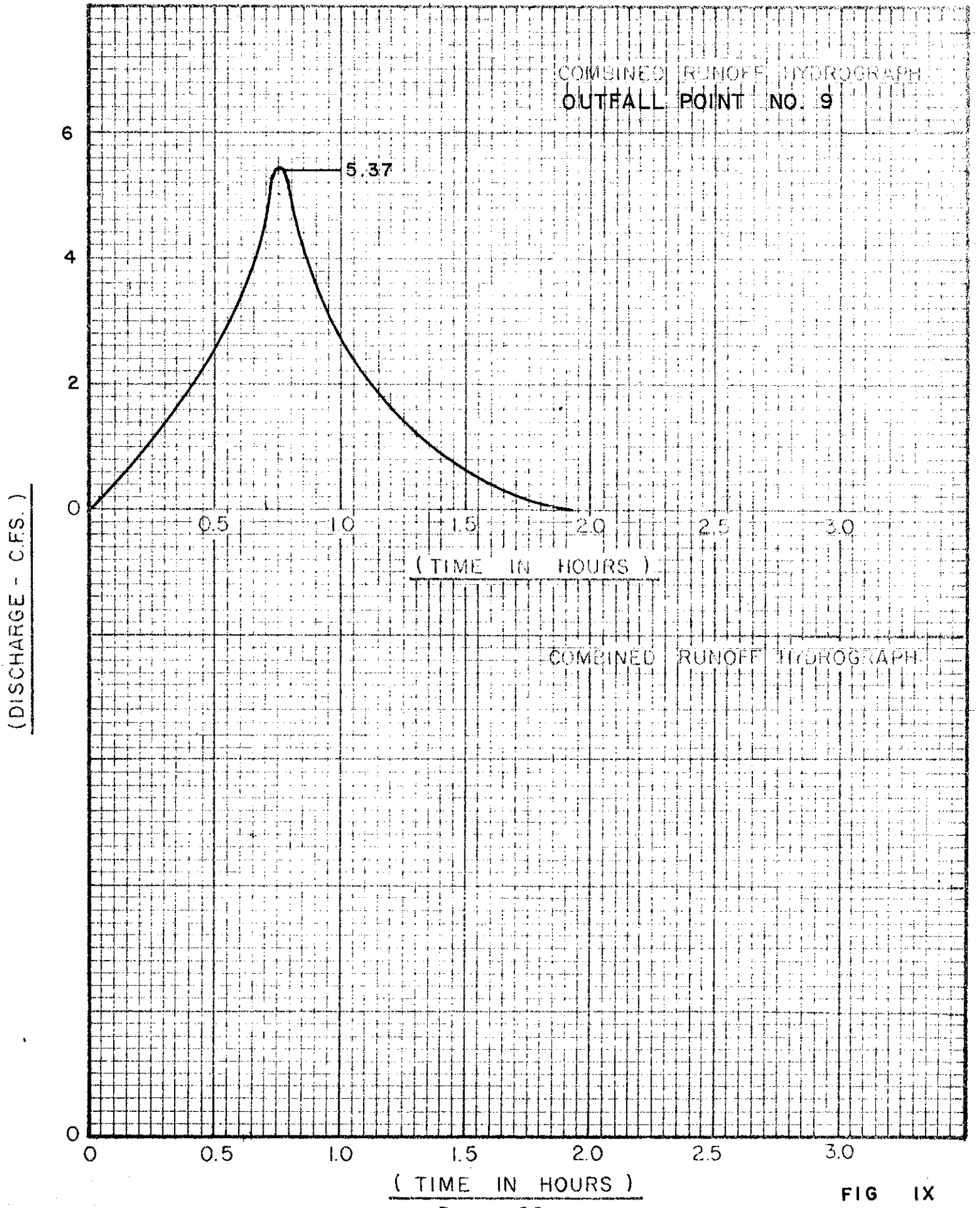

COMBINED RUNOFF HYDROGRAPH
OUTFALL POINT NO. 9
5.37
6
4
2
0
0.5
1.0
1.5
2.0
2.5
3.0
(TIME IN HOURS)
(DISCHARGE - C.F.S.)
COMBINED RUNOFF HYDROGRAPH
0
0
0.5
1.0
1.5
2.0
2.5
3.0
(TIME IN HOURS)

FIG IX

TABLE I

RUNOFF DISCHARGE

Area Designation	Area Miles ^{2}	Peak Q - 50 Year Storm CFS
A	.0120	5.37
1Ba Outfall Point	.1101	52.39
1Bd	.0049	2.61
2B	.0066	6.49
3B	.0110	8.22
4B	.0011	1.06
5B	.0010	.96
6B	.0211	8.95
6B Outfall Point	.1832	96.96
7B	.0010	5.18
8B	.0064	4.00
9B	.0158	8.33
10B	.0014	10.77
11B	.0209	11.03
12B	.0012	13.58
13B	.0203	8.76
13B Outfall Point	.2355	120.88
14B	.0006	.53
15B	.0121	6.39
16B	.0116	7.11
17B	.0099	5.31
17B Outfall Point	.2779	138.47
18B	.0209	12.64
19B	.0010	8.87
20B	.0013	1.17
21B	.0309	12.87
21B Outfall Point	.3310	155.75
22B	.0011	1.01
23B	.0188	9.90
24B	.0181	9.06
24B Outfall Point	.0191	10.00
25B	.0010	.96
26B	.0241	12.49
26B Outfall Point	.0446	27.48
27B	.0014	1.28
1C	.0025	1.74
2C	.0189	8.01