PETERSON FIELD

DRAINAGE BASIN

MASTER PLAN

NELSON, HALEY, PATTERSON & QUIRK, INC.

Return To: Gary Haynes

ENVIRONMENTAL NHPQ CONSULTANTS

PETERSON FIELD
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1974

NELSON, HALEY, PATTERSON and QUIRK, INC.
102 NORTH CASCADE SUITE 202
COLORADO SPRINGS, COLORADO

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SCOPE AND PURPOSE

The primary purpose of the preparation of a new Drainage Study of the Peterson Field Basin is to update previous plans to reflect new drainage design standards currently in effect, particularly the requirements to provide for a 100 year storm runoff. A secondary objective is to modify previous plans to reflect changes required by changes in the development of the basin.

To accomplish these objectives, a general approach to the overall study was established using the following elements:

1. Analyze the topography with present and planned development to establish drainage basin boundaries.
2. Calculate flow values at essential locations using a 100 year return period, one hour duration storm.
3. Inventory and analyze all existing drainage facilities.
4. Study alternate plans and estimate costs of proposed improvements.
5. Select the most desirable alternate plan.
6. Determine property status with respect to ownership, development plans, fee fee status, et cetera.
7. Recommend fees based upon the selected alternate and property status.

Subsequent sections of this report deal specifically with the study elements of the final plan adopted by the Drainage Board. This written report is to be used in conjunction with the Basin Map and the supplemental maps of the developed portion at the lower end of the basin. Study points and recommended improvements are shown on these maps.

BASIN DESCRIPTION

The Peterson Field Drainage Basin is an elongate area of 5,375 acres or 8.4 square miles in the southeast part of Colorado Springs. Its boundaries enclose portions of Township 14 South, Ranges 65 and 66 West of the 6th Principal Meridian. Only the lower part of the basin has been extensively developed. Slightly more than 40% of the basin area is within the limits of Peterson Field and thus restricted as to the type and extent of future development.

The topography of the area is a rolling, almost treeless plain that slopes gently to the southwest towards Fountain Creek. A soil cover of very porous sandy soils is found over all of the basin. These soils have developed over a thick alluvial layer of Pleistocene age. Bedrock exposures of Cretaceous sandstone occur near the northeast boundary of the basin.

High porosity of the soils in conjunction with the flat slopes and grassy vegetation create a relatively high infiltration rate and low runoff in the undeveloped areas. Little evidence of erosion and few water courses are found. The natural drainage system is ill-defined with indistinct subbasin boundaries and channels. Only in developed areas with manmade concentration of runoff is the channelization of stormwater evident.

Future development of the basin is anticipated to consist of low density residential areas northeast of the airport property. An area of commercial and light industrial development is expected between

the west airport boundary and the proposed Powers Boulevard.

The development of the lower part of the basin should continue as higher density residential areas. Preliminary planning for future development, when available, has been utilized in the preparation of this report.

DRAINAGE BASIN BOUNDARIES

The overall boundaries of the entire basin were reviewed to determine their current accuracy based upon additional topographic data available for this study. Major boundary changes from those of older studies were made in the southwest portion of the basin based on topography and current development. Boundary selection in the undeveloped area of this portion is somewhat arbitrary and may be displaced by street patterns and grading operations as it is developed.

Boundary lines of interior subbasins were established using all available topographic information, planned development, and the capability of existing facilities to carry the increased flow anticipated from a 100 year storm. The location of subbasin boundaries was also dependent upon the location of proposed facilities.

RUNOFF DETERMINATION

Flow quantities of runoff were computed by using the unit hydrograph procedure. This procedure requires input of the following factors:

1. Basin Size
2. Basin Shape
3. Soil Conditions
4. Slope
5. Impervious/Pervious Area Ratio
6. Rainfall Intensity
7. Storm Pattern

The first four items are physical properties of the basin and generally are not subject to adjustment by the hydrologist. The remainder are not as easily defined and are usually established as a matter of policy by the study agency. For this study the following parameters were established:

Impervious/Pervious Area Ratio - Existing land development, existing zoning, and projected land use were used to assume the ultimate land use pattern at the time of total basin development. Based upon this assumption, the percentages of impervious and pervious were established utilizing accepted values for each land use category.

Rainfall Intensity - Rainfall intensity defines a rate of rainfall for a given time interval and does not establish a storm pattern.

For this study, it was assumed that the design storm would produce a total of 2.5 inches of rainfall in a one hour period. This value is the maximum rainfall expected to occur in one hour on a 100 year return basis. This does not mean that this rate of rainfall will not be exceeded for shorter time durations (see Figure 1).

Storm Pattern - The manner in which precipitation occurs in a storm significantly affects the amount of runoff generated from a given area. A 100 year storm with a duration of six hours may produce a total rainfall of 3.5 inches while a 100 year storm lasting only one hour would produce a total of 2.5 inches with a lower volume of runoff but the same peak rate of runoff. Drainage facilities are sized on the basis of the peak runoff; thus, the pattern must be selected to produce peak runoff values consistent with the selected storm return frequency despite the duration of the storm.

The unit hydrograph for each area was used to calculate the storm hydrograph for that area for a 100 year storm. The actual calculations were performed by a Xerox Sigma III Computer System. The computer was so programmed that the printout gave a graphical as well as a tabular hydrograph solution. The computer program was capable of modifying the hydrographs on the main channel to show the effects of the detention storage pond on Peterson Field.

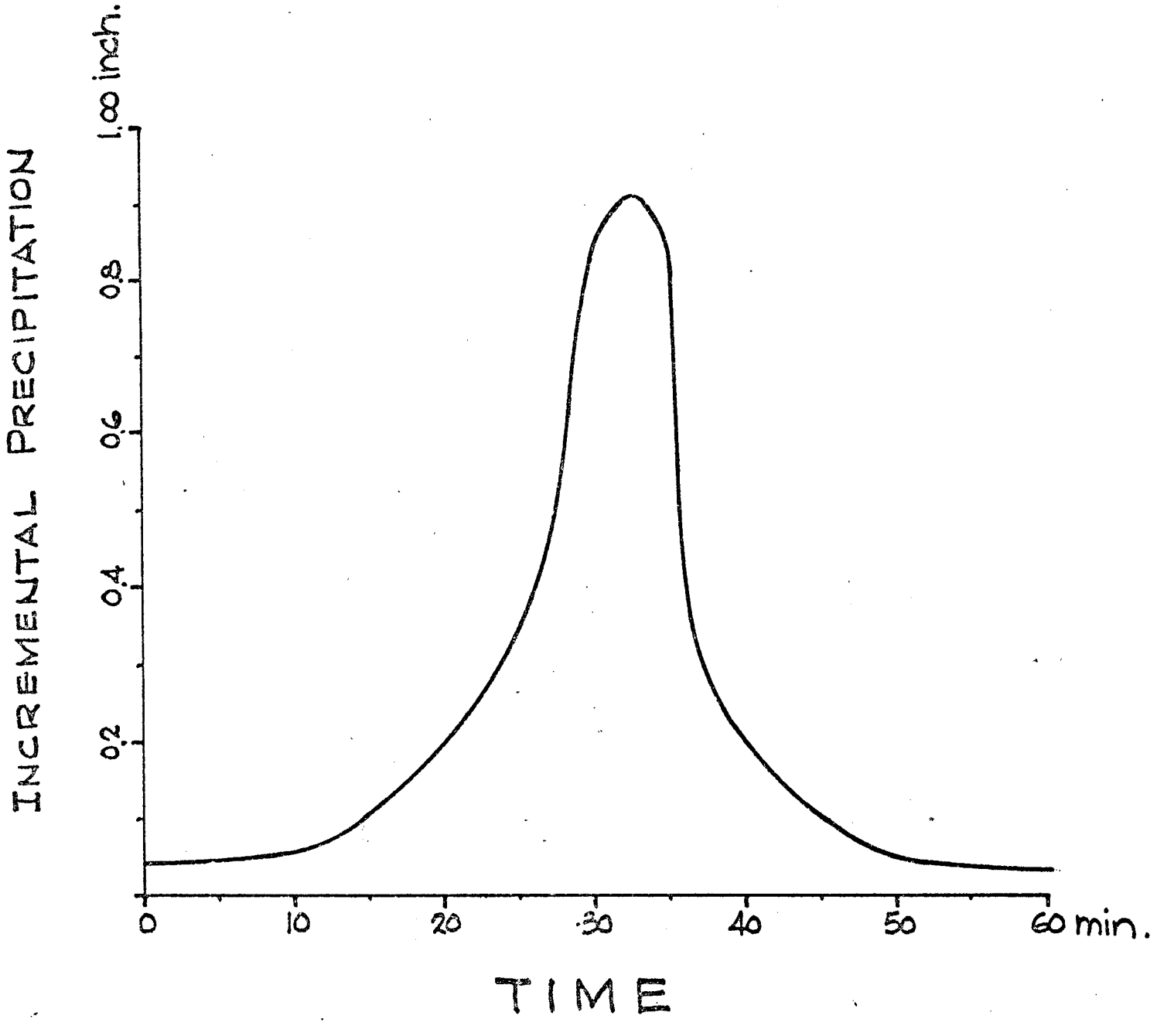
INCREMENTAL PRECIPITATION
0.2
0.4
0.6
0.8
1.00 inch.
0
10
20
30
40
50
60 min.
TIME

FIGURE I

The main drainage channel for the basin, most secondary facilities, and all bridges were sized using the peak runoff flow values from the storm hydrographs for a 100 year storm. Some minor subbasin facilities were sized using the Rational Method and a 50 year return storm.

Runoff hydrographs and effective rainfall determinations for the study points indicated on the Basin Map can be found in the appendix of this report. Peak flow values (Q) for these points are presented on Table I.

TABLE I

PEAK FLOW VALUES

Study Point	Q_{100} (cfs)
2	702
3	1,632
4 (into Detention Pond)	2,972
5	578
6	1,999
7J (Main Channel Flow)	2,072
8	2,183
9J	2,374
10J (Main Channel Flow)	3,363
11	3,713
12	3,713
21	488
22	521
23	891
7J (Powers Channel)	1,242
31	197
32J (Open Channel)	620
33	1,058
9J (Secondary Channel from the North)	1,058
40	244
32J (84" RCP)	628
51	121
53	249
10J (Secondary Channel from the North)	474

Study Point	Q_{50}
61	45
62	65
63	110
64	156

EXISTING FACILITIES

All major drainage facilities in existence at the time of the study are shown on the maps accompanying this report. The majority of these improvements were provided by the land developer and were designed to handle the flows from a 50 year storm. Generally speaking, most of these improvements do not have an adequate capacity to carry the projected runoff from a 100 year storm after full land development of the basin. To protect the investment in these facilities they were incorporated in the proposed system when possible. This necessitated some relocation of subbasin boundaries to balance 100 year flows with existing capacity. Description of major facilities are provided in the following paragraphs.

Area North and East of Peterson Field

No major drainage facilities have been constructed in this area. Existing facilities are mainly roadside ditches and culverts which appear to perform in a satisfactory fashion for existing conditions. Most of this area has not been developed and future projections call for large tract, low density development. Grass lined channels, improved roadside ditches and culverts will be required as the area develops in the future.

Peterson Field

The present drainage facilities within the airport boundaries have shown no serious deficiency to date. That portion of Peterson Field

occupied by the Air Force contains a storm sewer system which was designed and constructed by the Corps of Engineers. As this system is also maintained by them, it is assumed that any deficiencies will be corrected by the Corps of Engineers. Existing facilities within the Colorado Springs Municipal Airport portion of Peterson Field were not analyzed in this report since a recent drainage study was prepared by R. Keith Hook and Associates, Inc. for the airport. For more details on existing and proposed facilities see "Peterson Field Airport North-South Runway and Facilities West", July, 1973. The outfall points in the above report were coordinated with the facilities proposed in this basin study. The existing pond area west of the runway system is not adequate to contain the funoff from a 100 year storm and must be enlarged.

Hancock Crossing

The 72 inch corrugated metal pipe under Hancock Expressway does not have the capacity to transmit the anticipated peak flows when the basin is fully developed. However, future plans call for this portion of Hancock to be abandoned and a new structure of adequate size should be installed when the proposed new alignments of Hancock and Chelton are built.

Academy Crossing

A five barrel, 5' x 9 1/2' box culvert was built by the highway department where the present main channel crosses Academy Boulevard. Heavy siltation has almost closed this structure. The capacity of this structure when clear of obstruction is approximately 2,600 cfs. With the complete development of the basin, the peak flow at this point from

a 100 year storm would be 3,713 cfs even with the proposed detention storage upstream. The proposed realignment of the main channel to the north will result in only minor local drainage from the Colony Hills area passing through this culvert. The same situation exists at the box culvert on Colony Hills Circle which is completely blocked by silting. While inadequate for the main channel flow it will be large enough for the anticipated subbasin drainage.

Open Channel - Astrozon to Hancock

An existing concrete lined trapezoidal channel runs from the intersection of Chelton and Astrozon to Hancock. This channel has several changes in alignment and some constrictions at street crossings. The projected 100 year peak runoff at one of the 90° bends is 574 cfs. To prevent flooding of the adjacent residential area it is proposed that this subbasin be altered so that the drainage from the area north and east of Chelton and Astrozon be diverted to the adjacent subbasin. The existing channel should then be able to safely carry the anticipated flow of 249 cfs. The present outlet of this channel is a double barrel 3' x 9' box culvert across Hancock with a capacity of 378 cfs. The proposed diversion of the upper portion of the subbasin should make this structure safe for 100 year flows.

Northeast of Chelton and Astrozon

A combination open channel and 72 inch concrete pipe now carries the flow from this area into the open channel discussed in the previous

paragraph. This flow is to be diverted into a conduit on the east side of Chelton as previously stated. This pipe and channel are adequate for the flow resulting from a 50 year storm without flooding the adjacent streets.

Western Meadows

A concrete lined channel runs through this mobile home park from Astrozon to the south city limit. This channel and the street crossings were designed to carry 230 cfs but full development upstream and a 100 year storm would cause a flow far in excess of this capacity. With a change in subbasin boundaries and the diversion of runoff east of the proposed Powers Boulevard the area above the channel is greatly reduced and the channel should prove adequate for the reduced flows.

MASTER PLAN

The recommended master plan is shown on the Basin Map and the supplemental large scale maps. Pertinent data for the various facilities are tabulated in the following tables. It should be realized that proposed facilities in undeveloped areas were located and sized on anticipated development. Some changes in slope, alignment, or configuration may be desirable by the developer. Any changes from the recommendations in this report should have an equivalent capacity and, if open channels, sub-critical velocity should be maintained. Drop structures will probably be required in most open channels to maintain the required slope for sub-critical velocities. The location and height of these drop structures are left to the discretion of those who prepare the detail plans.

Natural channels within the basin do not have the capacity to transmit the large volumes anticipated from major storms without flooding adjacent areas. Future development with its subsequent faster concentration of runoff and larger flow quantities as more impervious cover is added requires that new drainage facilities be installed as growth occurs.

Several choices are available as to the type of facilities which may be used to remove excess water resulting from a 100 year storm. Direct construction and future maintenance costs are evident factors in the selection of an alternate type. Other considerations are accessibility, efficient land utilization, esthetics, permissible

velocities, soil conditions, and natural slope of the ground surface. While some of these items can be controlled by the designer, others must be accepted as they exist. The various types of improvements recommended in this report are discussed in the following paragraphs.

Grass Lines Channels

Earth or grass lined channels are probably the most esthetically acceptable of the alternates as they most closely resemble natural water courses. The major limitation of this type of channel is the requirement for slow velocities to limit erosion. This demands a larger cross-section for equivalent capacity and thus requires a larger area of land be reserved for drainage use. Even though lower initial costs can be expected, these channels require frequent maintenance to control erosion and undesirable vegetation.

The main channel upstream from the west boundary of Peterson Field is the only major channel recommended to be of this type within the basin. This channel should be designed with a maximum depth of six feet (including freeboard) and 3:1 side slopes. An allowable velocity of 7 fps requires that the sides and bottom of the channel have a good dense grass cover to minimize erosion. The recommended right-of-way width includes 32 feet outside the channel proper for maintenance access.

Concrete Lined Channels

Concrete lined open channels are a feasible compromise for large flows between grassed earth channels and covered conduits. Although

more expensive to construct than earth channels and with a less pleasing appearance, they offer considerable savings in surface area requirements and in future maintenance costs. Although the lining prevents erosion, velocities should be restricted to the sub-critical range as a safety measure and to prevent hydraulic jumps with subsequent overtopping of the lining.

The concrete lined channels proposed were sized with a six foot wide flat bottom for convenience in maintenance. Side slope ratios of 2:1 were used and the velocities were restricted to 10 fps except for the main outfall below Academy where 13 fps was used. The right-of-way requirements were based on the top width of the channel plus 16 feet on either side for construction and maintenance access.

Enclosed Conduits

Enclosed conduits, whether pipe or cast-in-place, offer a most desirable long term solution for removal of runoff. They require a minimum amount of property for construction and use, cannot be seen, and are relatively maintenance free. These advantages are offset by high installation costs, especially for the larger facilities needed to transmit high peak runoff volumes. All concrete pipe shown on this plan was sized by following the slope of the existing ground surface.

Detention Storage

Facilities for the temporary storage of excess runoff with a controlled rate of discharge over a longer period of time can result

in substantial cost savings for downstream channels. The maximum discharge rate from the storage pond becomes the controlling factor rather than peak runoff rates. The net savings are dependent upon the availability of an adequate area for the detention pond and the topographic suitability of the area. In the Peterson Field Basin the availability of large clear areas on the airport property near the main channel makes this alternative feasible. The location chosen for the detention pond is an existing basin and will require a minimum of excavation to provide the required 300 acre-feet storage capacity. Construction of this pond can be incorporated in future airport expansion in this vicinity or it can be a separate project when development of the area east of the airport causes excessive runoff to the main channel. All peak flows downstream from this storage pond were calculated with a maximum release rate from the storage pond of 160 cfs.

Non-Specified Facilities

Facilities other than those specifically mentioned in this report will be required as the basin is developed. In general, internal facilities such as inlets, catch basins, and a conveyance facility to the major drains will be needed. While it is not possible to identify specific requirements until development plans are completed, general cost estimates are possible based upon comparisons with similar areas. Using this approach those undeveloped areas remotely located from identified improvements were measured and the acreage multiplied by an estimated cost per acre.

TABLE II

MAIN CHANNEL IMPROVEMENTS

Reach	Q_{100} (cfs)	Lining	Size*	Slope	Velocity	R.O.W.
1 - 2	702	Grass	13 x 49 x 6	0.0076	7 fps	81 feet
2 - 3	1,000	Grass	24 x 60 x 6	.0065	7 fps	92 feet
	1,632	Grass	46 x 82 x 6	.0056	7 fps	114 feet
3 - 4	2,972	Grass	94 x 130 x 6	.0050	7 fps	162 feet
4 - 5	578	Grass	8.5 x 44.5 x 6	.0084	7 fps	77 feet
5 - 6	1,999	Grass	60 x 96 x 6	.0053	7 fps	128 feet
6 - 7J	2,072	Concrete	6 x 50 x 11	.0014	10 fps	82 feet
7J - 8	2,183	Concrete	6 x 50 x 11	.0014	10 fps	82 feet
8 - 9J	2,374	Concrete	6 x 50 x 11	.0014	10 fps	82 feet
9J - 10J	3,363	Concrete	6 x 60 x 13.5	.0010	10 fps	92 feet
10J- 11	3,713	Concrete	6 x 64 x 14.5	.0010	10 fps	96 feet
11 - 12	3,713	Concrete	6 x 64 x 14.5	.0010	10 fps	96 feet

Detention Pond with 300 acre-feet capacity at Point 4.

*Bottom x Top x Depth

TABLE III

SECONDARY CHANNEL IMPROVEMENTS

Reach	Q (cfs)	Type	Size	Slope	Velocity	R.O.W.
20 - 21	488	RCP	66 in.	0.0257	-	20 feet
21 - 22	521	RCP	78 in.	.0125	-	20 feet
22 - 23	891	RCP	78 & 90 in.	.0100	-	25 feet
23 - 7J	1,242	RCP	96, 102, & 108 in.	.0102	-	25 feet
30 - 31	197	RCP	48 in.	.0204	-	20 feet
31 - 32J	620	Concrete channel	6 x 38 x 8	.0023	9 fps	25 feet
32J- 33	1,058	RCP	96 in.	.0136	-	25 feet
33 - 9J	1,058	Concrete channel	6 x 30 x 6	.0023	10 fps	65 feet
40 - 41		RCP	72 in.	.0157	-	20 feet
41 - 32J	628	RCP	84 in.	.0088	-	25 feet
53 - 10J	474	Concrete channel	6 x 25 x 5	.0024	9 fps	42 feet
60 - 61	45	Grass	6 x 22 x 2	.0150	5 fps	23 feet
61 - 62	65	Grass	6 x 24.5 x 2.5	.0150	5 fps	24.5 feet
62 - 63	110	Grass	6 x 30 x 3	.0067	7 fps	30 feet
63 - 64	156	Grass	6 x 34 x 3.5	.0049	7 fps	34 feet

ESTIMATED CONSTRUCTION COSTS

The estimated costs of facilities including a ten percent contingency factor are summarized on the following pages. These estimates will probably require periodic adjustment to reflect inflationary pressures. The unit costs used in calculating these estimates are as follows:

Item	Unit Cost
Structural Excavation	$2.00 per C.Y.
Unclassified Channel Excavation	$0.60 per C.Y.
Structural Concrete	$135.00 per C.Y.
Concrete Lining	$85.00 per C.Y.
RCP Conduits	$0.80 per inch diameter per lineal foot

PETERSON FIELD

ESTIMATED COSTS

DRAINAGE						BRIDGE	
Reach	Type	Cost + 10%	Developer	City	Airport	Bridge Location	Cost + 10%
1 - 2	Grass Channel	$21,440	$ 21,440			Marksheffel Rd.	$ 11,900
2 - 3	Grass Channel	67,030	67,030				
3 - 4	Grass Channel	39,910			$39,910		
4 - 5	Grass Channel	40,180			40,180		
5 - 6	Grass Channel	25,890			25,890	Point 6	36,610
6 - 7J	Concrete Channel	257,380	257,380			Powers Blvd.	52,990
7J- 8	Concrete Channel	300,970	300,970			Chelton Rd.	30,280
8 - 9J	Concrete Channel	175,400	175,400				
9J- 10J	Concrete Channel	242,370	242,370				
10J-11	Concrete Channel	161,560	161,560			Academy Blvd.	70,550
11 - 12	Concrete Channel	373,040	373,040				
20 - 21	66" RCP	82,940	82,940				
21 - 22	78" RCP	69,190	69,190				
22 - 23	78" & 90" RCP	155,230	155,230				
23 - 7J	96", 102" & 108" RCP	348,480	308,880	$39,600			

		DRAINAGE				BRIDGE	
Reach	Type	Cost + 10%	Developer	City	Airport	Bridge Location	Cost + 10%
30 - 31	48" RCP	$67,420	$67,420				
31 - 32J	Concrete Channel	124,040	124,040				
32J- 33	96" RCP	137,500	68,750	$68,750			
33 - 9J	Concrete Channel	62,520	62,520				
Point 40						Inlet section at Fountain Blvd.	$ 5,500
40 - 41	72" RCP	172,960	172,960				
41 - 32J	84" RCP	159,120		159,120			
53 - 10J	Concrete Channel	52,100	52,100				
Non-specified Improvements		495,000	495,000				
Detention Pond		715,000	238,334	238,333	238,333		
Colony Hills Outfall	Grass Channel	6,000	4,040	1,960			
TOTAL		$4,352,670	$3,500,594	$507,763	$344,313		$207,830

FEE DETERMINATION

Both a Drainage Basin Fee and a Bridge Fee are required to be paid by developers to pay the costs of required improvements in the basin. Certain costs are also to be paid by the City of Colorado Springs to increase the capacity of the existing drainage system so that flows from a 100 year storm can be transmitted. The area enclosed by Peterson Field itself was not used in determining the fee structure and the costs of drainage facilities required on the airport are to be borne by the airport except for the costs of the detention pond which are to be shared equally by the airport, the city, and developers.

The following table shows the derivation of the Drainage Fee and the Bridge Fee. The net acreage for fee assessment was derived by subtracting the area of city owned property and the area on which Drainage Fees have been previously paid from the gross area of the basin. The costs for improvements on the airport property and the costs to be paid by the city for upgrading to the 100 year storm capacity were subtracted from the gross cost estimates of improvements within the basin. The unit fees were then calculated by dividing the net costs to developers by the net acreage available in the basin for future development.

FEE DETERMINATION

Gross Basin Area	5,375 acres
Area of Peterson Field within Basin	- 2,175 acres
Net Area in Basin Available for Development	3,200 acres

Estimated Cost of Bridges in the Basin $207,830

Bridge Fee:
$207,830 ÷ 3,200 acres = $65.00 per acre

Net Basin Area Available for Development	3,200 acres
Area Previously Developed or Drainage Fee Paid	- 480 acres
Net Area to be Assessed Drainage Fee	2,720 acres

Estimated Cost of Drainage Improvements to Developers $3,500,594

Drainage Fee:
$3,500,594 ÷ 2,720 acres = $1,289 per acre

APPENDIX

DETERMINATION OF EFFECTIVE RAINFALL

I-2 PETERSON FIELD DRAINAGE

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 96%				IMPERVIOUS AREA 4%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	96 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	4% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.004	0.004
30	2.195	0.351	0.461	0.083	0.261	0.117	0.112	0.000	0.023	0.438	0.018	0.130
40	2.317	0.122	1.383	0.083	0.000	1.299	1.247	0.000	0.069	1.314	0.053	1.300
50	2.416	0.099	0.351	0.083	0.000	0.268	0.257	0.000	0.018	0.334	0.013	0.270
60	2.500	0.084	0.099	0.083	0.000	0.016	0.015	0.000	0.005	0.094	0.004	0.019
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.632	0.100	0.125	2.279	0.091	1.723

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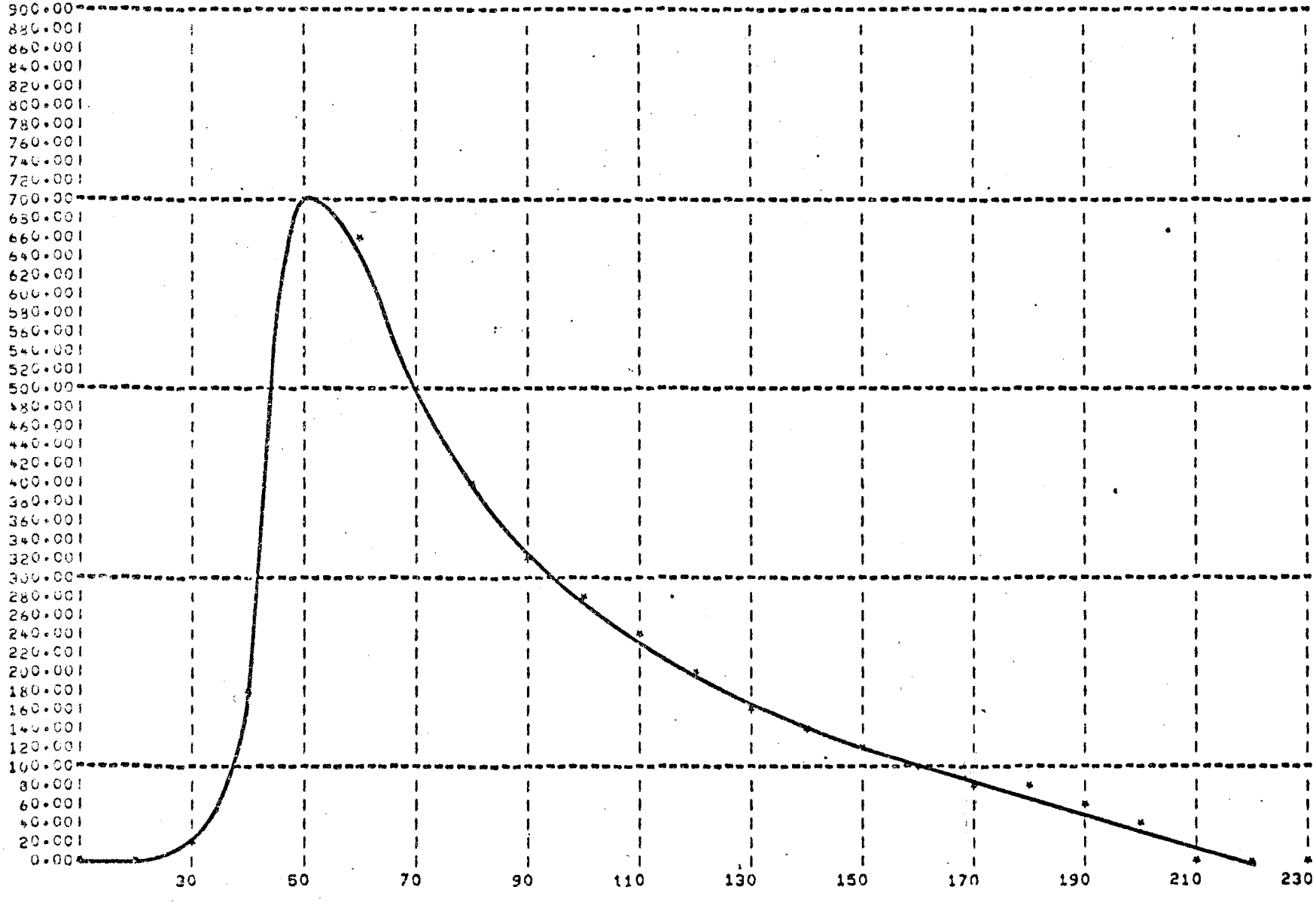
STORM HYDROGRAPH

I-2 PETERSON FIELD DRAINAGE
100 YEAR STORM

TIME TO PEAK=50.0 MIN. PEAK RUNOFF= 702.3 CFS RUNOFF VOL.= 59.7 ACRE FEET



DETERMINATION OF EFFECTIVE RAINFALL

2-3 PETERSON FIELD

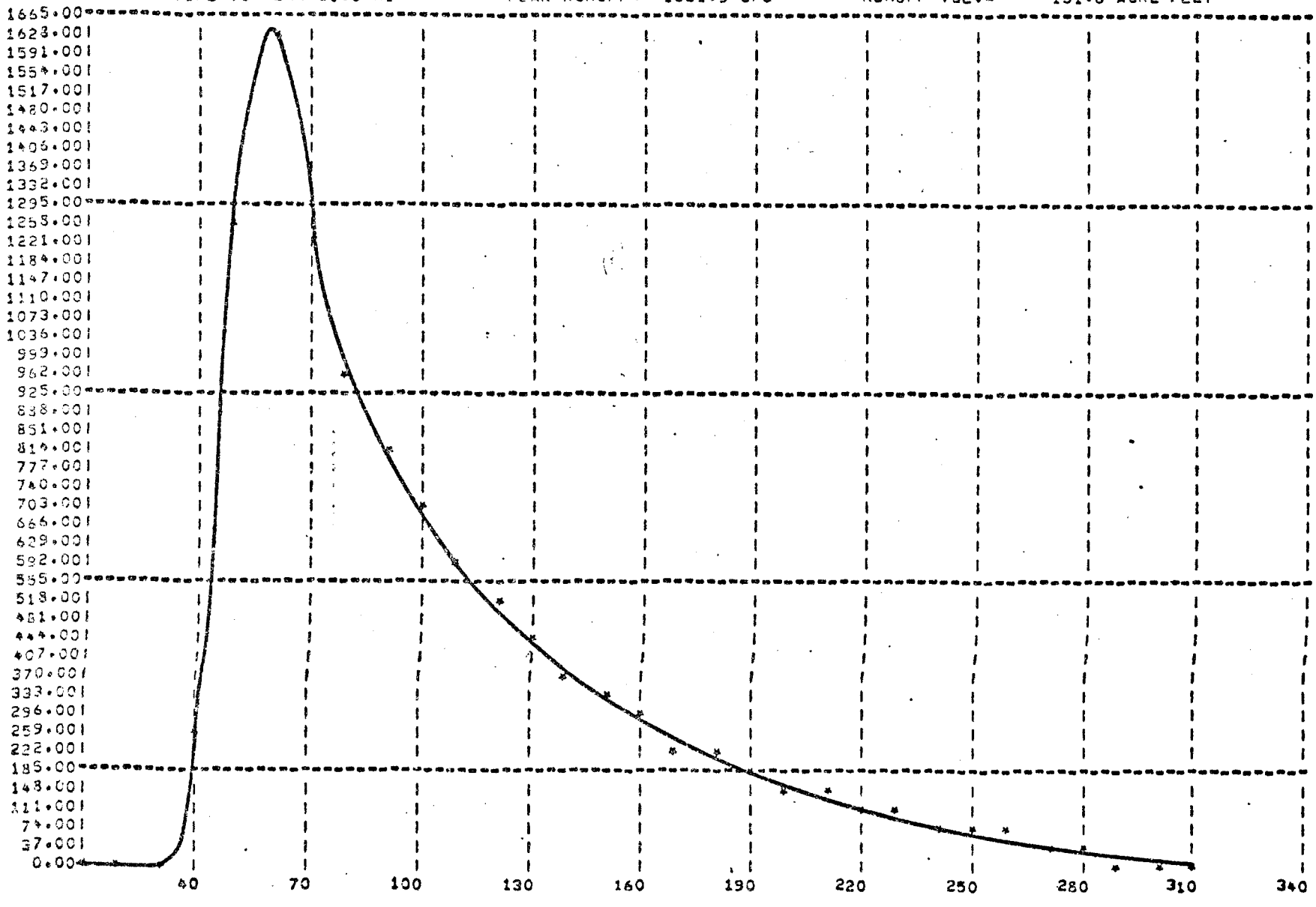
DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 95%				IMPERVIOUS AREA 5%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	95 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	5% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.005	0.005
30	2.195	0.351	0.461	0.083	0.261	0.117	0.111	0.000	0.023	0.438	0.022	0.133
40	2.317	0.122	1.383	0.083	0.000	1.299	1.234	0.000	0.069	1.314	0.066	1.300
50	2.416	0.099	0.351	0.083	0.000	0.268	0.254	0.000	0.018	0.334	0.017	0.271
60	2.500	0.084	0.099	0.083	0.000	0.016	0.015	0.000	0.005	0.094	0.005	0.020
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.615	0.100	0.125	2.279	0.114	1.729

STORM HYDROGRAPH

2-3 PETERSON FIELD

100 YEAR STORM

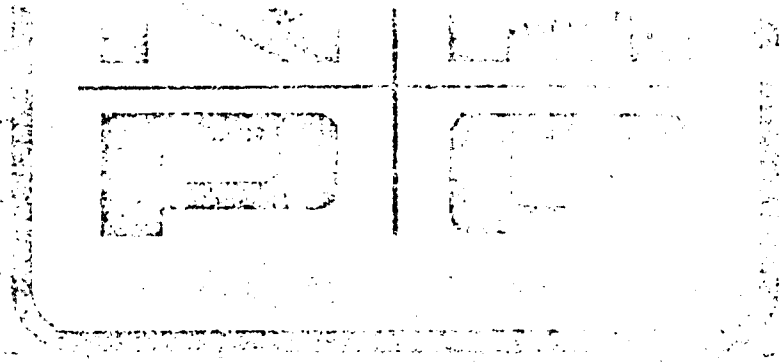


DETERMINATION OF EFFECTIVE RAINFALL

3-4 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 86% MAX. INFIL. (IN.)	PERVIOUS AREA 86% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 86% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 86% 86 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 13% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 13% LOSS (IN.)	IMPERVIOUS AREA 13% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 13% 13% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.014	0.014
30	2.195	0.351	0.461	0.083	0.261	0.117	0.101	0.000	0.023	0.438	0.061	0.162
40	2.317	0.122	1.383	0.083	0.000	1.299	1.118	0.000	0.069	1.314	0.184	1.301
50	2.416	0.099	0.351	0.083	0.000	0.268	0.230	0.000	0.018	0.334	0.047	0.277
60	2.500	0.084	0.099	0.083	0.000	0.016	0.014	0.000	0.005	0.094	0.013	0.027
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.462	0.100	0.125	2.279	0.319	1.781

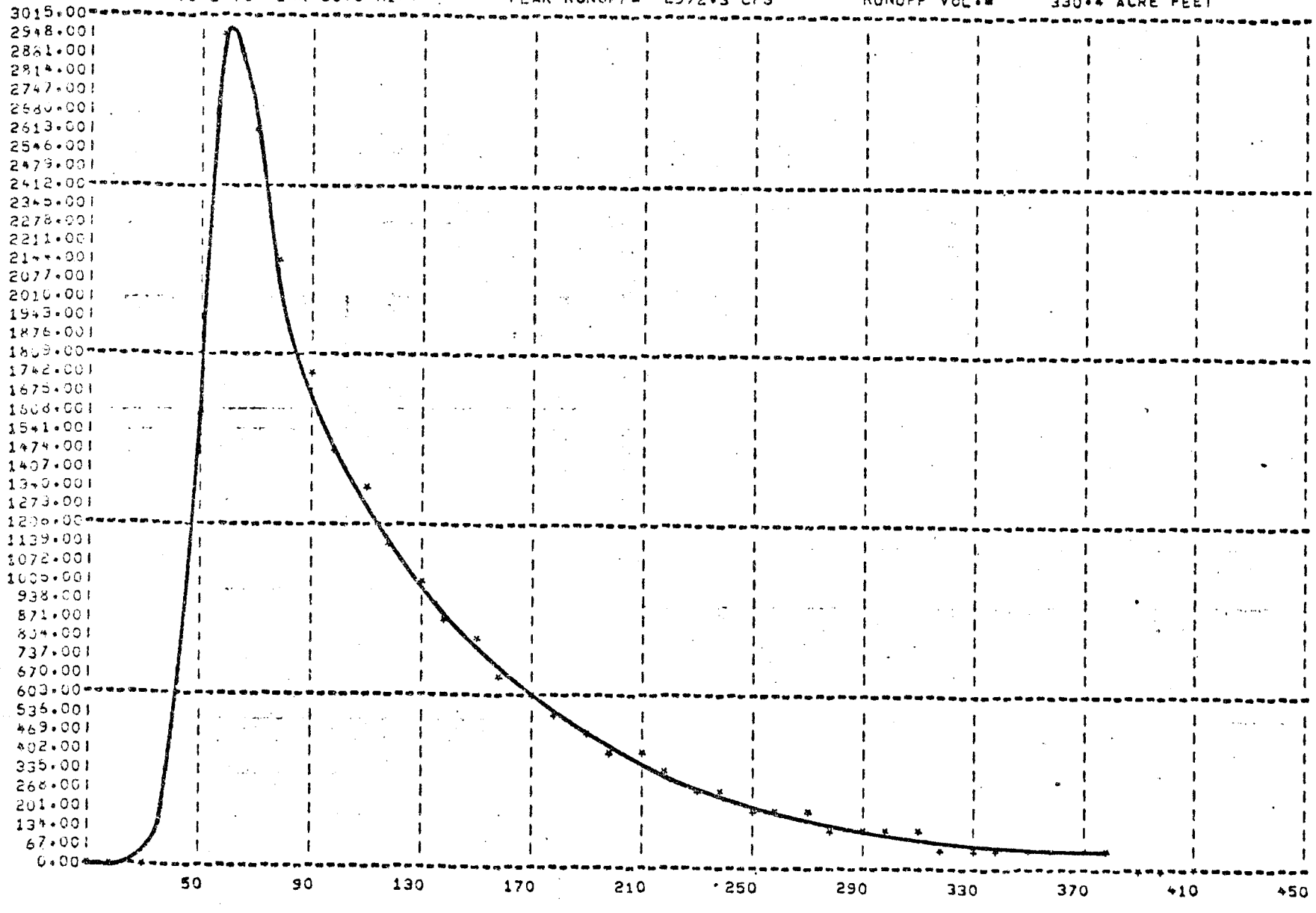


STORM HYDROGRAPH

3-4 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=60.0 MIN. PEAK RUNOFF= 2972.3 CFS RUNOFF VOL.= 330.4 ACRE FEET

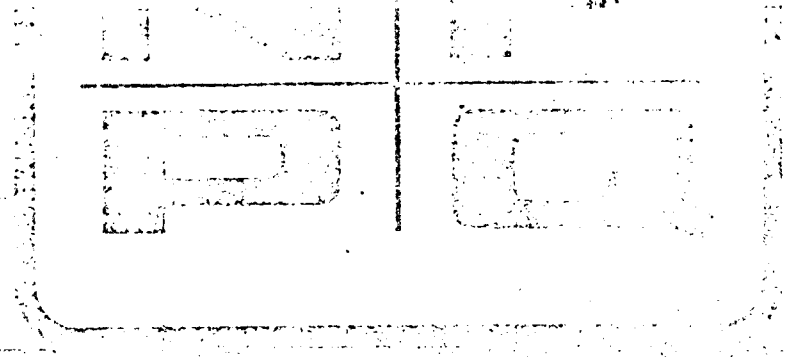


DETERMINATION OF EFFECTIVE RAINFALL

4-5 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 95% MAX. INFIL. (IN.)	PERVIOUS AREA 95% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 95% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 95% 95 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 5% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 5% LOSS (IN.)	IMPERVIOUS AREA 5% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 5% 5% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.005	0.005
30	2.195	0.351	0.461	0.083	0.261	0.117	0.111	0.000	0.023	0.438	0.022	0.133
40	2.317	0.122	1.383	0.083	0.000	1.299	1.234	0.000	0.069	1.314	0.066	1.300
50	2.416	0.099	0.351	0.083	0.000	0.268	0.254	0.000	0.018	0.334	0.017	0.271
60	2.500	0.084	0.099	0.083	0.000	0.016	0.015	0.000	0.005	0.094	0.005	0.020
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.615	0.100	0.125	2.279	0.114	1.729

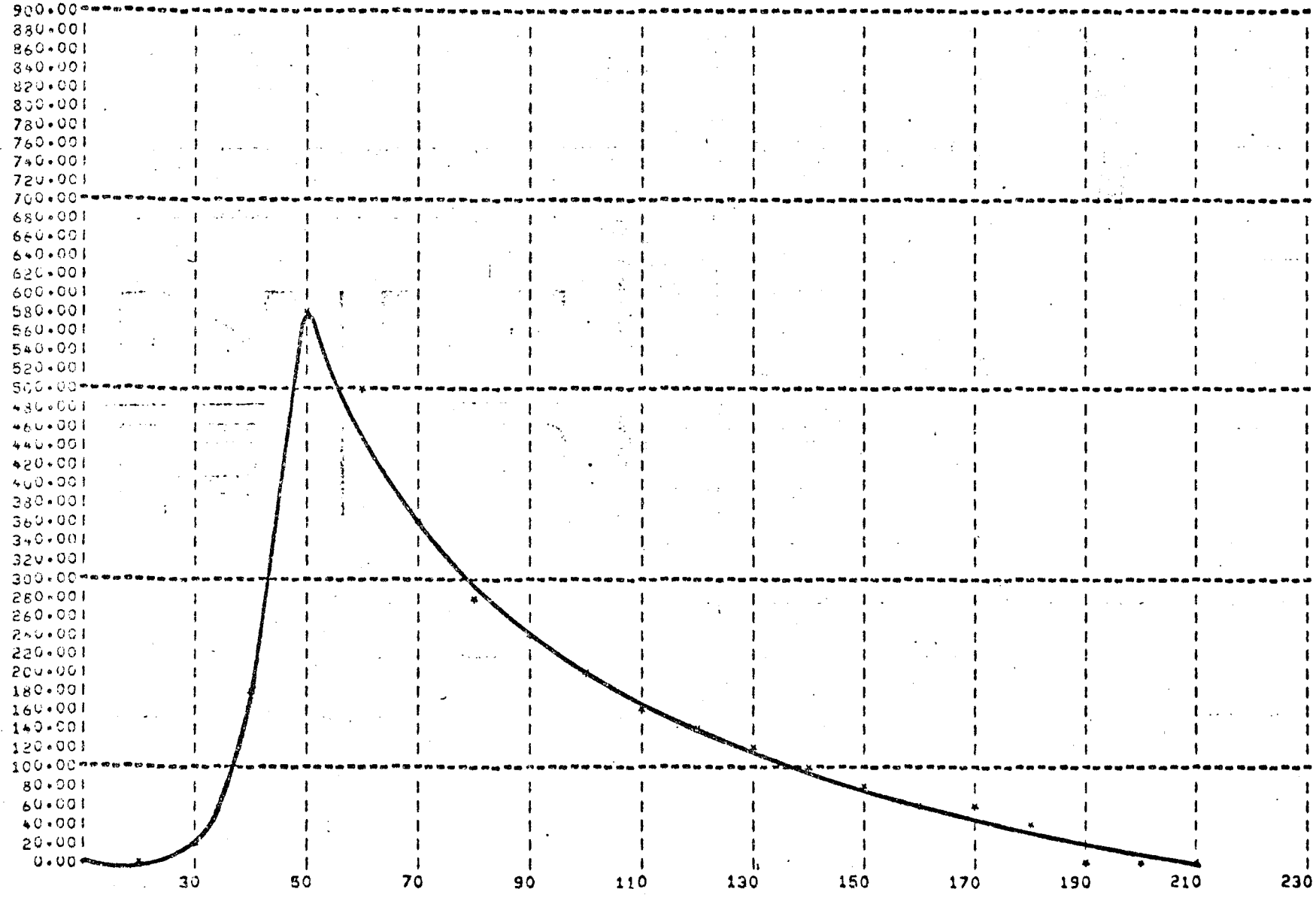


STORM HYDROGRAPH

4-5 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=50.0 MIN. PEAK RUNOFF= 577.8 CFS RUNOFF VOL.= 44.1 ACRE FEET

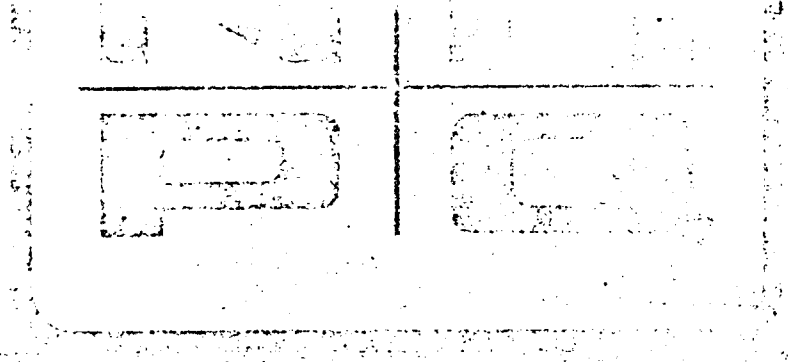


DETERMINATION OF EFFECTIVE RAINFALL

5-6 PETE FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 87% MAX. INFIL. (IN.)	PERVIOUS AREA 87% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 87% EFFEC. PRECIP. (IN.)	87 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 13% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 13% LOSS (IN.)	IMPERVIOUS AREA 13% EFFEC. PRECIP. (IN.)	13% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.884	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.013	0.013
30	2.195	0.351	0.461	0.083	0.261	0.117	0.102	0.000	0.023	0.438	0.057	0.159
40	2.317	0.122	1.383	0.083	0.000	1.299	1.131	0.000	0.069	1.314	0.171	1.301
50	2.416	0.099	0.351	0.083	0.000	0.268	0.233	0.000	0.018	0.334	0.043	0.276
60	2.500	0.084	0.099	0.083	0.000	0.016	0.014	0.000	0.005	0.094	0.012	0.026
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.479	0.100	0.125	2.279	0.296	1.775

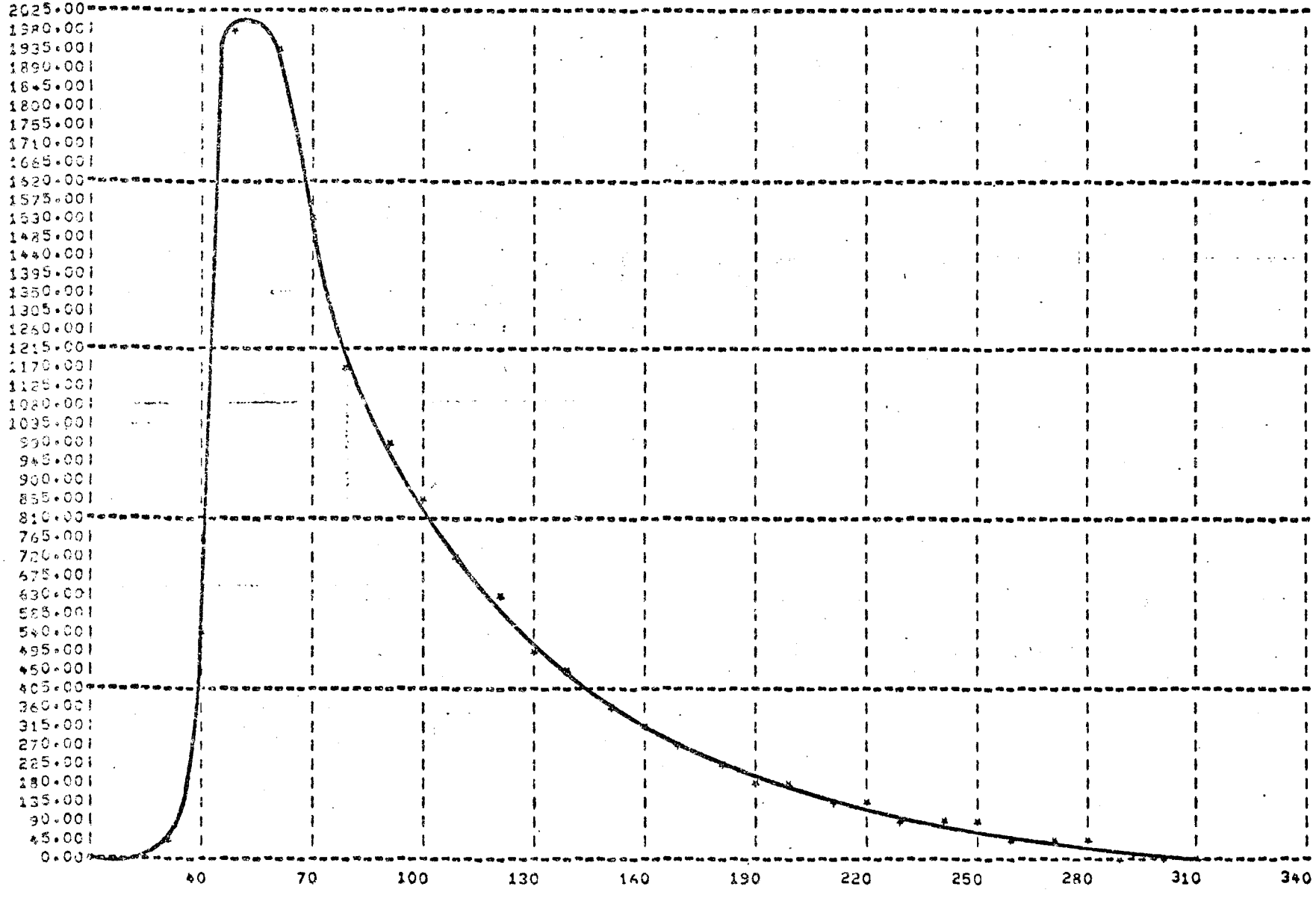


STORM HYDROGRAPH

5-6 PETE FIELD

100 YEAR STORM

TIME TO PEAK=50.0 MIN. PEAK RUNOFF= 1999.3 CFS RUNOFF VOL.= 190.0 ACRE FEET

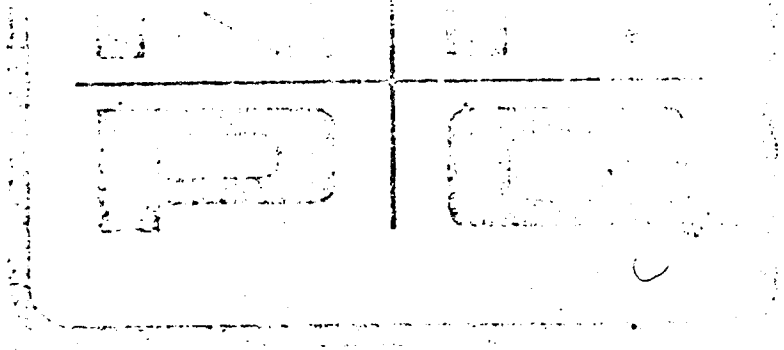


DETERMINATION OF EFFECTIVE RAINFALL

G-7J PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 71% MAX. INFIL. (IN.)	PERVIOUS AREA 71% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 71% EFFEC. PRECIP. (IN.)	71 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 29% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 29% LOSS (IN.)	IMPERVIOUS AREA 29% EFFEC. PRECIP. (IN.)	29% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.029	0.029
30	2.195	0.351	0.461	0.083	0.261	0.117	0.083	0.000	0.023	0.438	0.127	0.210
40	2.317	0.122	1.383	0.083	0.000	1.299	0.923	0.000	0.069	1.314	0.381	1.304
50	2.416	0.099	0.351	0.083	0.000	0.268	0.190	0.000	0.018	0.334	0.097	0.287
60	2.500	0.084	0.099	0.083	0.000	0.016	0.011	0.000	0.005	0.094	0.027	0.039
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.207	0.100	0.125	2.279	0.661	1.868



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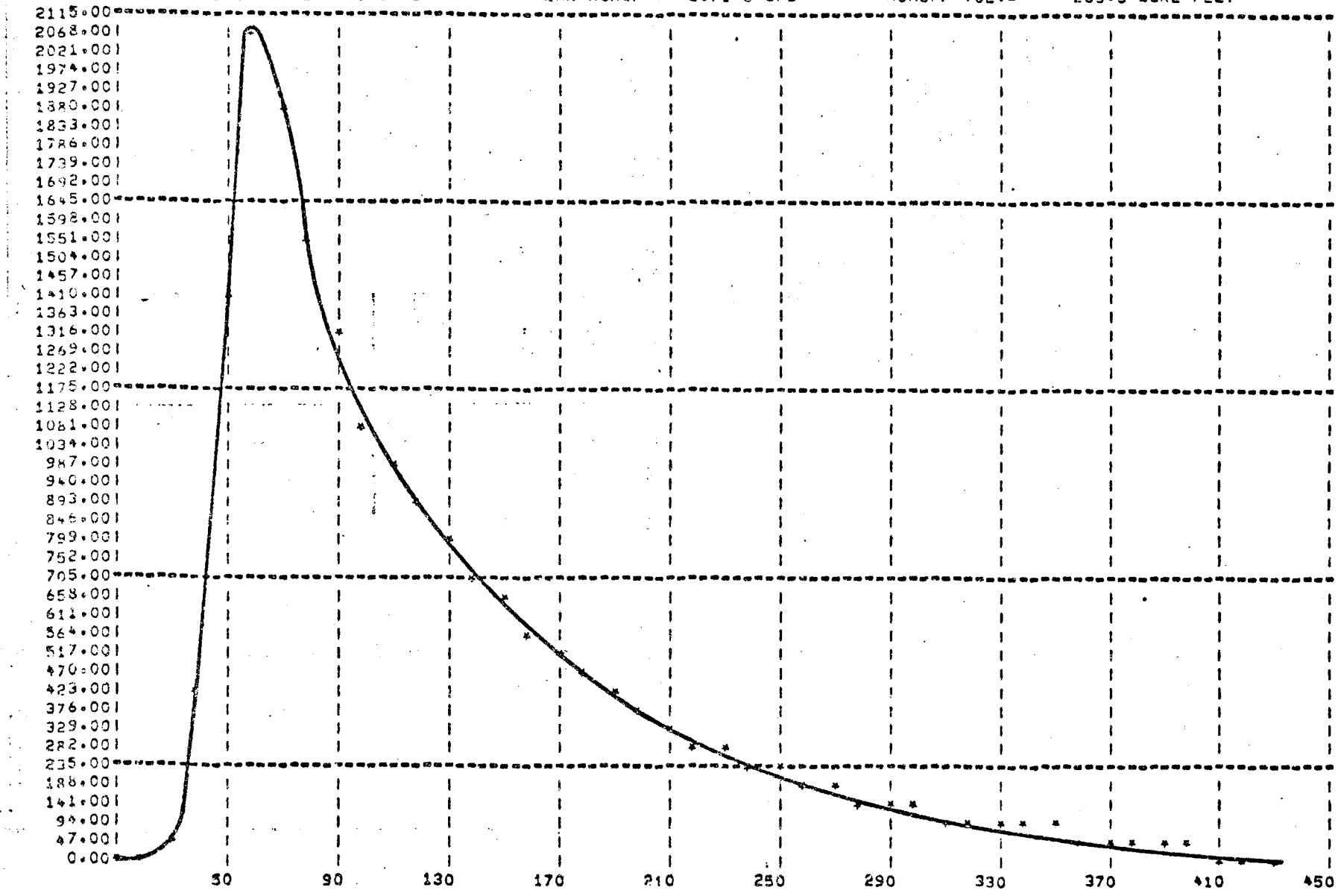
STORM HYDROGRAPH

6-7J PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=60.0 MIN. PEAK RUNOFF= 2071.8 CFS RUNOFF VOL.= 265.3 ACRE FEET



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 2050.3
* 60.00  10.00
* 0.50
* 0.30   0.10
  0.65   0.35
  3.41   1.97
* 0.00   0.00
*   3      1
  DATA SET NO.  1
 USE THESE DATA SET NO. IF UPDATES ARE NEEDED
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7J-8 DETERMINATION OF EFFECTIVE RAINFALL

PETERSON FIELD BASIN NO. 6PD

DESIGN STORM: 100 YEAR RECURRENCE INTERVAL

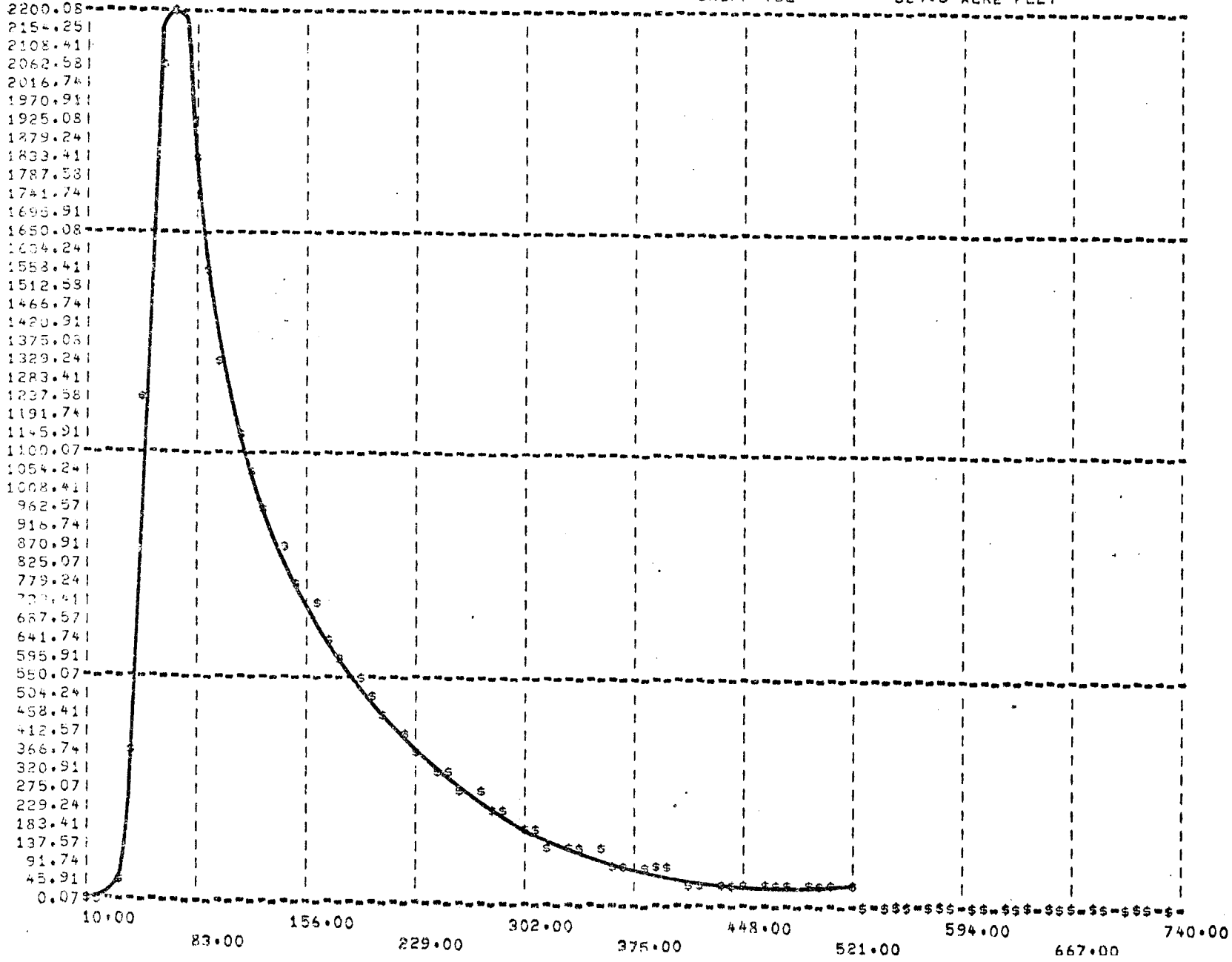
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 65% MAX. INFIL. (IN.)	PERVIOUS AREA 65% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 65% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 65% 65 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 35% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 35% LOSS (IN.)	IMPERVIOUS AREA 35% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 35% 35% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.035	0.035
30	2.195	0.351	0.461	0.083	0.261	0.117	0.076	0.000	0.023	0.438	0.153	0.229
40	2.317	0.122	1.383	0.083	0.000	1.299	0.845	0.000	0.069	1.314	0.460	1.304
50	2.416	0.099	0.351	0.083	0.000	0.268	0.174	0.000	0.018	0.334	0.117	0.291
60	2.500	0.084	0.099	0.083	0.000	0.016	0.010	0.000	0.005	0.094	0.033	0.043
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.105	0.100	0.125	2.279	0.798	1.903

STORM HYDROGRAPH

PETERSON FIELD TJ-8

100 YEAR STORM

TIME TO PEAK= 70. MIN.
PEAK RUNOFF= 2183.26 CFS
RUNOFF VOL= 324.5 ACRE FEET



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PETERSON FIELD 8 - 9J

DESIGN STORM: 100 YEAR RECURRENCE INTERVAL

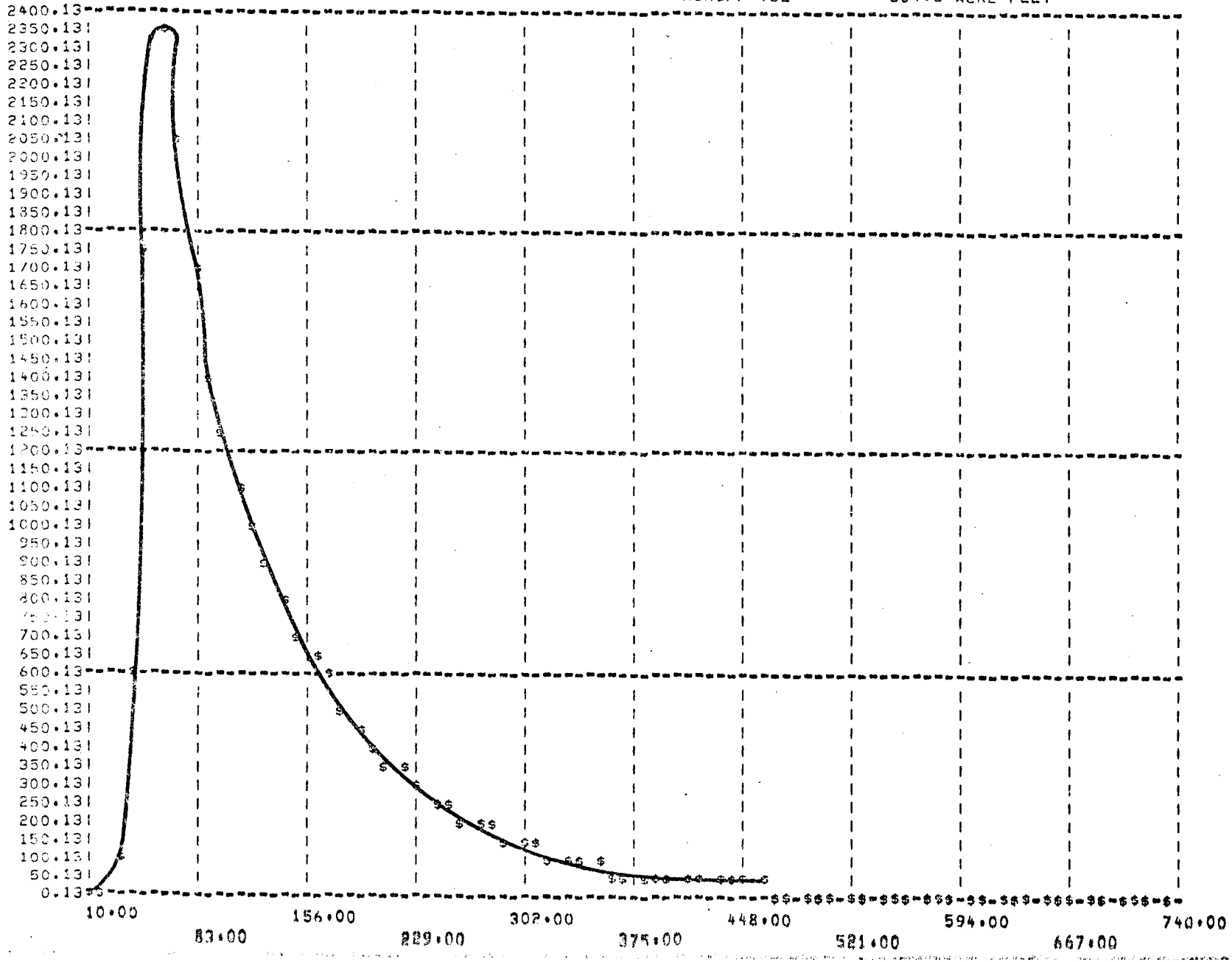
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 66% MAX. INFIL. (IN.)	PERVIOUS AREA 66% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 66% EFFEC. PRECIP. (IN.)	66 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 34% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 34% LOSS (IN.)	IMPERVIOUS AREA 34% EFFEC. PRECIP. (IN.)	34% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.034	0.034
30	2.195	0.351	0.461	0.083	0.261	0.117	0.077	0.000	0.023	0.438	0.149	0.226
40	2.317	0.122	1.383	0.083	0.000	1.299	0.858	0.000	0.069	1.314	0.447	1.304
50	2.416	0.099	0.351	0.083	0.000	0.268	0.177	0.000	0.018	0.334	0.113	0.290
60	2.500	0.084	0.099	0.083	0.000	0.016	0.010	0.000	0.005	0.094	0.032	0.042
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.122	0.100	0.125	2.279	0.775	1.897

STORM HYDROGRAPH

PETERSON FIELD 8-9J

100 YEAR STORM

TIME TO PEAK= 60. MIN.
PEAK RUNOFF= 2373.92 CFS
RUNOFF VOL= 304.8 ACRE FEET

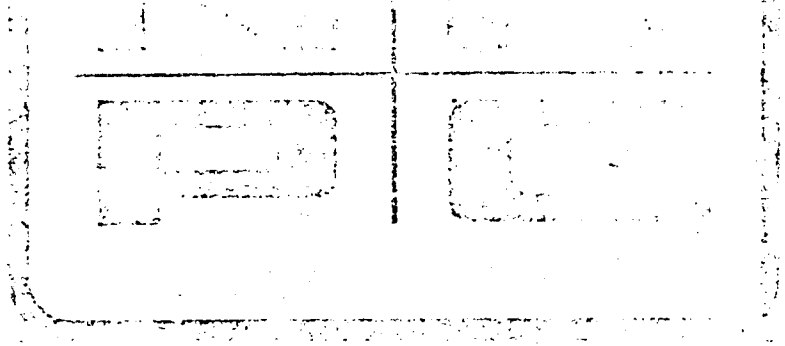


DETERMINATION OF EFFECTIVE RAINFALL

10J-12 PETE FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 63% MAX. INFIL. (IN.)	PERVIOUS AREA 63% DETENTION & DEPRESSTAN STORAGE (IN.)	PERVIOUS AREA 63% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 63% 63 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 37% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 37% LOSS (IN.)	IMPERVIOUS AREA 37% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 37% 37% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.037	0.037
30	2.195	0.351	0.461	0.083	0.261	0.117	0.074	0.000	0.023	0.438	0.162	0.236
40	2.317	0.122	1.383	0.083	0.000	1.299	0.819	0.000	0.069	1.314	0.486	1.305
50	2.416	0.099	0.351	0.083	0.000	0.268	0.169	0.000	0.018	0.334	0.123	0.292
60	2.500	0.084	0.099	0.083	0.000	0.016	0.010	0.000	0.005	0.094	0.035	0.045
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.071	0.100	0.125	2.279	0.843	1.914

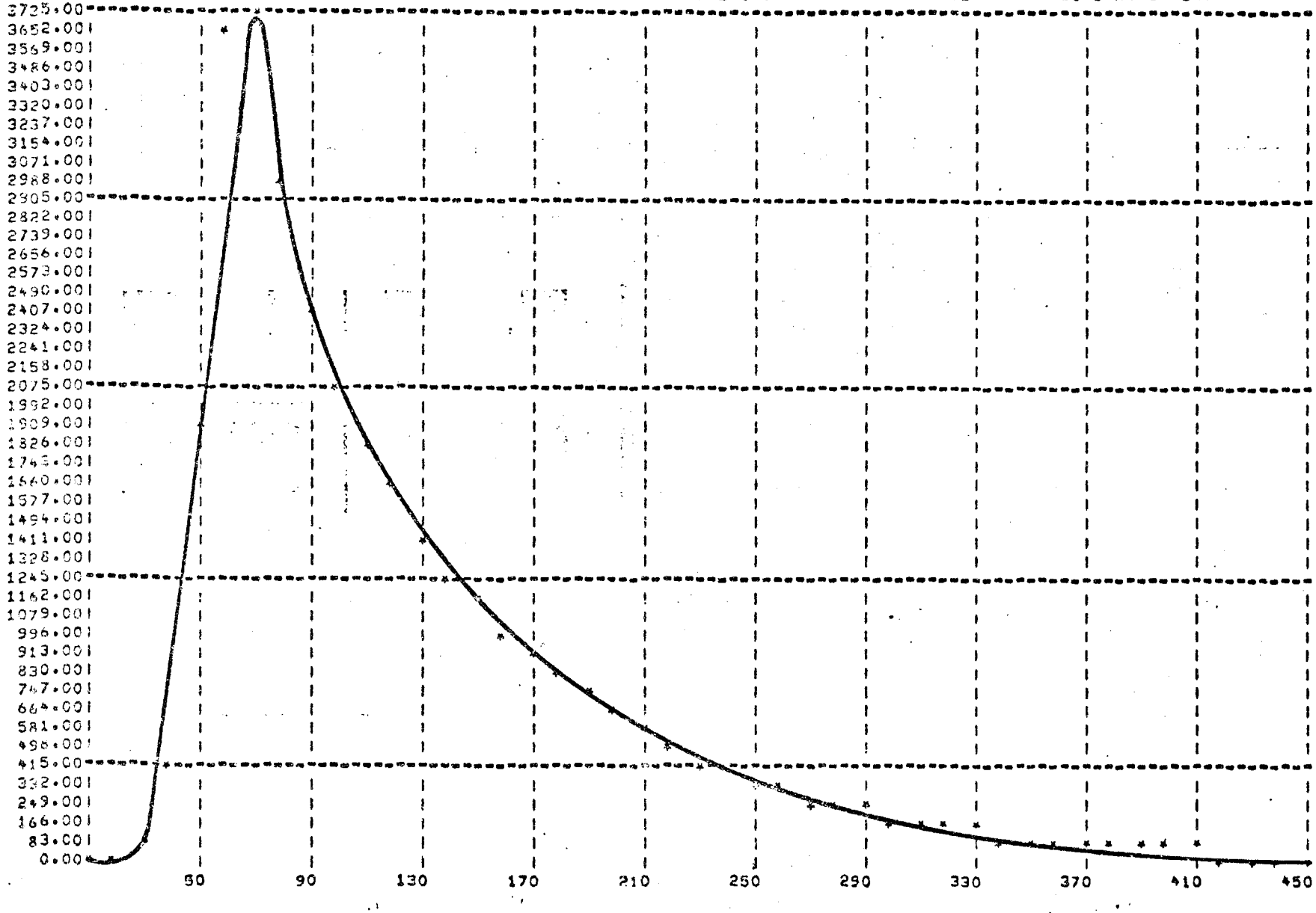


STORM HYDROGRAPH

10J-12 PETE FIELD

100 YEAR STORM

TIME TO PEAK=70.0 MIN. PEAK RUNOFF= 3713.2 CFS RUNOFF VOL.= 461.8 ACRE FEET



DETERMINATION OF EFFECTIVE RAINFALL

20-21 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

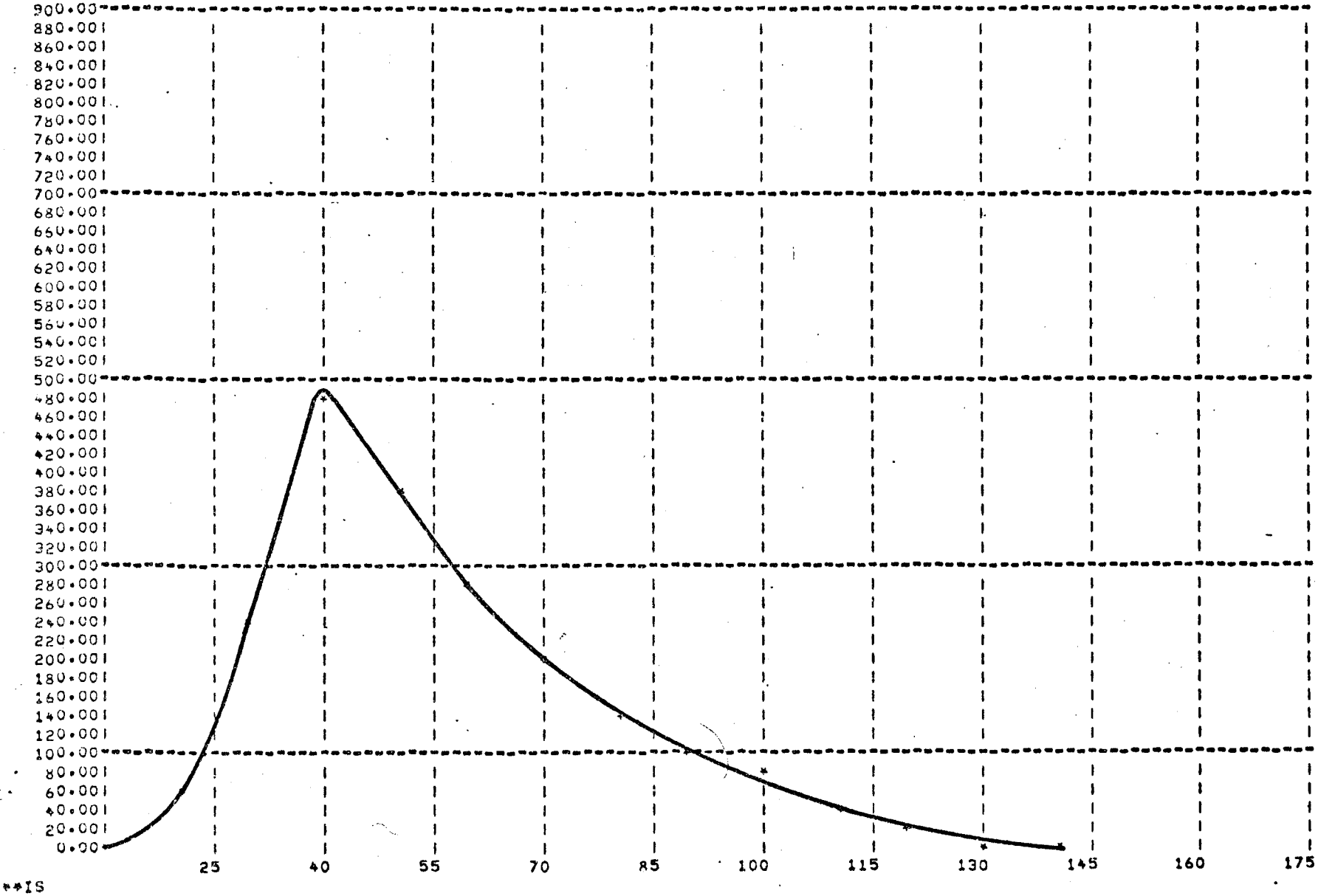
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 20%				IMPERVIOUS AREA 80%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	20 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	80% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.080	0.080
30	2.195	0.351	0.461	0.083	0.261	0.117	0.023	0.000	0.023	0.438	0.350	0.374
40	2.317	0.122	1.383	0.083	0.000	1.299	0.260	0.000	0.069	1.314	1.051	1.311
50	2.416	0.099	0.351	0.083	0.000	0.268	0.054	0.000	0.018	0.334	0.267	0.320
60	2.500	0.084	0.099	0.083	0.000	0.016	0.003	0.000	0.005	0.094	0.075	0.079
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	0.340	0.100	0.125	2.279	1.823	2.163

STORM HYDROGRAPH

20-21 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=40.0 MIN. PEAK RUNOFF= 488.3 CFS RUNOFF VOL.= 28.6 ACRE FEET

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DETERMINATION OF EFFECTIVE RAINFALL

21 - 22 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

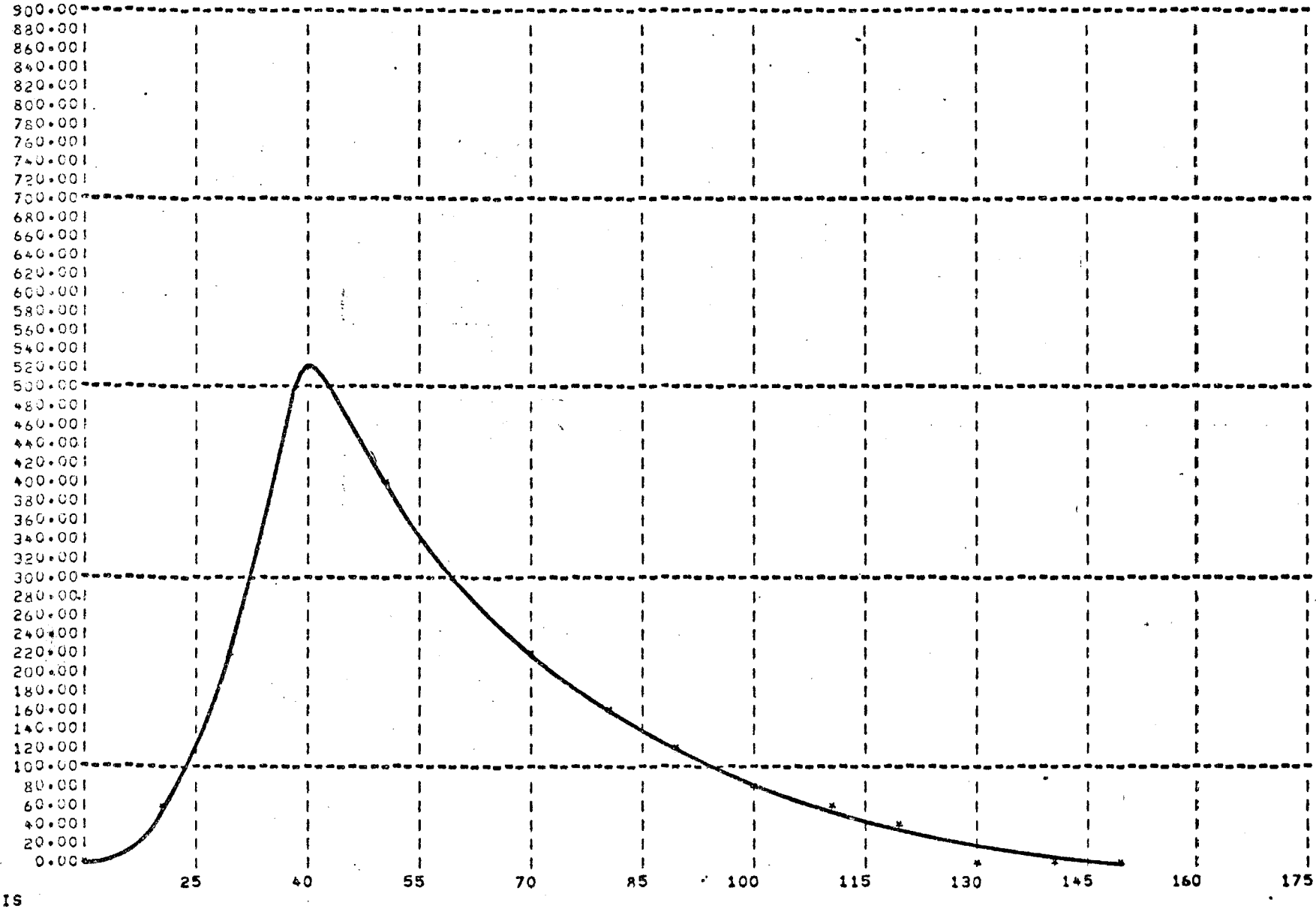
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 20%				IMPERVIOUS AREA 80%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	20 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	80% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.080	0.080
30	2.195	0.351	0.461	0.083	0.261	0.117	0.023	0.000	0.023	0.438	0.350	0.374
40	2.317	0.122	1.383	0.083	0.000	1.299	0.260	0.000	0.069	1.314	1.051	1.311
50	2.416	0.099	0.351	0.083	0.000	0.268	0.054	0.000	0.018	0.334	0.267	0.320
60	2.500	0.084	0.099	0.083	0.000	0.016	0.003	0.000	0.005	0.094	0.075	0.079
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	0.340	0.100	0.125	2.279	1.823	2.163

STORM HYDROGRAPH

21-22 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=40.0 MIN. PEAK RUNOFF= 520.6 CFS RUNOFF VOL.= 31.1 ACRE FEET

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DETERMINATION OF EFFECTIVE RAINFALL

22-23 PETERSON FIELD

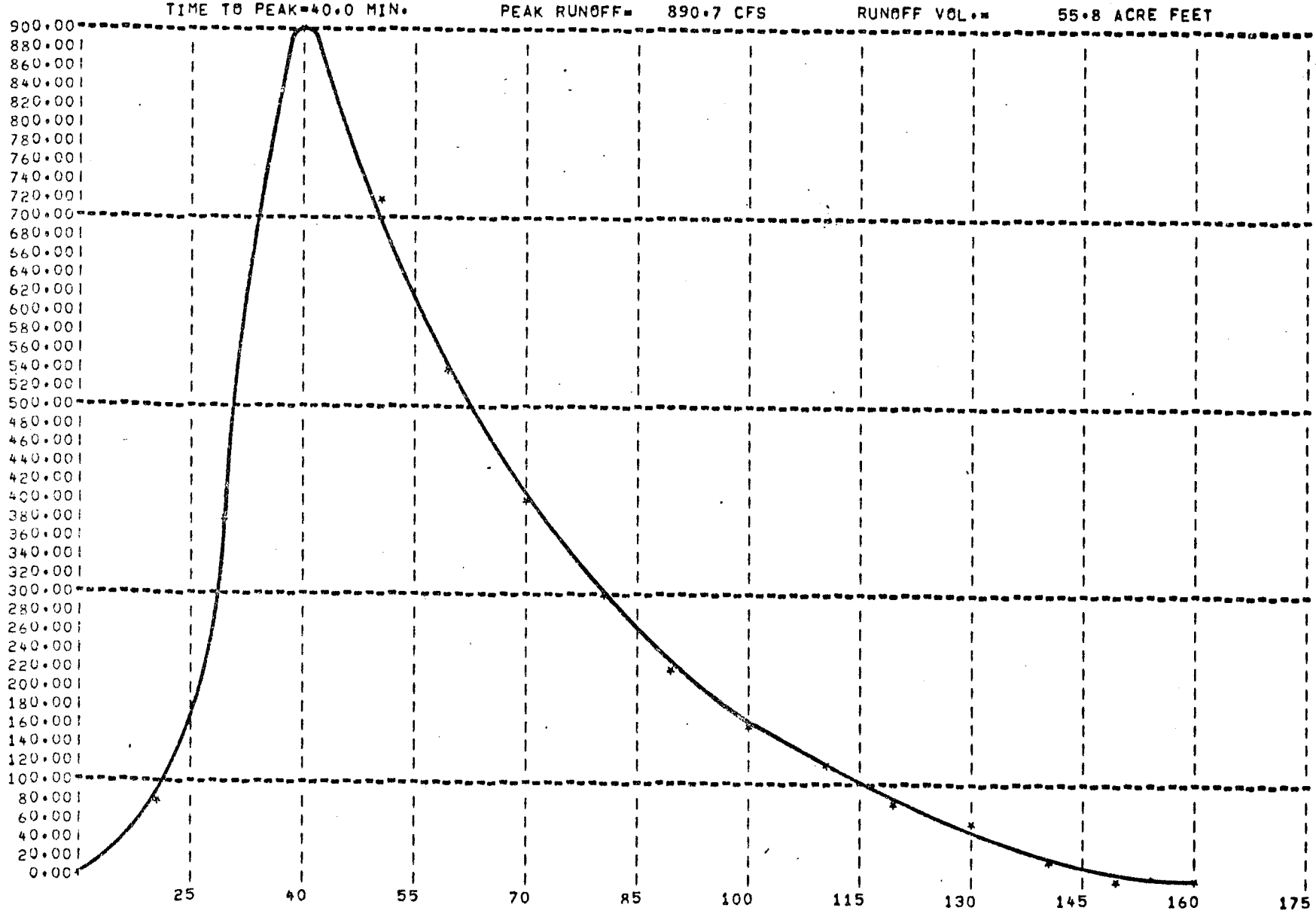
DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 21%				IMPERVIOUS AREA 79%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	21 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	79% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.079	0.079
30	2.195	0.351	0.461	0.083	0.261	0.117	0.025	0.000	0.023	0.438	0.346	0.370
40	2.317	0.122	1.383	0.083	0.000	1.299	0.273	0.000	0.069	1.314	1.038	1.311
50	2.416	0.099	0.351	0.083	0.000	0.268	0.056	0.000	0.018	0.334	0.264	0.320
60	2.500	0.084	0.099	0.083	0.000	0.016	0.003	0.000	0.005	0.094	0.074	0.078
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	0.357	0.100	0.125	2.279	1.801	2.158

STORM HYDROGRAPH

22-23. PETERSON FIELD

100 YEAR STORM



DETERMINATION OF EFFECTIVE RAINFALL

23-7J PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

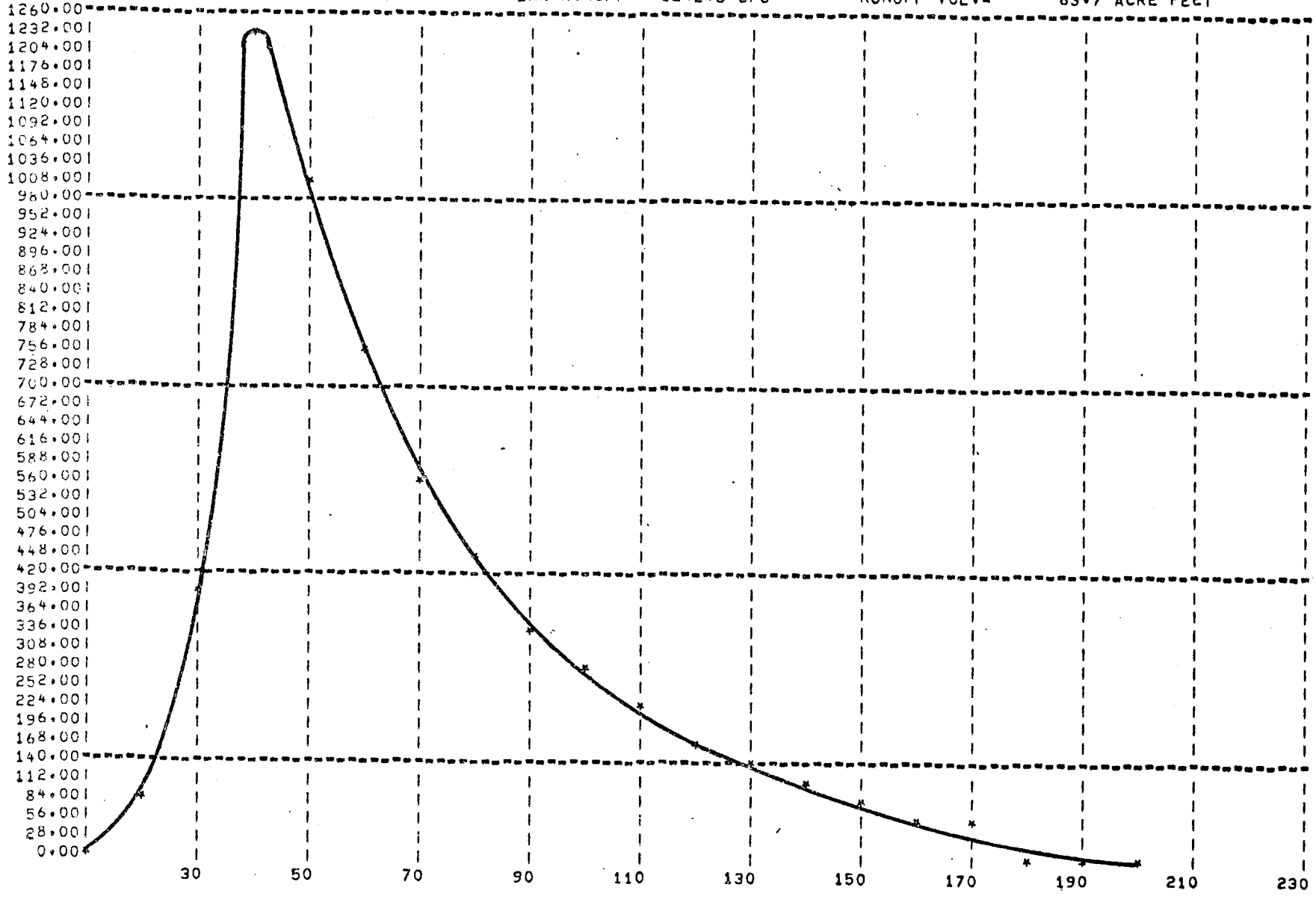
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 21% MAX. INFIL. (IN.)	PERVIOUS AREA 21% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 21% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 21% 21 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 79% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 79% LOSS (IN.)	IMPERVIOUS AREA 79% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 79% 79% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.079	0.079
30	2.195	0.351	0.461	0.083	0.261	0.117	0.025	0.000	0.023	0.438	0.346	0.370
40	2.317	0.122	1.383	0.083	0.000	1.299	0.273	0.000	0.069	1.314	1.038	1.311
50	2.416	0.099	0.351	0.083	0.000	0.268	0.056	0.000	0.018	0.334	0.264	0.320
60	2.500	0.084	0.099	0.083	0.000	0.016	0.003	0.000	0.005	0.094	0.074	0.078
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	0.357	0.100	0.125	2.279	1.801	2.158

STORM HYDROGRAPH

23-73 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=40.0 MIN. PEAK RUNOFF= 1242.3 CFS RUNOFF VOL.= 83.7 ACRE FEET



DETERMINATION OF EFFECTIVE RAINFALL

30-31 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

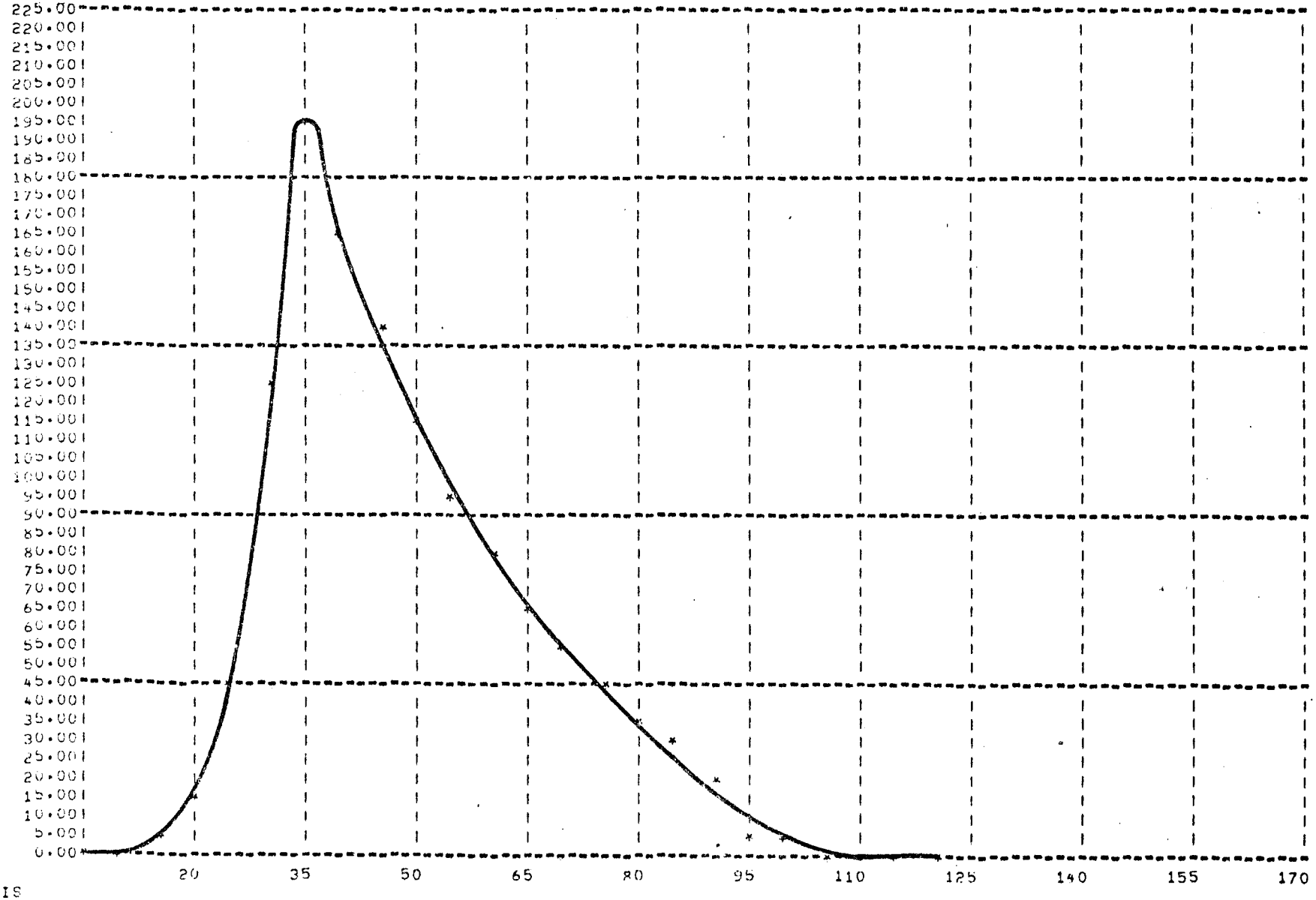
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 60% MAX. INFIL. (IN.)	PERVIOUS AREA 60% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 60% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 60% 60 % EFFEC. PRECIP.	IMPERVIOUS AREA 40% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 40% LOSS (IN.)	IMPERVIOUS AREA 40% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 40% 40% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.922	0.922	0.041	0.042	0.000	0.000	0.000	0.041	0.002	0.000	0.000	0.000
10	1.383	0.461	0.047	0.042	0.006	0.000	0.000	0.047	0.002	0.000	0.000	0.000
15	1.646	0.263	0.057	0.042	0.016	0.000	0.000	0.012	0.003	0.042	0.017	0.017
20	1.844	0.198	0.176	0.042	0.134	0.000	0.000	0.000	0.009	0.167	0.067	0.067
25	2.019	0.176	0.198	0.042	0.145	0.011	0.007	0.000	0.010	0.188	0.075	0.082
30	2.195	0.176	0.461	0.042	0.000	0.419	0.252	0.000	0.023	0.438	0.175	0.427
35	2.259	0.064	0.922	0.042	0.000	0.880	0.528	0.000	0.046	0.876	0.350	0.878
40	2.317	0.057	0.263	0.042	0.000	0.222	0.133	0.000	0.013	0.250	0.100	0.233
45	2.369	0.052	0.176	0.042	0.000	0.134	0.080	0.000	0.009	0.167	0.067	0.147
50	2.416	0.047	0.064	0.042	0.000	0.023	0.014	0.000	0.003	0.061	0.024	0.038
55	2.459	0.044	0.052	0.042	0.000	0.010	0.006	0.000	0.003	0.049	0.020	0.026
60	2.500	0.041	0.044	0.042	0.000	0.002	0.001	0.000	0.002	0.041	0.017	0.018
TOTALS	2.500	2.500	2.500	0.500	0.300	1.701	1.021	0.100	0.125	2.279	0.912	1.932

STORM HYDROGRAPH

30-31 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=35.0 MIN. PEAK RUNOFF= 196.6 CFS RUNOFF VOL.= 8.9 ACRE FEET

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DETERMINATION OF EFFECTIVE RAINFALL

32J-9J PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

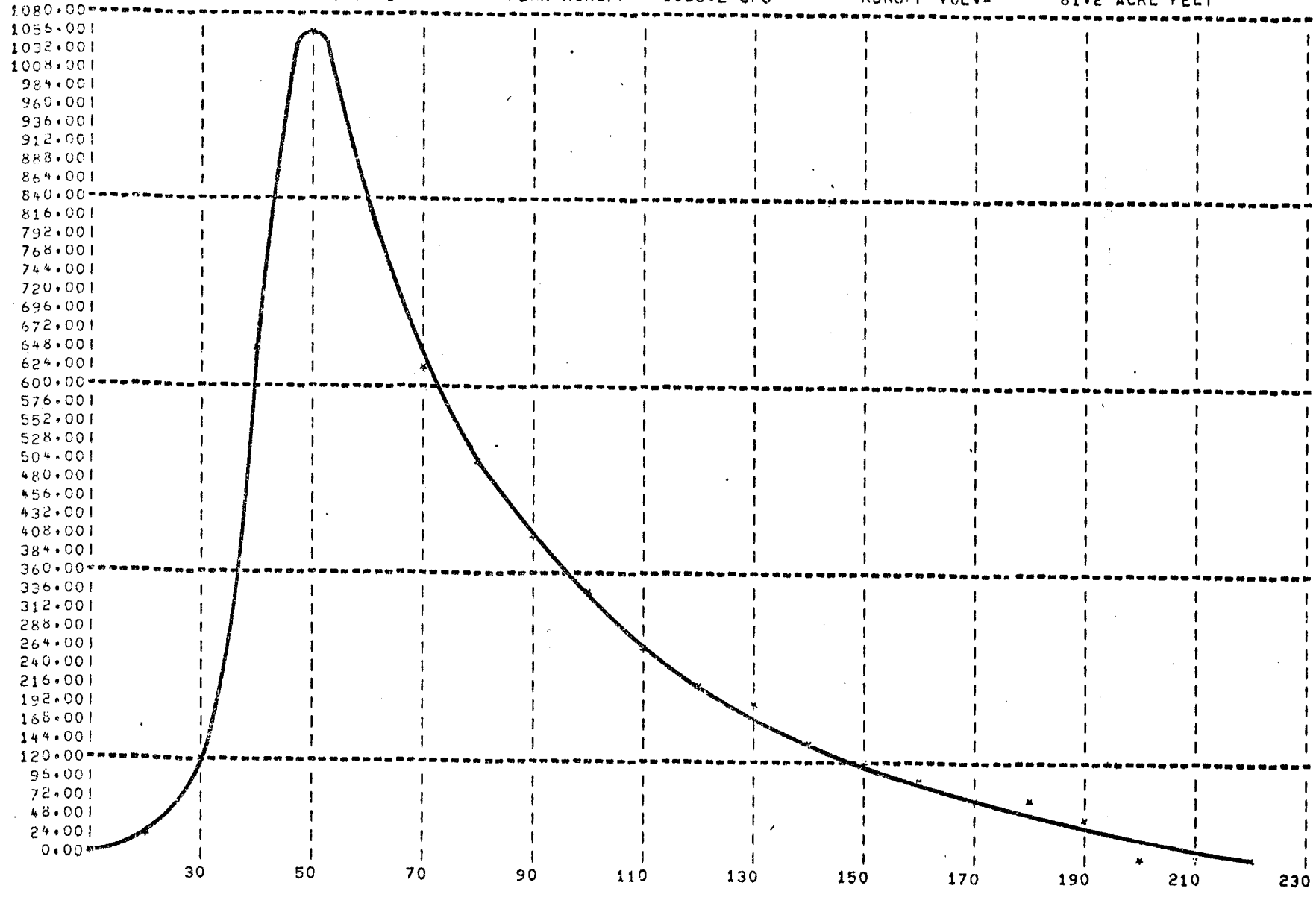
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 60%				IMPERVIOUS AREA 40%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	60 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	40% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.040	0.040
30	2.195	0.351	0.461	0.083	0.261	0.117	0.070	0.000	0.023	0.438	0.175	0.245
40	2.317	0.122	1.383	0.083	0.000	1.299	0.780	0.000	0.069	1.314	0.525	1.305
50	2.416	0.099	0.351	0.083	0.000	0.268	0.161	0.000	0.018	0.334	0.133	0.294
60	2.500	0.084	0.099	0.083	0.000	0.016	0.009	0.000	0.005	0.094	0.038	0.047
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.020	0.100	0.125	2.279	0.912	1.932

STORM HYDROGRAPH

32J-9J PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=50.0 MIN. PEAK RUNOFF= 1058.2 CFS RUNOFF VOL.= 81.2 ACRE FEET



DETERMINATION OF EFFECTIVE RAINFALL

BASIN 40 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

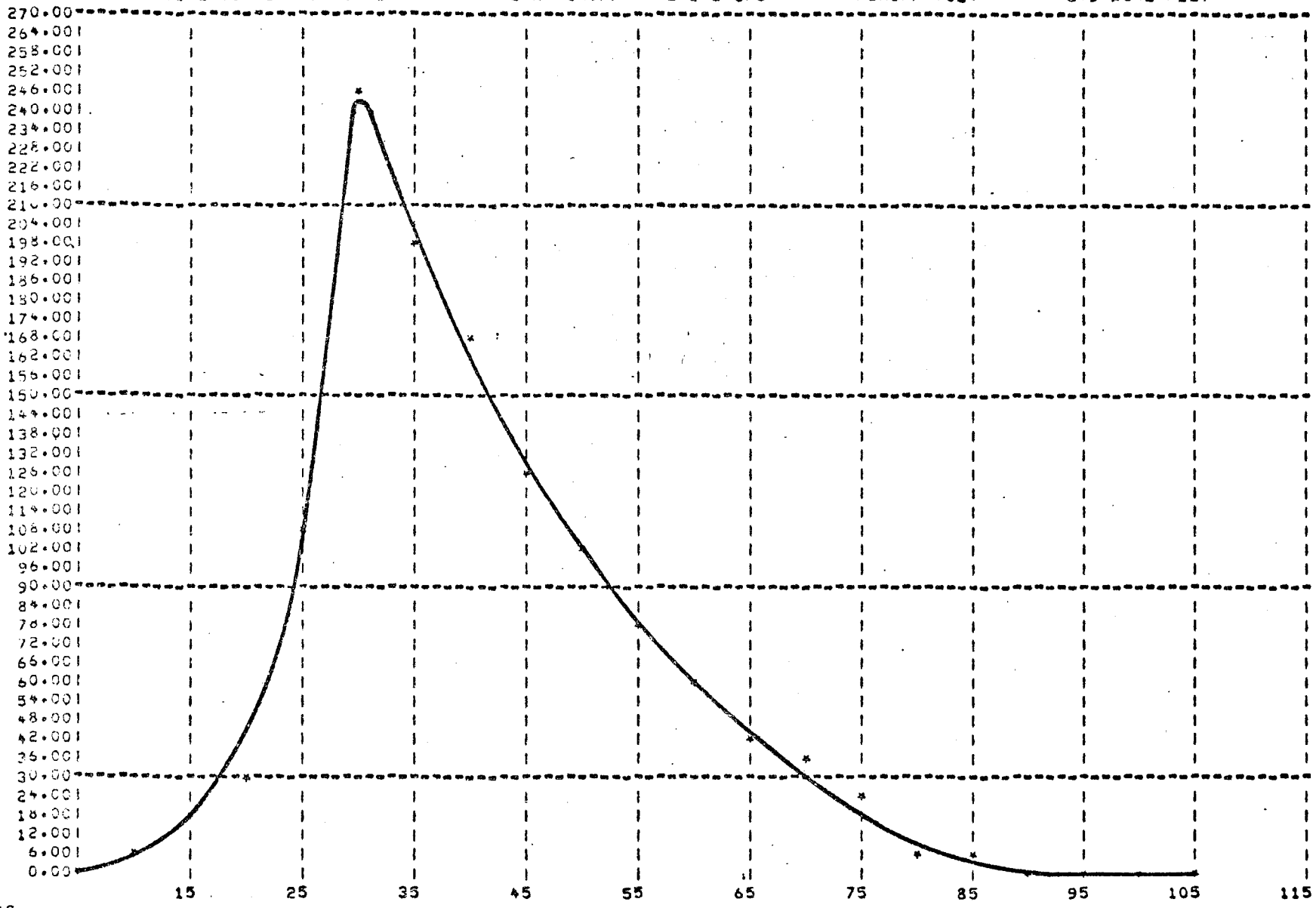
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 55%				IMPERVIOUS AREA 45%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	55 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	45% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.922	0.922	0.041	0.042	0.000	0.000	0.000	0.041	0.002	0.000	0.000	0.000
10	1.383	0.461	0.047	0.042	0.006	0.000	0.000	0.047	0.002	0.000	0.000	0.000
15	1.646	0.263	0.057	0.042	0.016	0.000	0.000	0.012	0.003	0.042	0.019	0.019
20	1.844	0.198	0.176	0.042	0.134	0.000	0.000	0.000	0.009	0.167	0.075	0.075
25	2.019	0.176	0.198	0.042	0.145	0.011	0.006	0.000	0.010	0.188	0.084	0.091
30	2.195	0.176	0.461	0.042	0.000	0.419	0.231	0.000	0.023	0.438	0.197	0.428
35	2.259	0.064	0.922	0.042	0.000	0.880	0.484	0.000	0.046	0.876	0.394	0.878
40	2.317	0.057	0.263	0.042	0.000	0.222	0.122	0.000	0.013	0.250	0.113	0.235
45	2.369	0.052	0.176	0.042	0.000	0.134	0.074	0.000	0.009	0.167	0.075	0.149
50	2.416	0.047	0.064	0.042	0.000	0.023	0.013	0.000	0.003	0.061	0.028	0.040
55	2.459	0.044	0.052	0.042	0.000	0.010	0.006	0.000	0.003	0.049	0.022	0.028
60	2.500	0.041	0.044	0.042	0.000	0.002	0.001	0.000	0.002	0.041	0.019	0.020
TOTALS	2.500	2.500	2.500	0.500	0.300	1.701	0.936	0.100	0.125	2.279	1.026	1.961

STORM HYDROGRAPH

BASIN 40 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=30.0 MIN. PEAK RUNOFF= 243.5 CFS RUNOFF VOL.= 8.9 ACRE FEET

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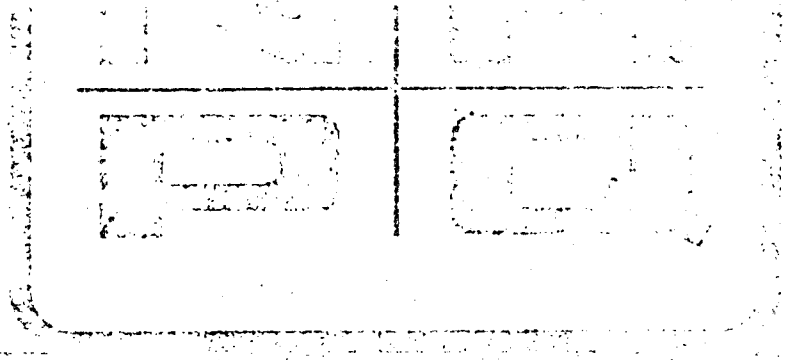
DETERMINATION OF EFFECTIVE RAINFALL

41-32J PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

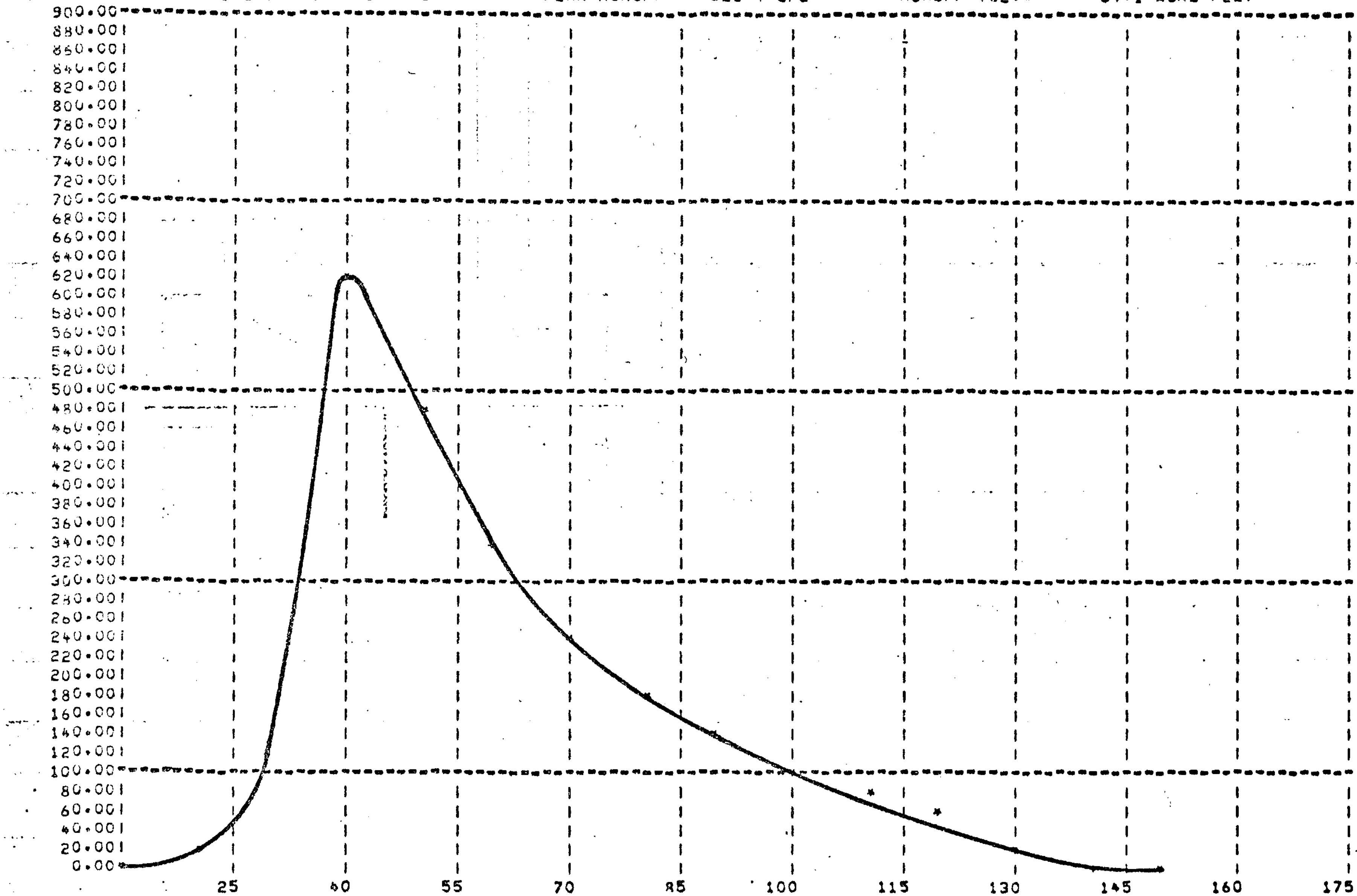
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 59% MAX. INFIL. (IN.)	PERVIOUS AREA 59% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 59% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 59% 59 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 41% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 41% LOSS (IN.)	IMPERVIOUS AREA 41% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 41% 41% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.041	0.041
30	2.195	0.351	0.461	0.083	0.261	0.117	0.069	0.000	0.023	0.438	0.180	0.249
40	2.317	0.122	1.383	0.083	0.000	1.299	0.767	0.000	0.069	1.314	0.539	1.305
50	2.416	0.099	0.351	0.083	0.000	0.268	0.158	0.000	0.018	0.334	0.137	0.295
60	2.500	0.084	0.099	0.083	0.000	0.016	0.009	0.000	0.005	0.094	0.039	0.048
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	1.003	0.100	0.125	2.279	0.934	1.937



STORM HYDROGRAPH

41-32J PETERSON FIELD
100 YEAR STORM

TIME TO PEAK=40.0 MIN. PEAK RUNOFF= 628.4 CFS RUNOFF VOL.= 34.1 ACRE FEET



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DETERMINATION OF EFFECTIVE RAINFALL

50-51 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

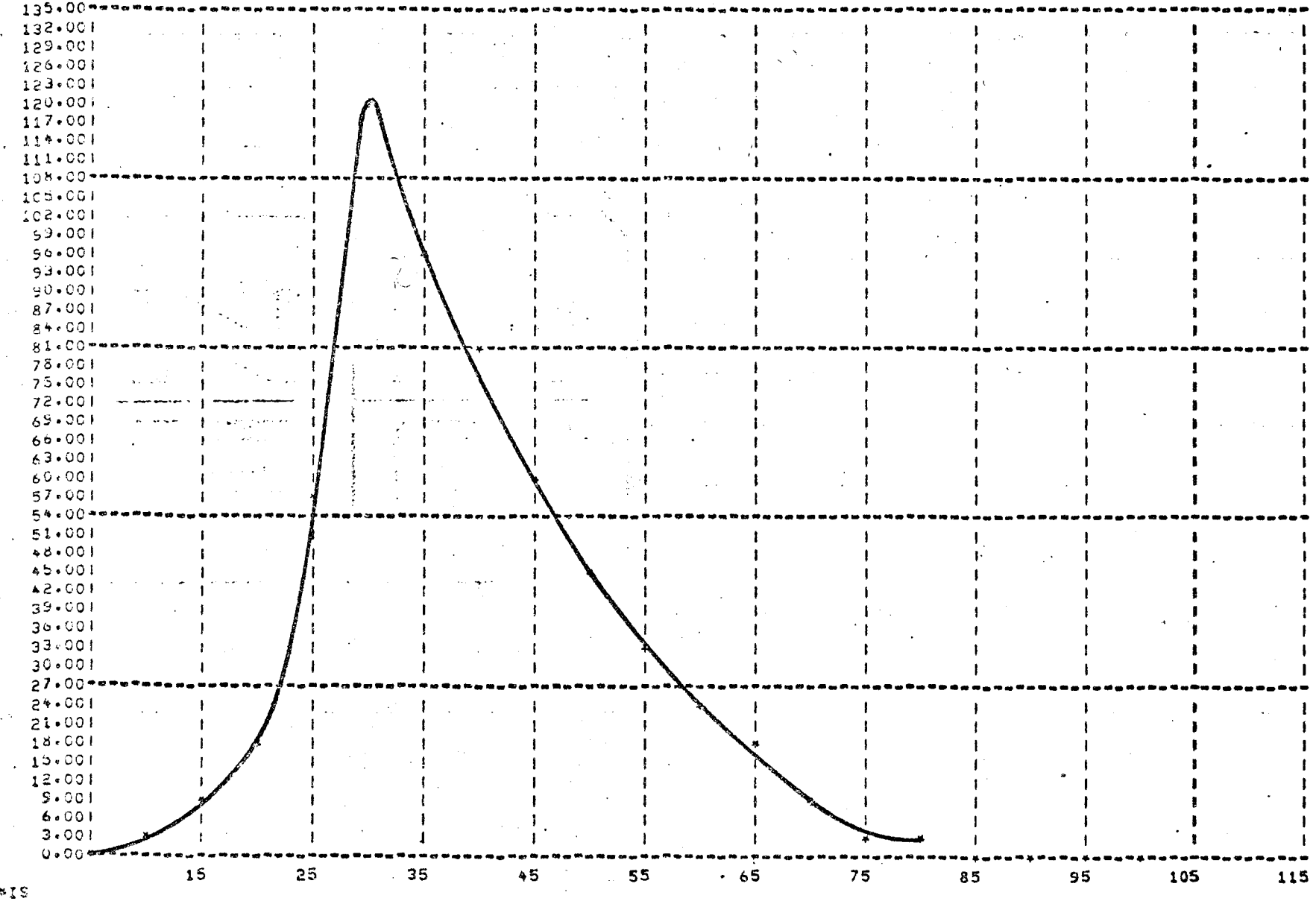
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 50% MAX. INFIL. (IN.)	PERVIOUS AREA 50% DETENTION & DEPRESSION STORAGE (IN.)	PERVIOUS AREA 50% EFFEC. PRECIP. (IN.)	PERVIOUS AREA 50% 50 % EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 50% DETENTION & DEPRESSION STORAGE (IN.)	IMPERVIOUS AREA 50% LOSS (IN.)	IMPERVIOUS AREA 50% EFFEC. PRECIP. (IN.)	IMPERVIOUS AREA 50% 50% EFFEC. PRECIP. (IN.)	TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.922	0.922	0.041	0.042	0.000	0.000	0.000	0.041	0.002	0.000	0.000	0.000
10	1.383	0.461	0.047	0.042	0.006	0.000	0.000	0.047	0.002	0.000	0.000	0.000
15	1.646	0.263	0.057	0.042	0.016	0.000	0.000	0.012	0.003	0.042	0.021	0.021
20	1.844	0.198	0.176	0.042	0.134	0.000	0.000	0.000	0.009	0.167	0.083	0.083
25	2.019	0.176	0.198	0.042	0.145	0.011	0.006	0.000	0.010	0.188	0.094	0.099
30	2.195	0.176	0.461	0.042	0.000	0.419	0.210	0.000	0.023	0.438	0.219	0.429
35	2.259	0.064	0.922	0.042	0.000	0.880	0.440	0.000	0.046	0.876	0.438	0.878
40	2.317	0.057	0.263	0.042	0.000	0.222	0.111	0.000	0.013	0.250	0.125	0.236
45	2.369	0.052	0.176	0.042	0.000	0.134	0.067	0.000	0.009	0.167	0.083	0.150
50	2.416	0.047	0.064	0.042	0.000	0.023	0.011	0.000	0.003	0.061	0.031	0.042
55	2.459	0.044	0.052	0.042	0.000	0.010	0.005	0.000	0.003	0.049	0.025	0.030
60	2.500	0.041	0.044	0.042	0.000	0.002	0.001	0.000	0.002	0.041	0.021	0.022
TOTALS	2.500	2.500	2.500	0.500	0.300	1.701	0.851	0.100	0.125	2.279	1.140	1.990

STORM HYDROGRAPH

50-51 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=30.0 MIN. PEAK RUNOFF= 120.6 CFS RUNOFF VOL.= 4.2 ACRE FEET

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DETERMINATION OF EFFECTIVE RAINFALL

51-53 PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

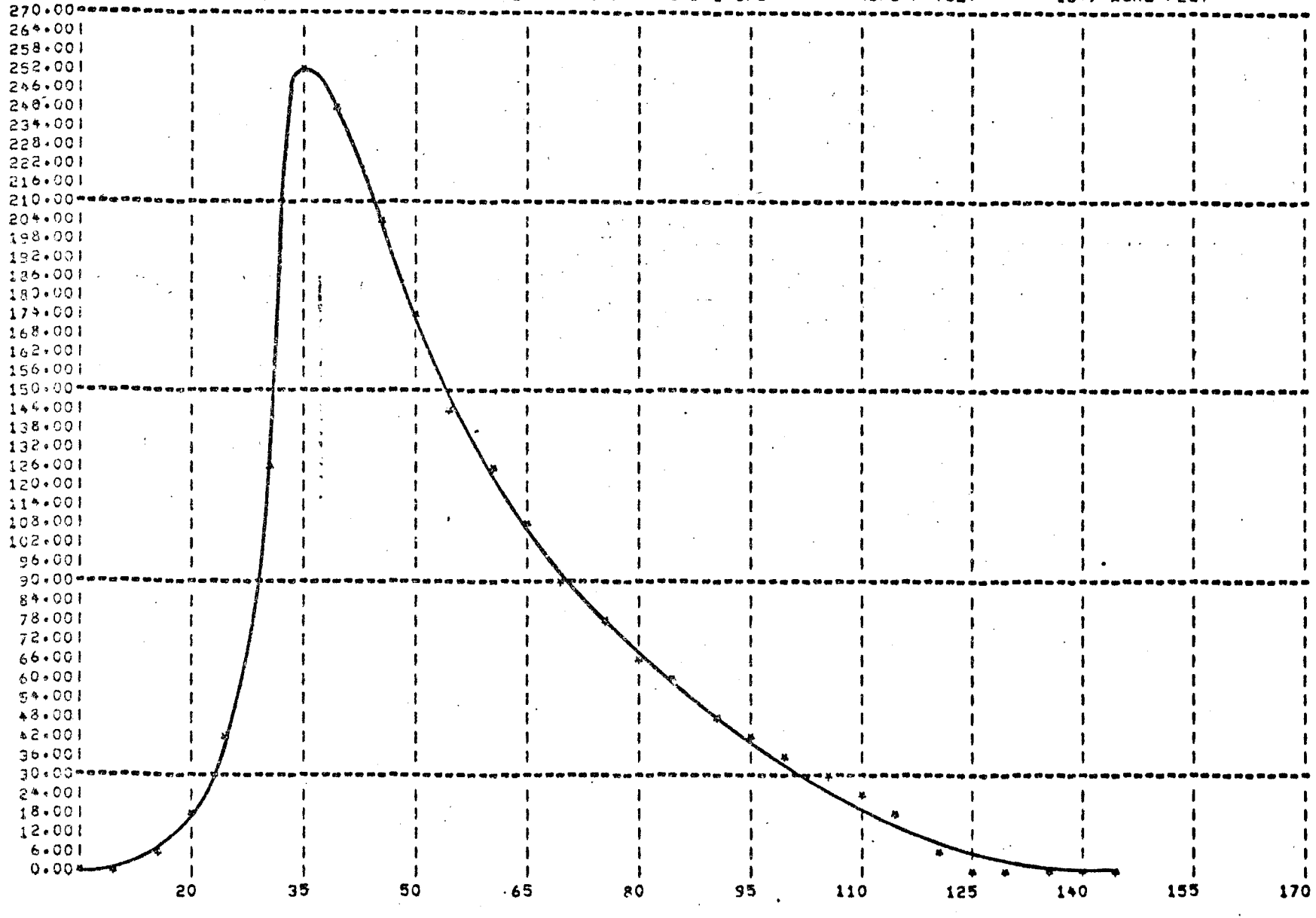
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 60%				IMPERVIOUS AREA 40%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	60 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	40% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.922	0.922	0.041	0.042	0.000	0.000	0.000	0.041	0.002	0.000	0.000	0.000
10	1.383	0.461	0.047	0.042	0.006	0.000	0.000	0.047	0.002	0.000	0.000	0.000
15	1.646	0.263	0.057	0.042	0.016	0.000	0.000	0.012	0.003	0.042	0.017	0.017
20	1.844	0.198	0.176	0.042	0.134	0.000	0.000	0.000	0.009	0.167	0.067	0.067
25	2.019	0.176	0.198	0.042	0.145	0.011	0.007	0.000	0.010	0.188	0.075	0.082
30	2.195	0.176	0.461	0.042	0.000	0.419	0.252	0.000	0.023	0.438	0.175	0.427
35	2.259	0.064	0.922	0.042	0.000	0.880	0.528	0.000	0.046	0.876	0.350	0.878
40	2.317	0.057	0.263	0.042	0.000	0.222	0.133	0.000	0.013	0.250	0.100	0.233
45	2.369	0.052	0.176	0.042	0.000	0.134	0.080	0.000	0.009	0.167	0.067	0.147
50	2.416	0.047	0.064	0.042	0.000	0.023	0.014	0.000	0.003	0.061	0.024	0.038
55	2.459	0.044	0.052	0.042	0.000	0.010	0.006	0.000	0.003	0.049	0.020	0.026
60	2.500	0.041	0.044	0.042	0.000	0.002	0.001	0.000	0.002	0.041	0.017	0.018
TOTALS	2.500	2.500	2.500	0.500	0.300	1.701	1.021	0.100	0.125	2.279	0.912	1.932

STORM HYDROGRAPH

51-53 PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=35.0 MIN. PEAK RUNOFF= 249.1 CFS RUNOFF VOL.= 13.7 ACRE FEET



DETERMINATION OF EFFECTIVE RAINFALL

52-53 -PETERSON FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

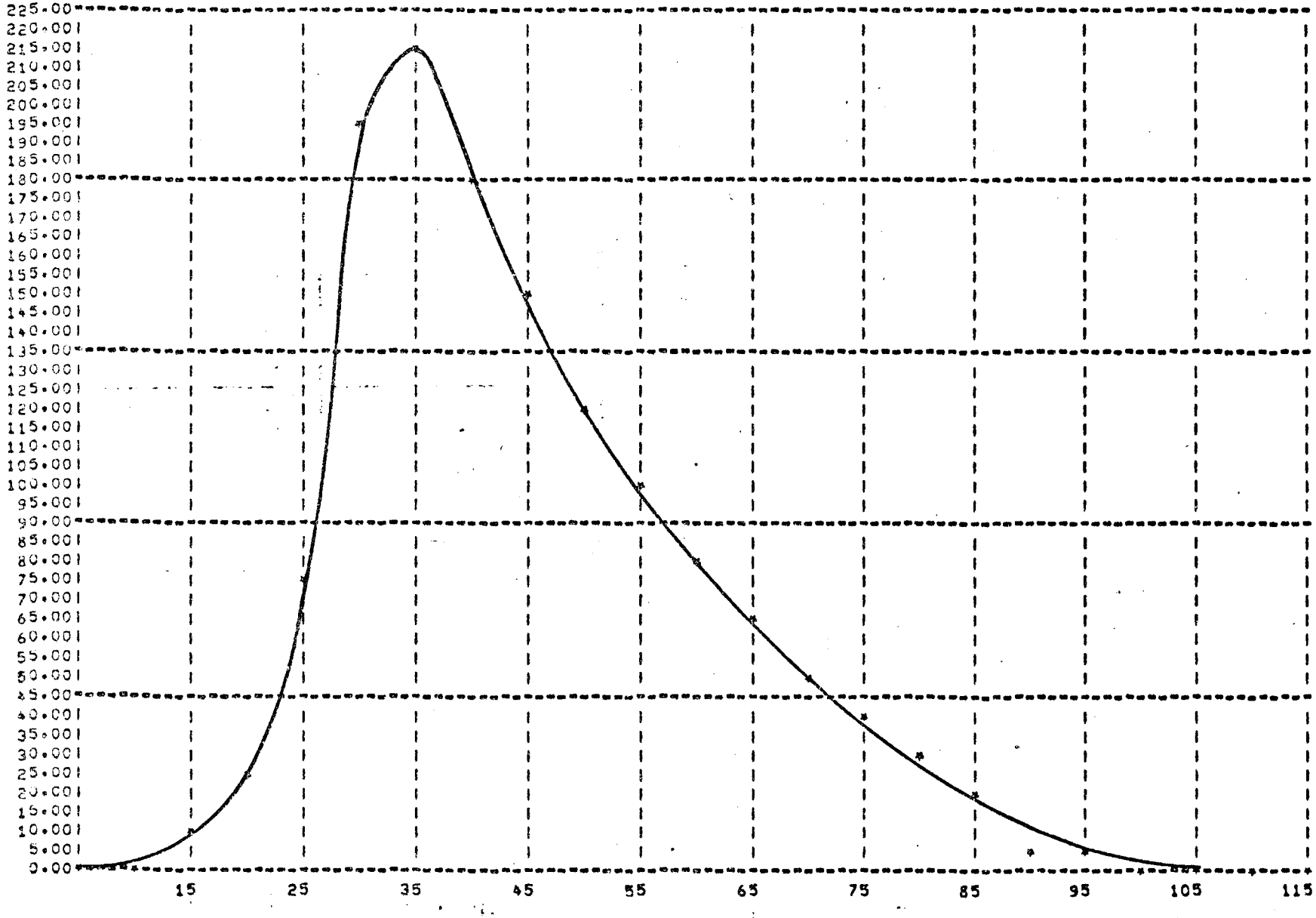
TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 60%				IMPERVIOUS AREA 40%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	60 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	40% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.922	0.922	0.041	0.042	0.000	0.000	0.000	0.041	0.002	0.000	0.000	0.000
10	1.383	0.461	0.047	0.042	0.006	0.000	0.000	0.047	0.002	0.000	0.000	0.000
15	1.646	0.263	0.057	0.042	0.016	0.000	0.000	0.012	0.003	0.042	0.017	0.017
20	1.844	0.198	0.176	0.042	0.134	0.000	0.000	0.000	0.009	0.167	0.067	0.067
25	2.019	0.176	0.198	0.042	0.145	0.011	0.007	0.000	0.010	0.188	0.075	0.082
30	2.195	0.176	0.461	0.042	0.000	0.419	0.252	0.000	0.023	0.438	0.175	0.427
35	2.259	0.064	0.922	0.042	0.000	0.880	0.528	0.000	0.046	0.876	0.350	0.878
40	2.317	0.057	0.263	0.042	0.000	0.222	0.133	0.000	0.013	0.250	0.100	0.233
45	2.369	0.052	0.176	0.042	0.000	0.134	0.080	0.000	0.009	0.167	0.067	0.147
50	2.416	0.047	0.064	0.042	0.000	0.023	0.014	0.000	0.003	0.061	0.024	0.038
55	2.459	0.044	0.052	0.042	0.000	0.010	0.006	0.000	0.003	0.049	0.020	0.026
60	2.500	0.041	0.044	0.042	0.000	0.002	0.001	0.000	0.002	0.041	0.017	0.018
TOTALS	2.500	2.500	2.500	0.500	0.300	1.701	1.021	0.100	0.125	2.279	0.912	1.932

STORM HYDROGRAPH

52-53 -PETERSON FIELD

100 YEAR STORM

TIME TO PEAK=35.0 MIN. PEAK RUNOFF= 215.8 CFS RUNOFF VOL.= 9.8 ACRE FEET

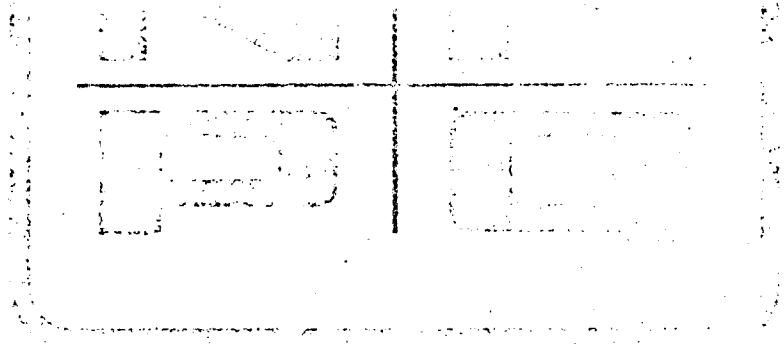


DETERMINATION OF EFFECTIVE RAINFALL

53-10J PETE FIELD

DESIGN STORM: 100 YEAR RECURRENCE INTERVALL

TIME (MIN)	TOTAL PRECIP. (IN.)	INCREM. PRECIP. (IN.)	REARRANGED INCREM. PRECIP. (IN.)	PERVIOUS AREA 58%				IMPERVIOUS AREA 42%				TOTAL AVERAGE EFFECTIVE PRECIP. (IN.)
				MAX. INFIL. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	EFFEC. PRECIP. (IN.)	58 % EFFEC. PRECIP. (IN.)	DETENTION & DEPRESSION STORAGE (IN.)	LOSS (IN.)	EFFEC. PRECIP. (IN.)	42% EFFEC. PRECIP. (IN.)	
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	1.383	1.383	0.084	0.083	0.001	0.000	0.000	0.084	0.004	0.000	0.000	0.000
20	1.844	0.461	0.122	0.083	0.039	0.000	0.000	0.016	0.006	0.100	0.042	0.042
30	2.195	0.351	0.461	0.083	0.261	0.117	0.068	0.000	0.023	0.438	0.184	0.252
40	2.317	0.122	1.383	0.083	0.000	1.299	0.754	0.000	0.069	1.314	0.552	1.305
50	2.416	0.099	0.351	0.083	0.000	0.268	0.155	0.000	0.018	0.334	0.140	0.295
60	2.500	0.084	0.099	0.083	0.000	0.016	0.009	0.000	0.005	0.094	0.040	0.049
TOTALS	2.500	2.500	2.500	0.500	0.300	1.700	0.986	0.100	0.125	2.279	0.957	1.943



STORM HYDROGRAPH

53-103 PETE FIELD

100 YEAR STORM

TIME TO PEAK=40.0 MIN. PEAK RUNOFF= 473.8 CFS RUNOFF VOL.= 23.5 ACRE FEET