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ESTIMATION OF RIVERFLOWS IN UNGAUGED CATCHMENTS

VOLUME 2

FIGURES AND APPENDICIES

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FIGURES 1-100

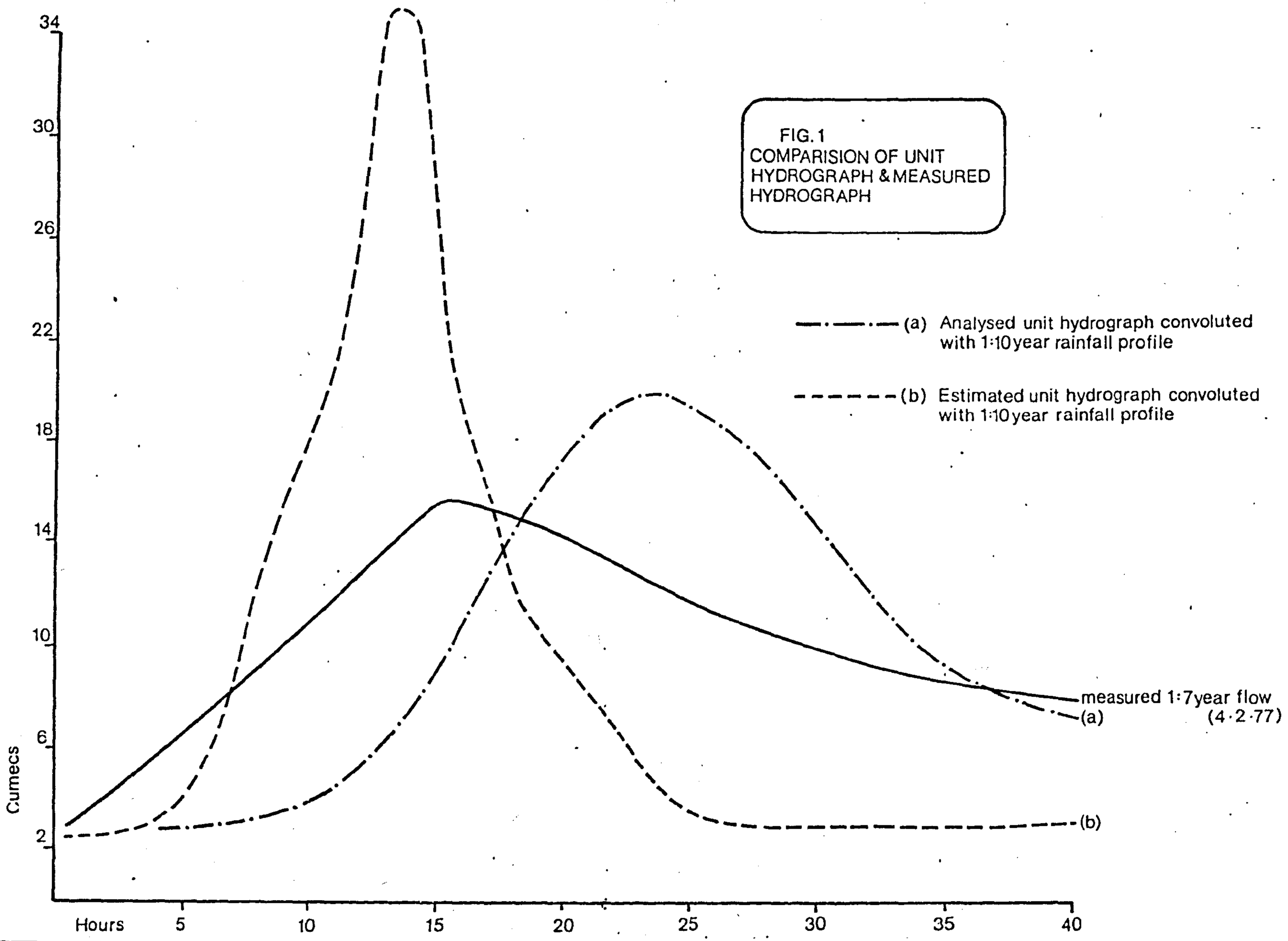
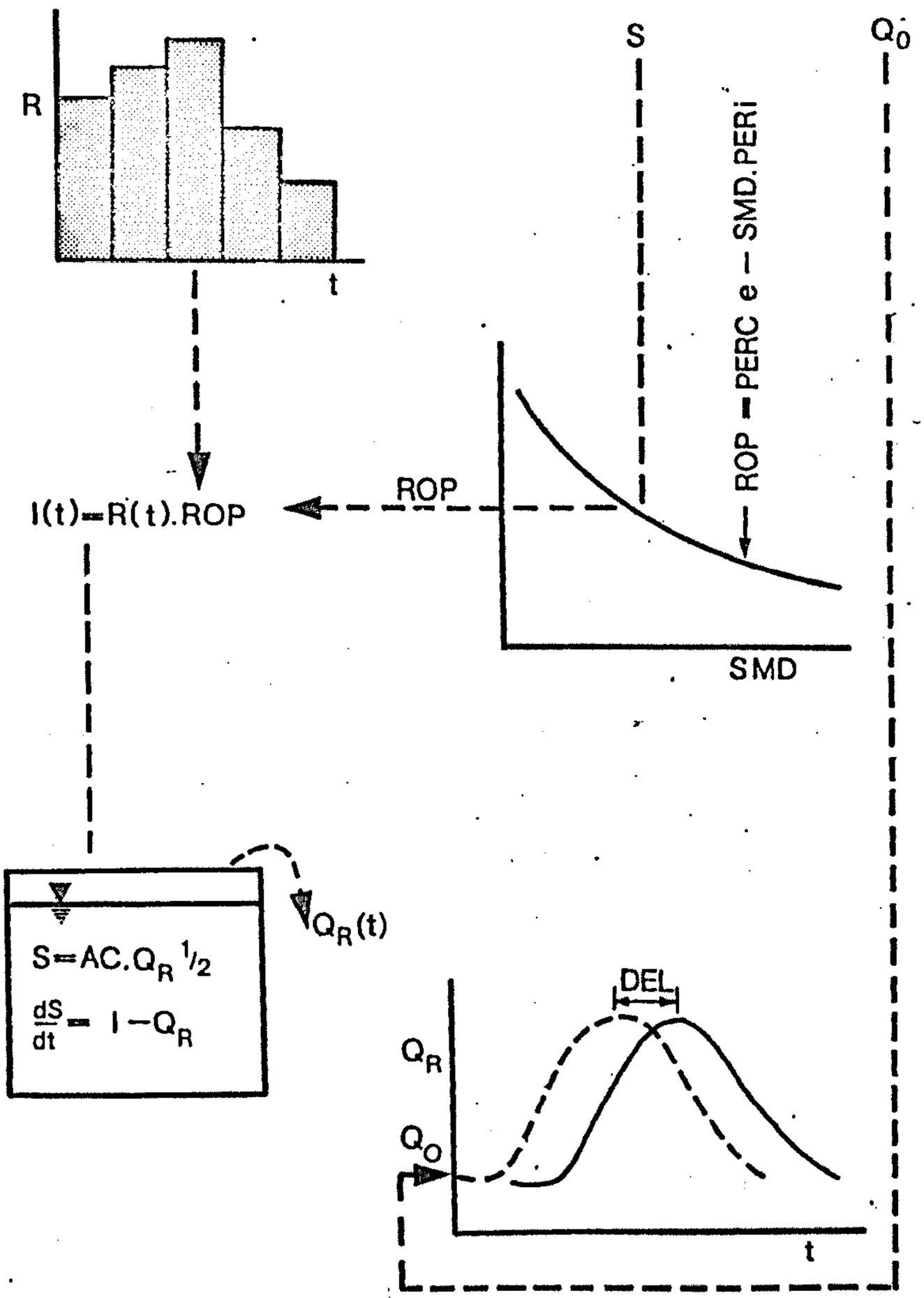


FIG. 1
COMPARISION OF UNIT HYDROGRAPH & MEASURED HYDROGRAPH

FIG. 2

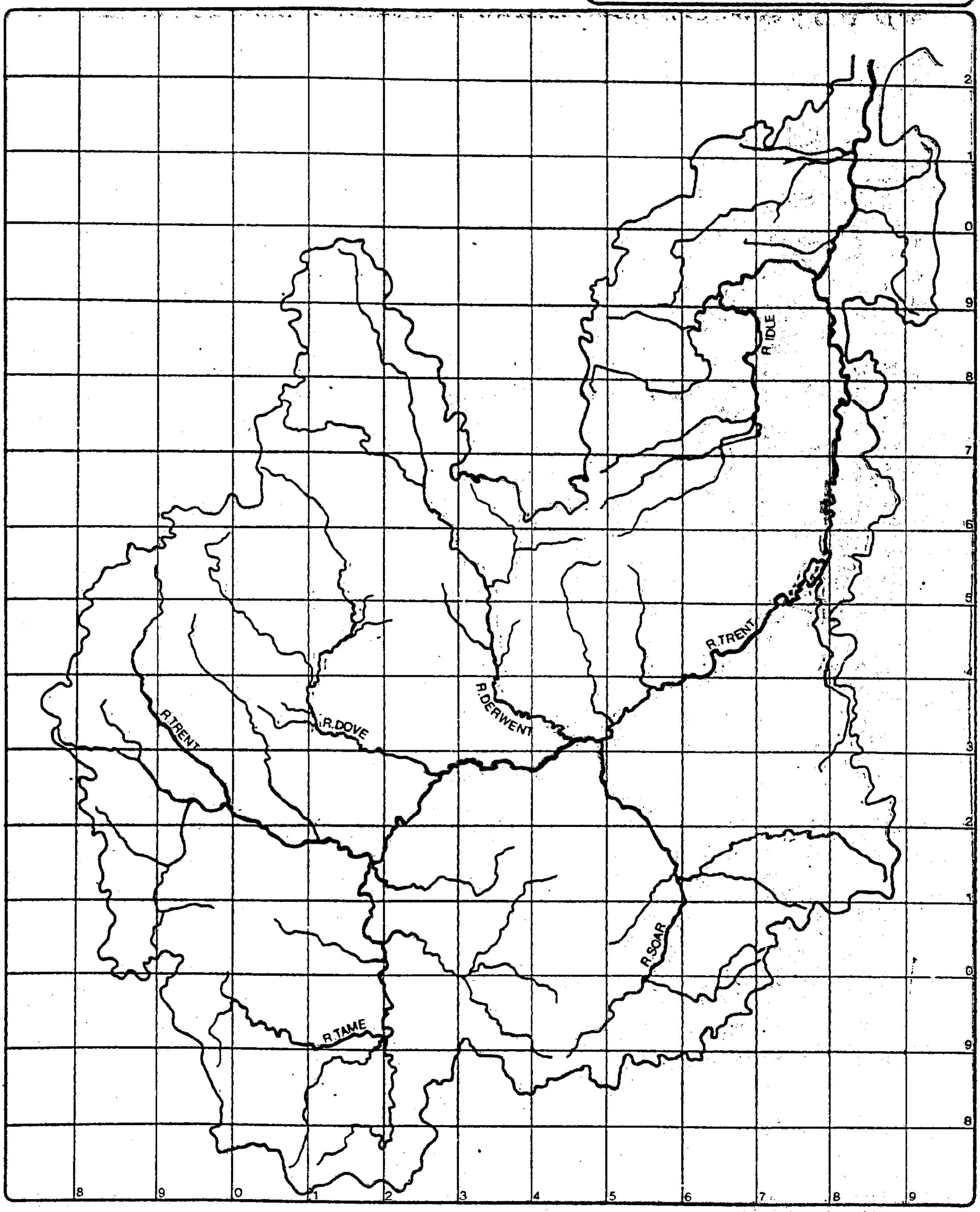
Isolated Events Model



t = time (hours)
R = Rainfall (mm)
SMD = Soil Moisture Defecit (mm)
Q_0 = Initial Discharge
Q_R = Runoff Hydrograph Ordinates

PERC
PERi
AC
DEL
} Parameters

RIVER TRENT BASIN



LIAS

MERCIA MUDSTONE

SHERWOOD SANDSTONE

PERMIAN LIMESTONE

WESTPHALIAN (COAL MEASURES)

NAMURIAN (MILLSTONE GRIT)

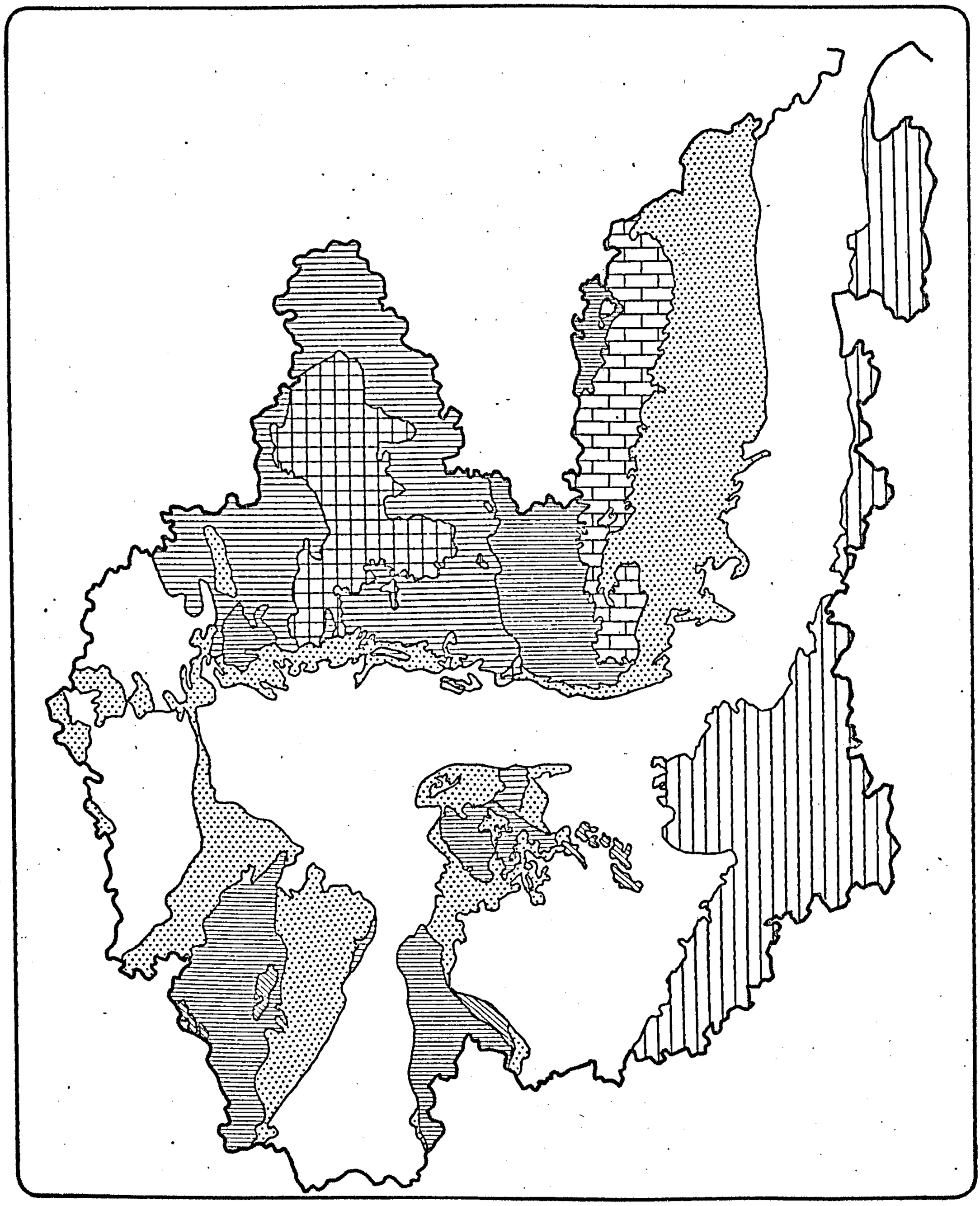
DINANTIAN (CARB. L'STONE)

PRE CAMBRIAN

TRENT AREA GEOLOGY

FIG. 4

0 10 20 30 Kilometres



LIAS

MERCIA MUDSTONE

SHERWOOD SANDSTONE

PERMIAN LIMESTONE

WESTPHALIAN (COAL MEASURES)

NAMURIAN (MILLSTONE GRIT)

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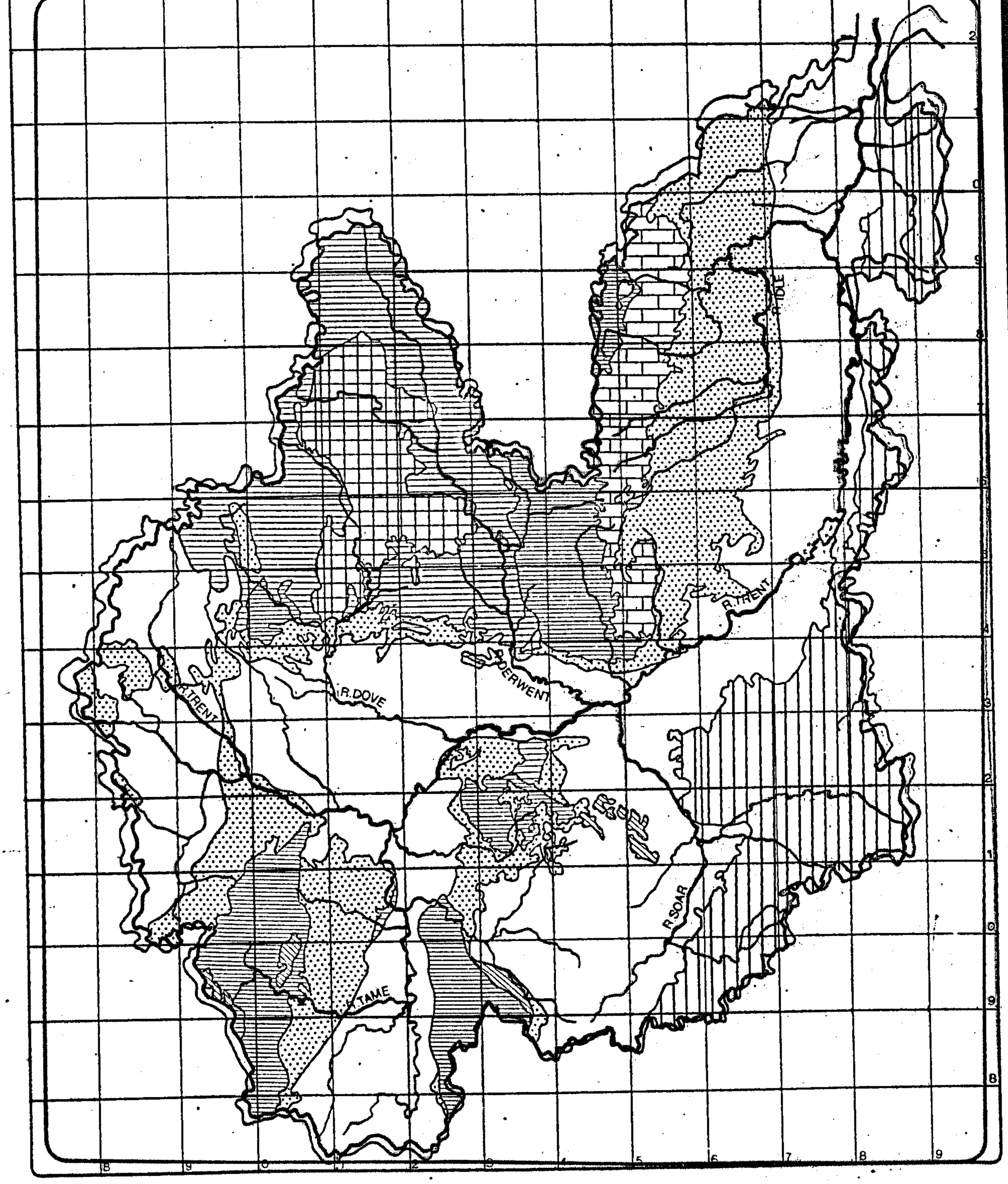
PRE CAMBRIAN

TRENT AREA GEOLOGY

FIG. 4

RIVER TRENT BASIN

0 10 20 30 Kilometres



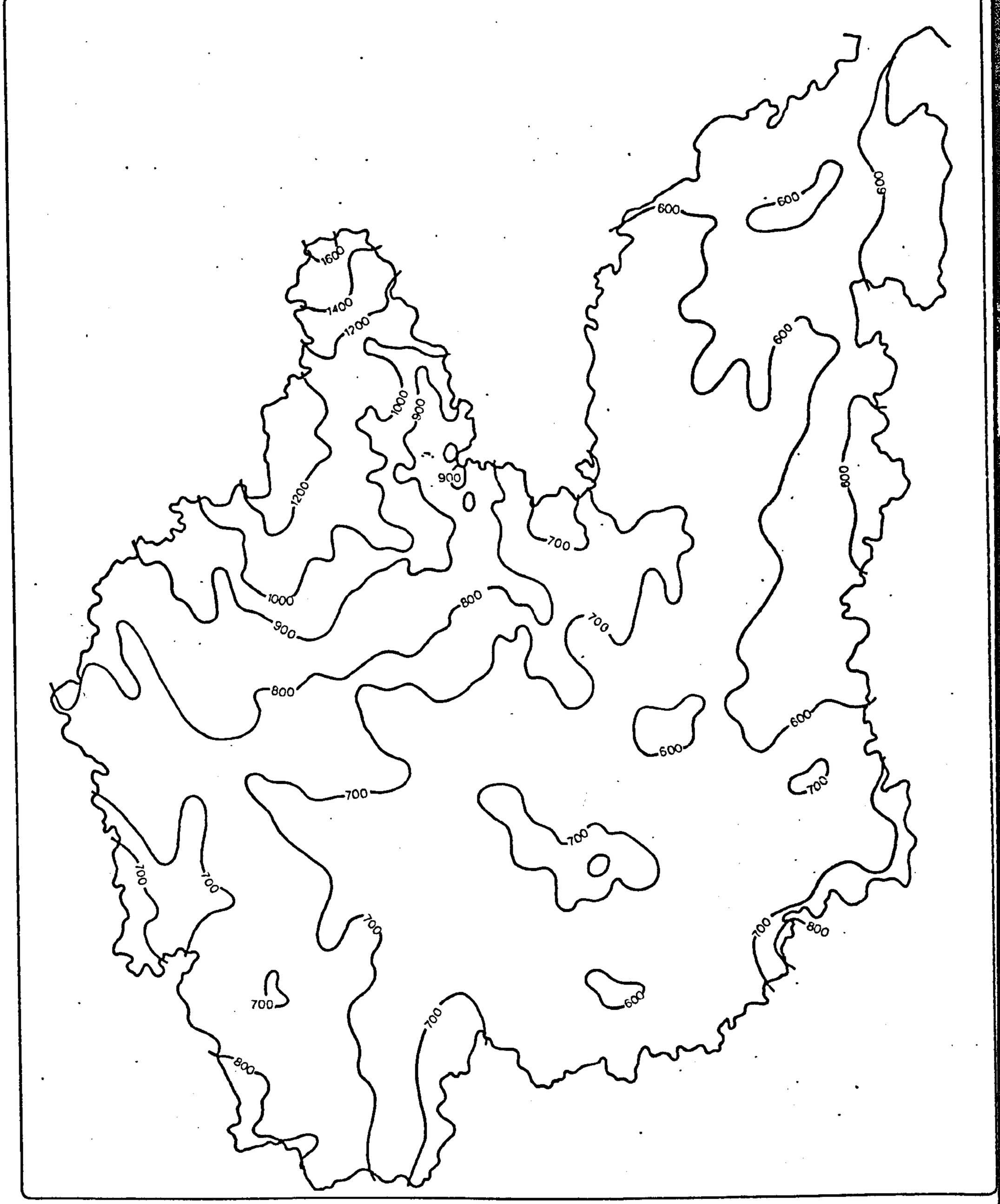
TRENT AREA

MEAN ANNUAL PRECIPITATION

FIG. 5

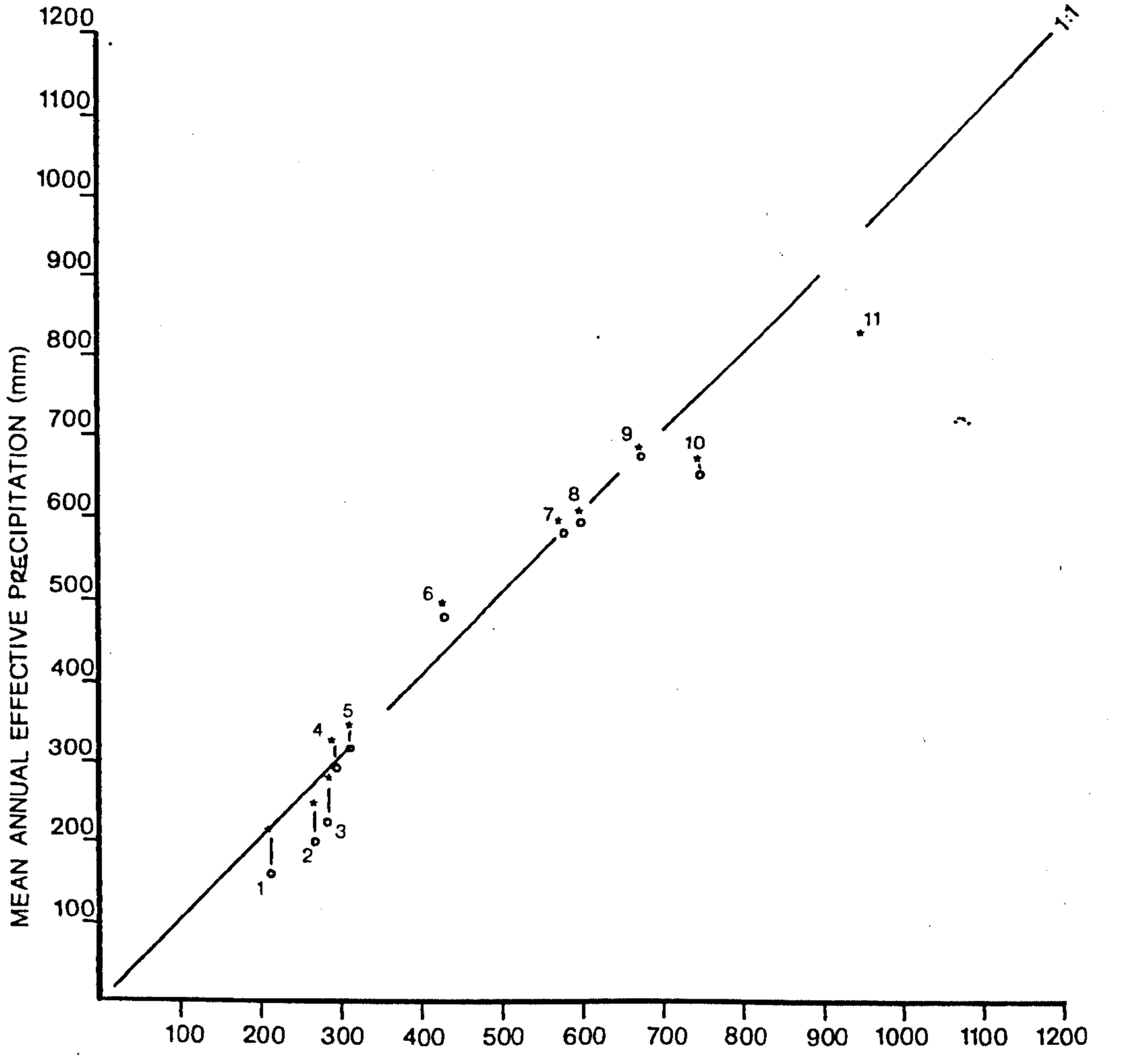
700 ISOHYETS IN MILLIMETRES PER ANNUM

0 10 20 30 Kilometres



Comparison of effective precipitation and runoff

FIG. 6



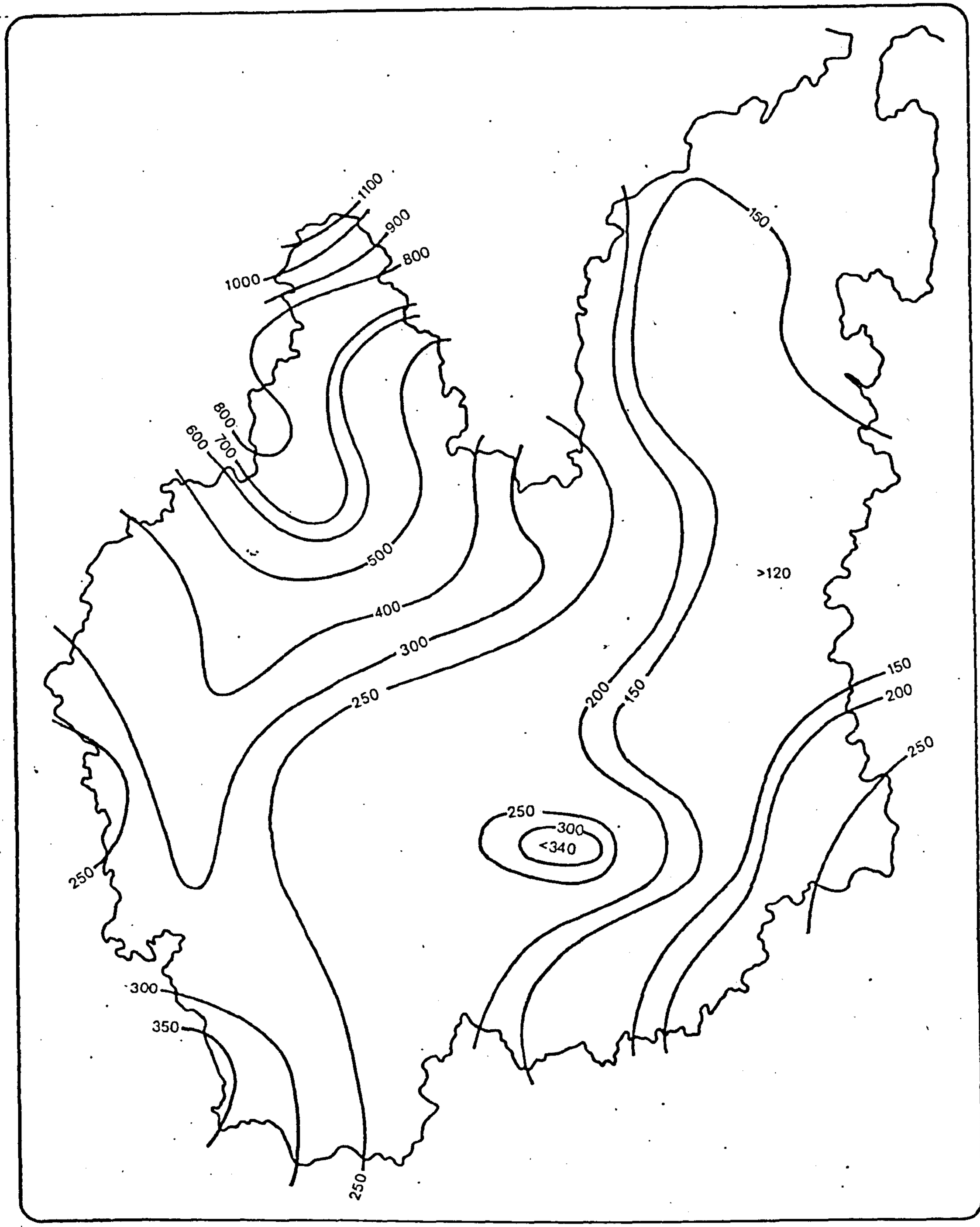
1 Syston
2 Polesworth
3 Ratcliffe Culey
4 Blackbrook
5 Calthorpe Park
6 Rocester (Churnet)
7 Wafehouses
8 Rocester (Dove)
9 Izaak Walton
10 Ilam
11 Hollinsclough

* Adjusted using ratio(R)
o Potential evaporation

TRENT AREA
MEAN ANNUAL EFFECTIVE PRECIPITATION
[ADJUSTED]
FIG.7

600 ISOHYETS IN MILLIMETRES PER ANNUM

0 10 20 30km



Keuper Marl

Lias

Metamorphic/Igneous

Coal Measures

Millstone Grit

Sandstone

Oolitic Limestone

Carboniferous Limestone

FIG. 8

ARBITRARY GEOLOGICAL INDEX

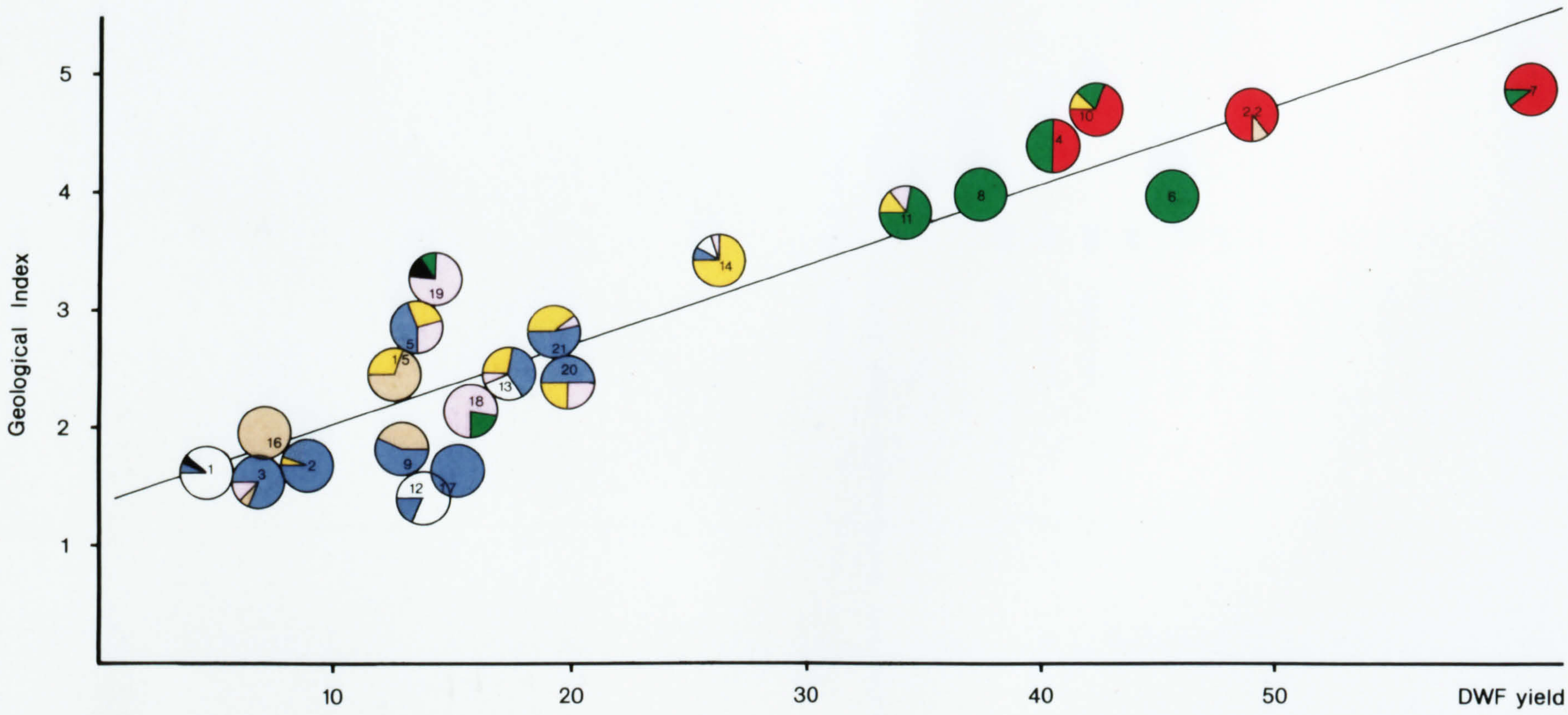


FIGURE 8a

STATION REFERENCE NUMBERS (FIGURE 8)

1	Syston	12	Coleshill
2	Ratcliffe Culey	13	Stoke
3	Polesworth	14	Wingfield Pk
4	Ilam	15	Penkridge
5	Calthorpe Pk	16	Gt Bridgford
6	Yorkshire Bridge	17	Ashford
7	Izaak Walton	18	Stareton
8	Hollinsclough	19	Roddington
9	Black Brook	20	Walcott
10	Rocester (D)	21	Tenbury
11	Rocester (C)	22	Rhos-y-Pentref

In catchments of mixed geology all indices were apportioned according to the areal extent of different rock types.

Group 1

2

3

4

5

URBAN (6)

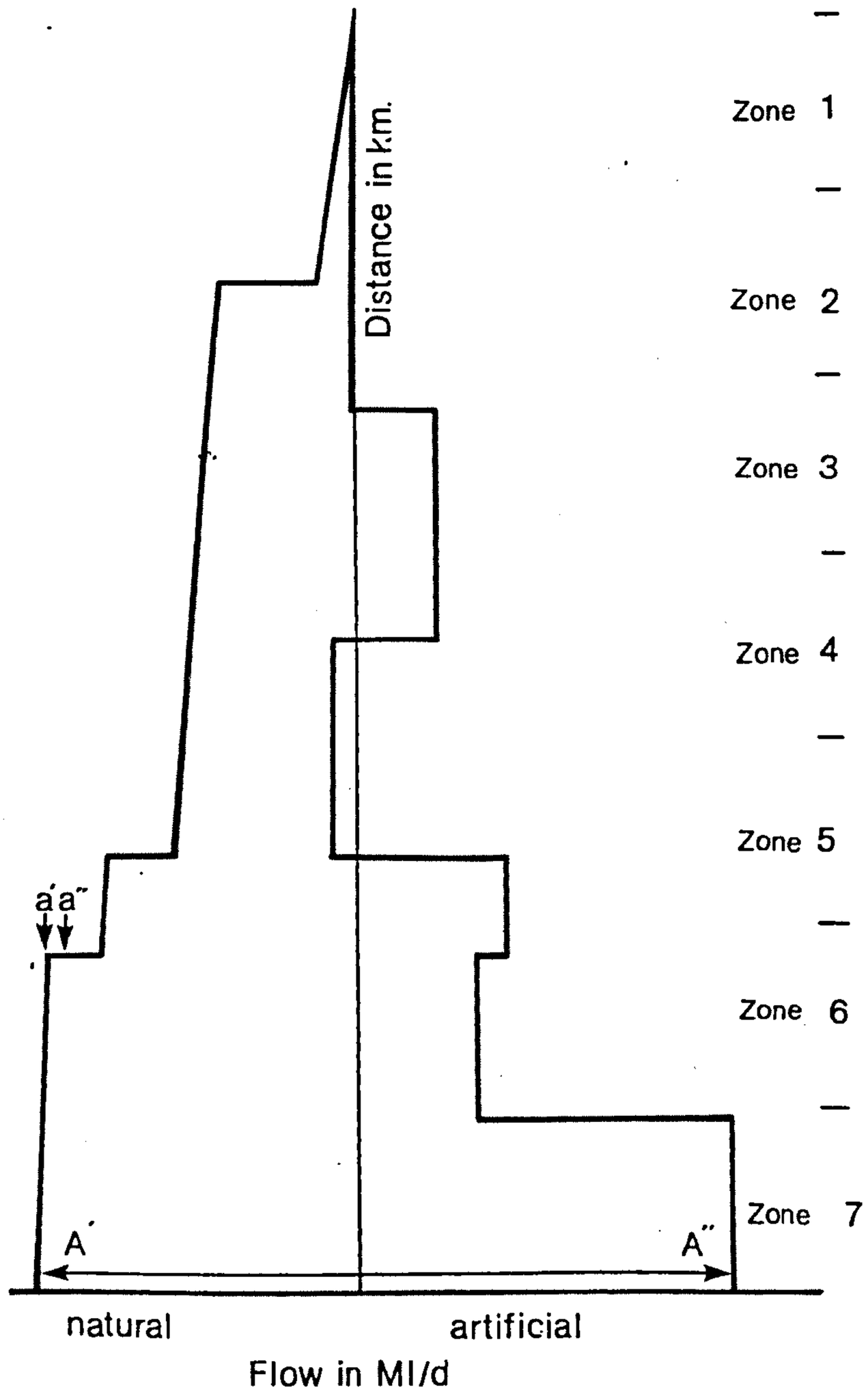
SOIL INDEX

(after Mackney 1977)

FIG. 9

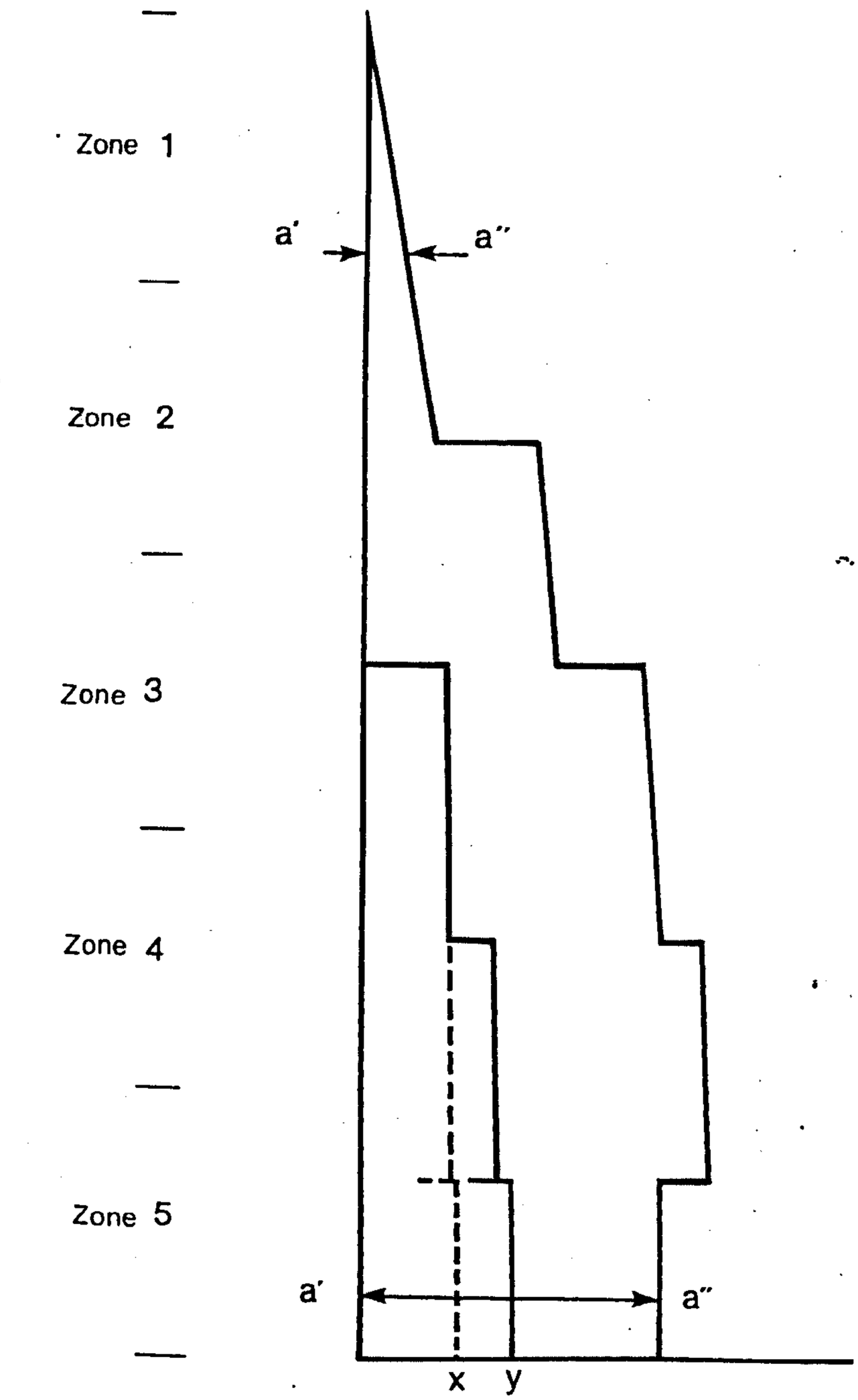
Simplified Residual Flow
Quantity Diagram

FIG. 10



Simpified Residual Flow
Quality Diagram

FIG.11

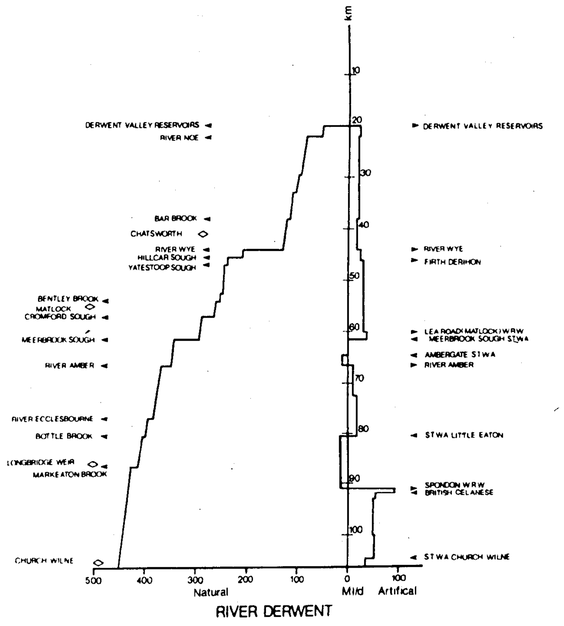


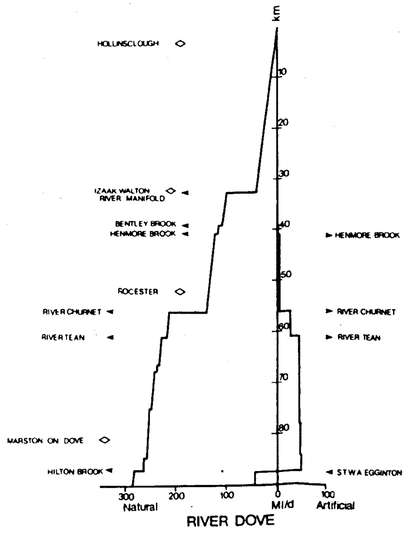
y total (sewage, industrial and thermal) effluent
x sewage and industrial effluent

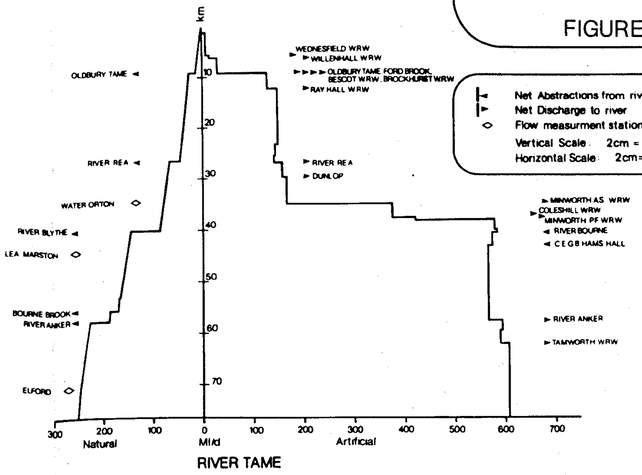
RESIDUAL FLOW DIAGRAM
DRY WEATHER FLOW CONDITIONS

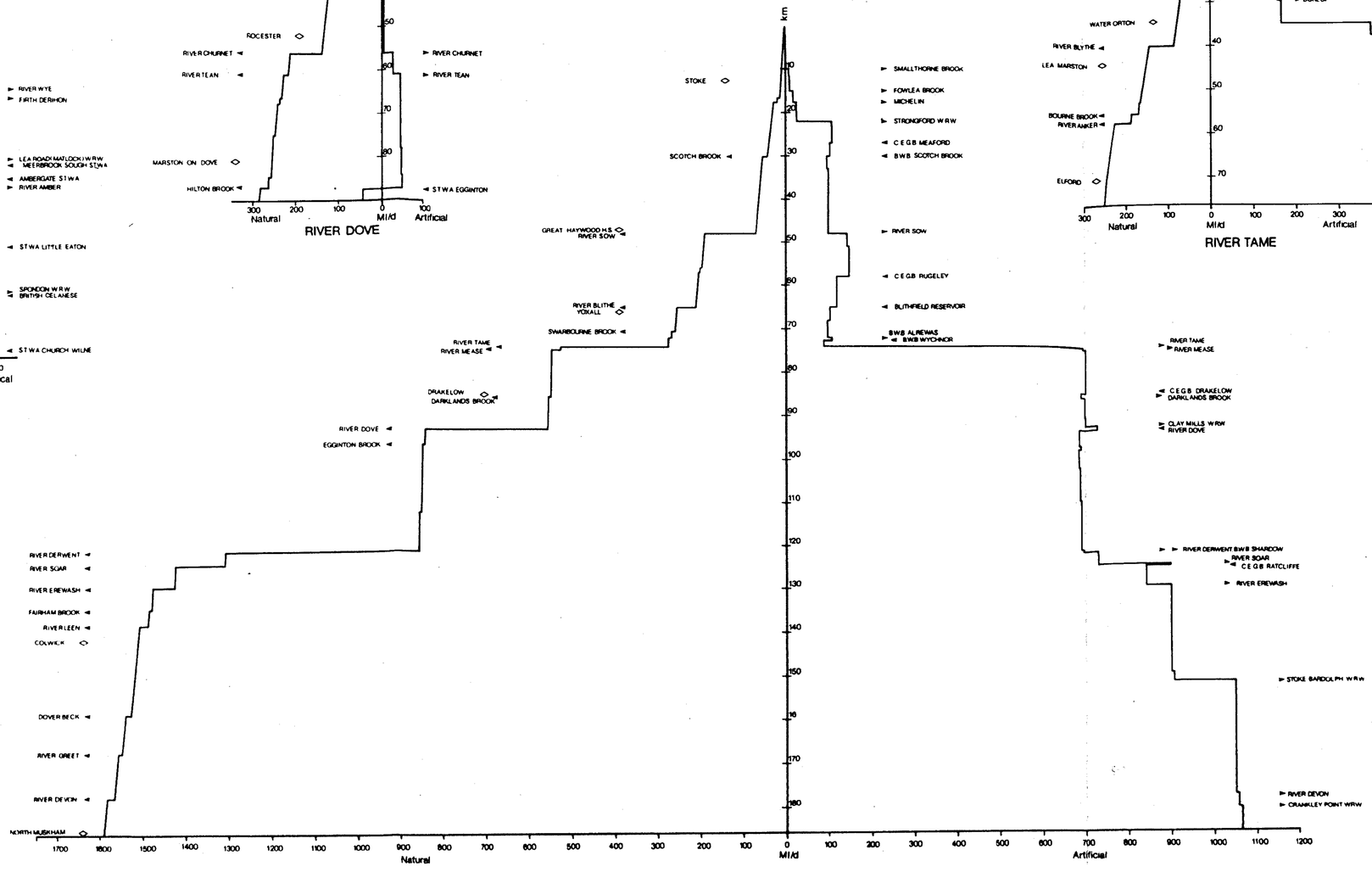
FIGURE 12

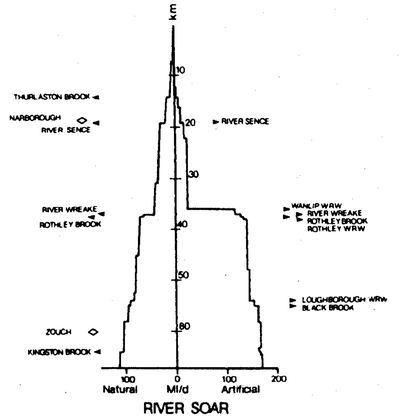
Net Abstractions from river > 5 Ml/d
Net Discharge to river > 5 Ml/d
Flow measurment stations
Vertical Scale: 2cm = 10km
Horizontal Scale: 2cm = 100Ml/d









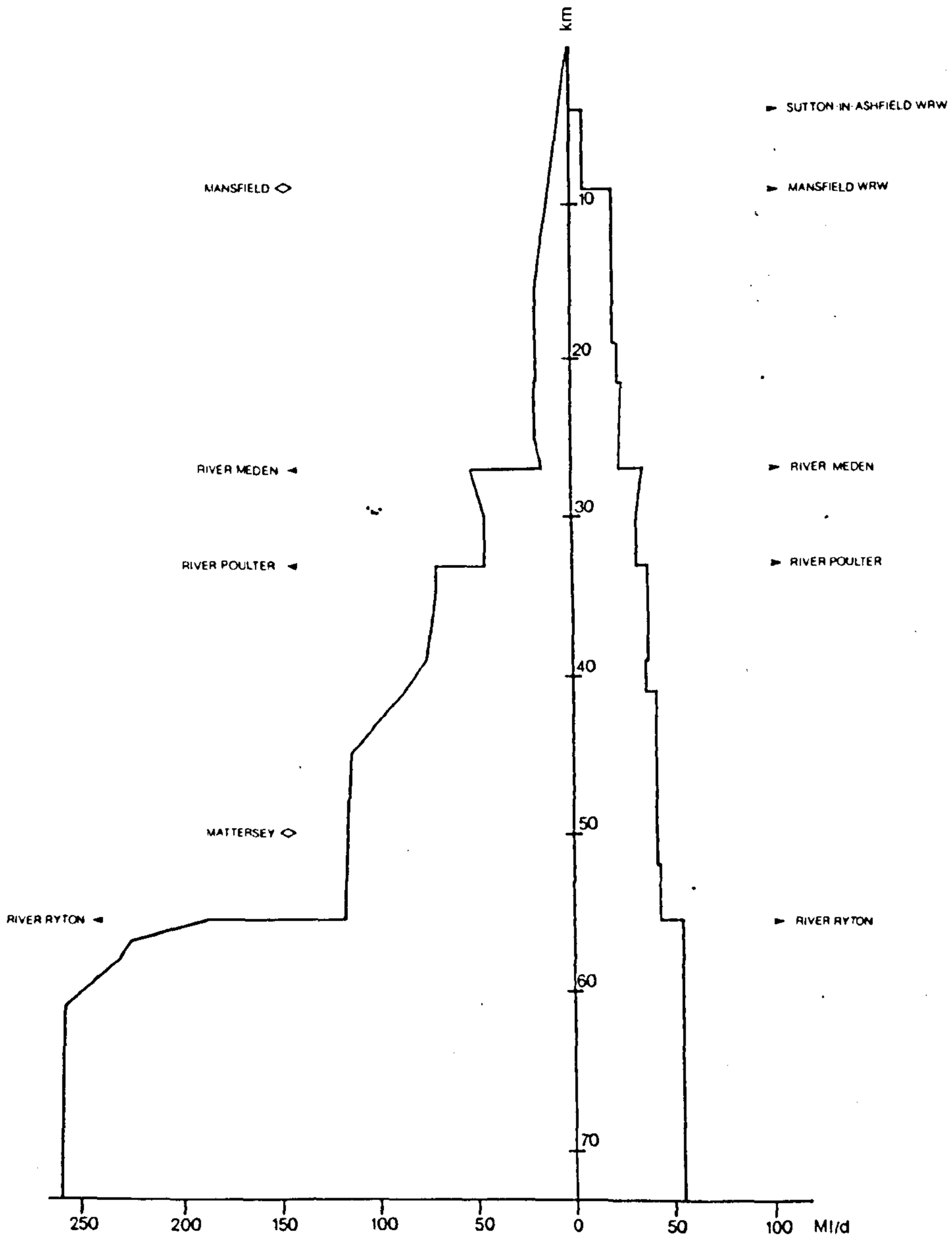


RESIDUAL FLOW DIAGRAM

DRY WEATHER FLOW CONDITIONS

RIVER IDLE FIG.12'a

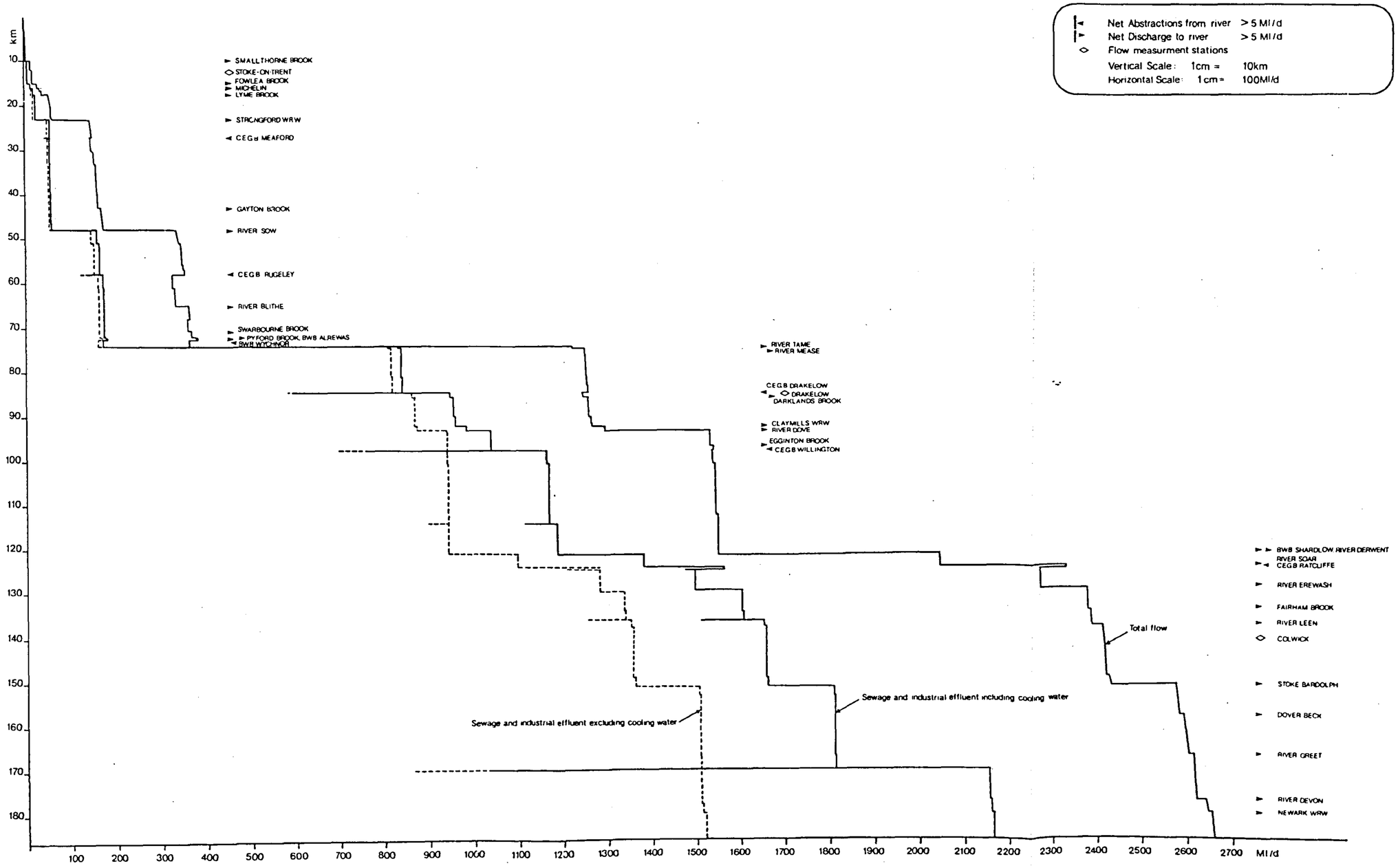
|◄ Net Abstractions from river > 5 Ml/d
|► Net Discharge to river > 5 Ml/d
◇ Flow measurment stations
Vertical Scale: 1cm = 5km
Horizontal Scale: 5cm = 200 Ml/d



RESIDUAL FLOW DIAGRAM
DRY WEATHER FLOW CONDITIONS
RIVER TRENT

FIG.13

|◄ Net Abstractions from river > 5 Ml/d
|► Net Discharge to river > 5 Ml/d
◇ Flow measurment stations
Vertical Scale: 1cm = 10km
Horizontal Scale: 1cm = 100Ml/d



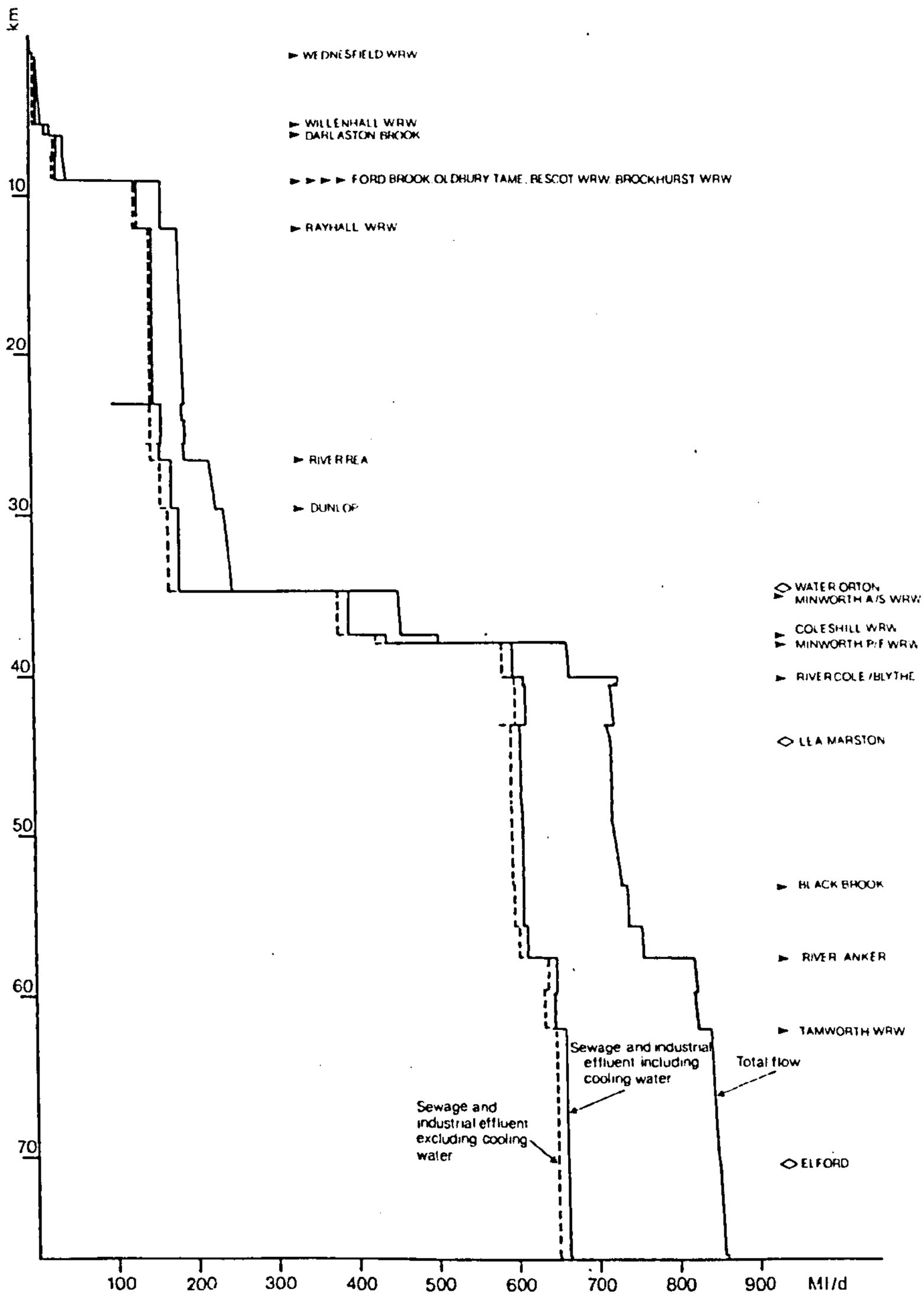
J.P. 1980

RESIDUAL FLOW DIAGRAM

DRY WEATHER FLOW CONDITIONS

RIVER TAME FIG. 14

|◄ Net Abstractions from river > 5 Ml/d
|► Net Discharge to river > 5 Ml/d
◇ Flow measurment stations
Vertical Scale 1cm = 5km
Horizontal Scale 1cm = 100Ml/d



J.P. 1980

RESIDUAL FLOW DIAGRAM

DRY WEATHER FLOW CONDITIONS

RIVER DOVE FIG. 15

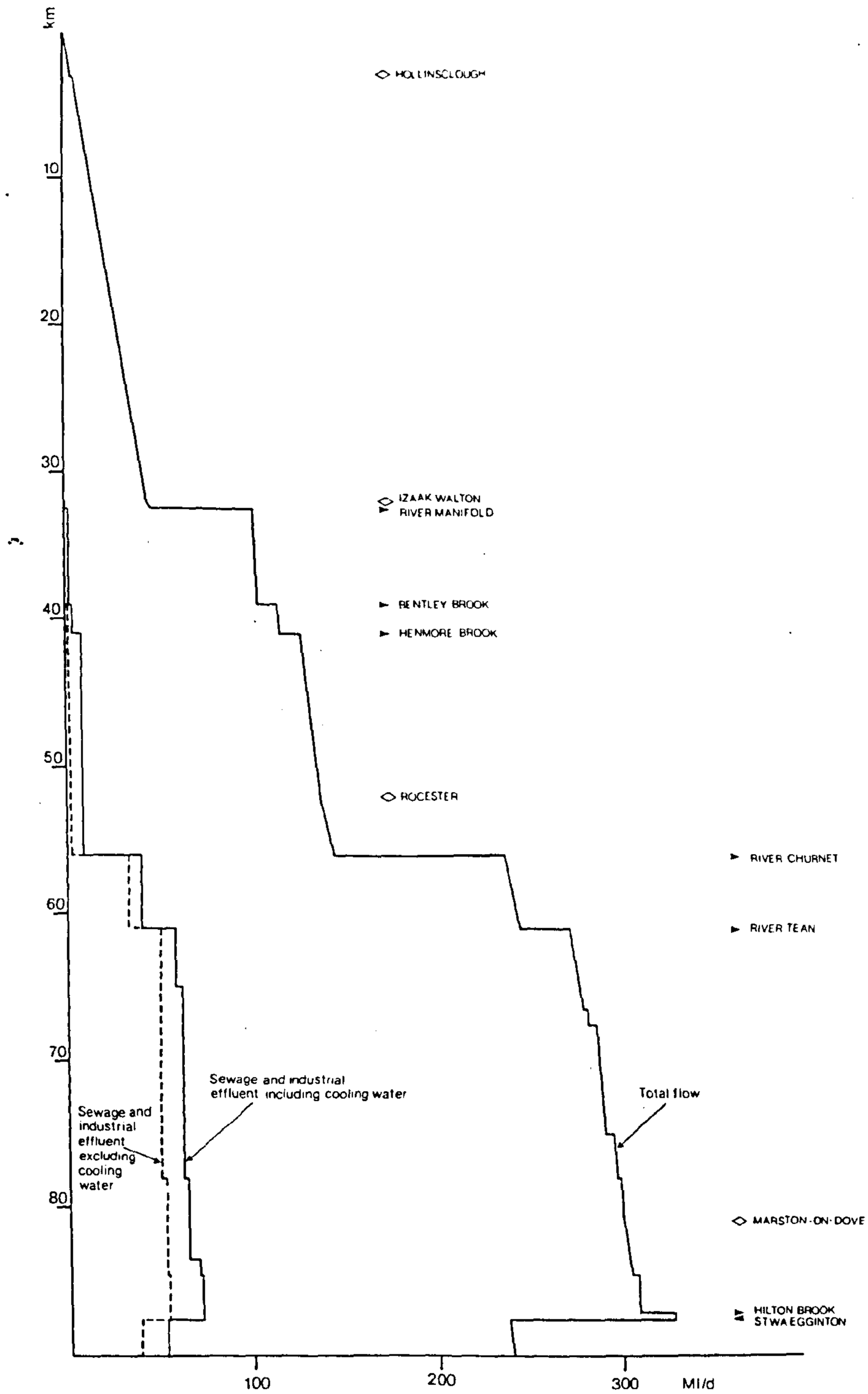
◄| Net Abstractions from river > 5 Ml/d

►| Net Discharge to river > 5 Ml/d

◇ Flow measurment stations

Vertical Scale 1cm = 5km

Horizontal Scale 5cm = 200Ml/d

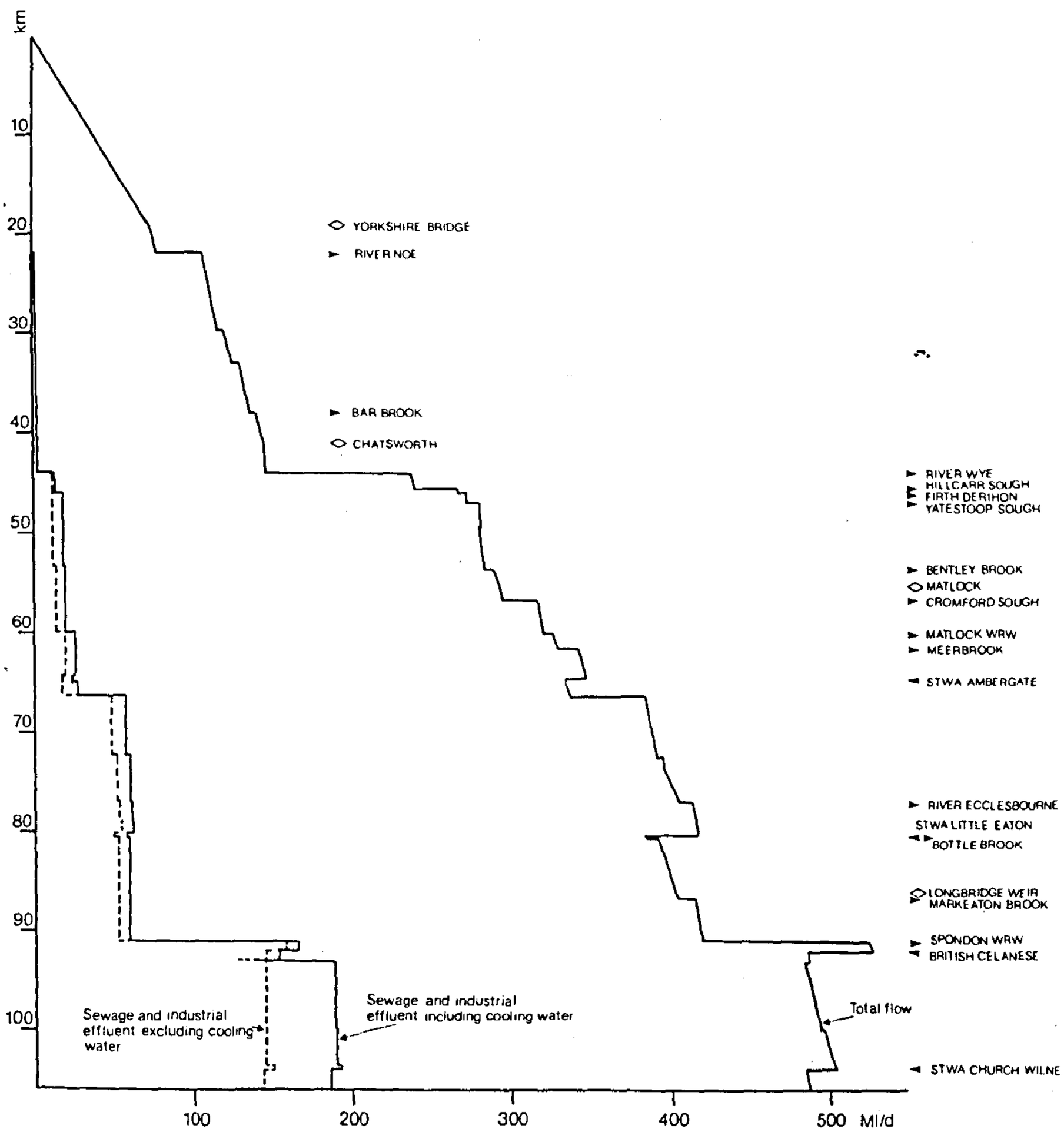


J.P. 1980

RESIDUAL FLOW DIAGRAM
DRY WEATHER FLOW CONDITIONS
RIVER DERWENT FIG.16

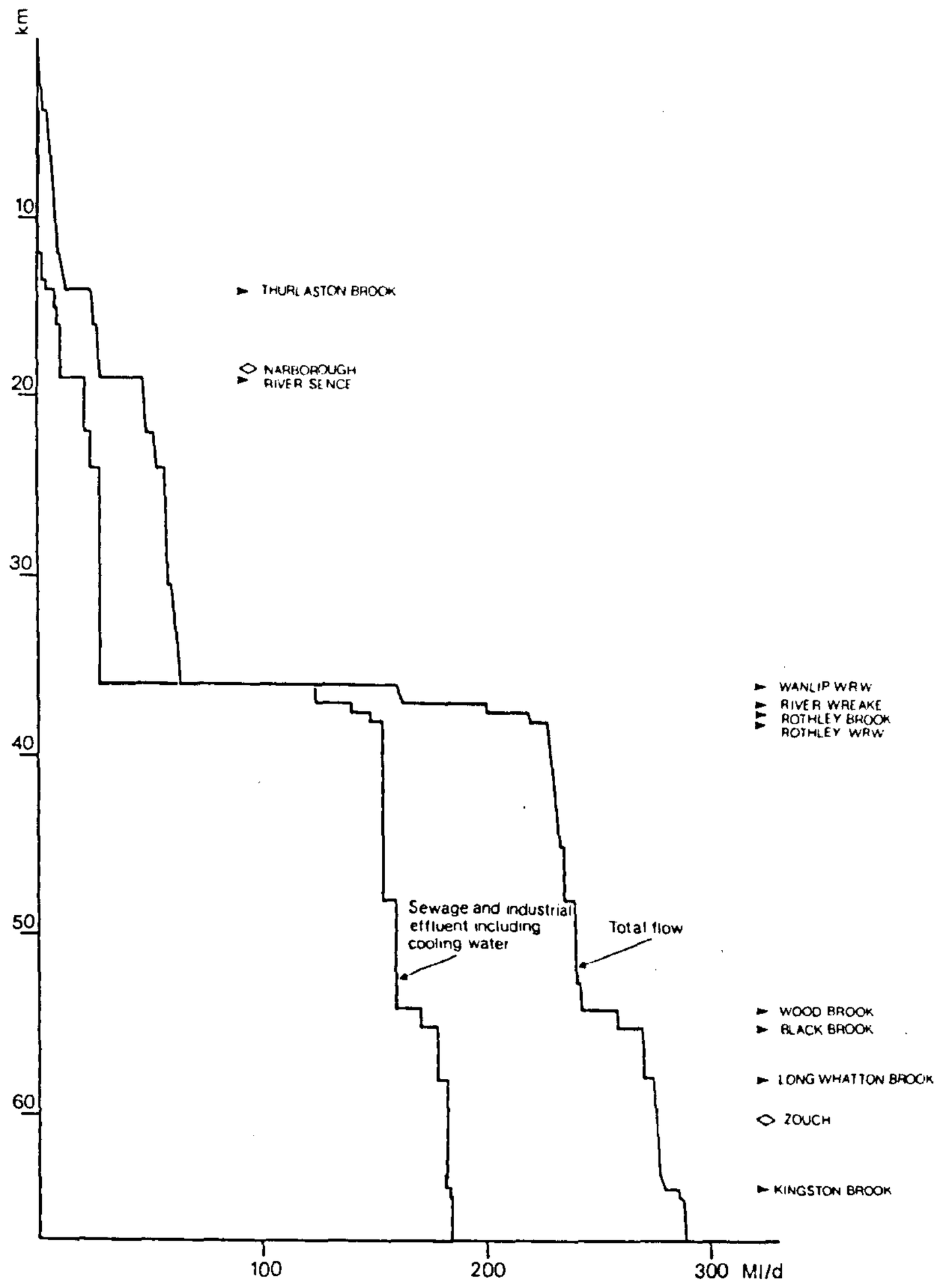
|◄ Net Abstractions from river > 5 Ml/d
|► Net Discharge to river > 5 Ml/d
◇ Flow measurment stations

Vertical Scale: 5 cm = 40km
Horizontal Scale: 1cm = 50Ml/d



RESIDUAL FLOW DIAGRAM
DRY WEATHER FLOW CONDITIONS
RIVER SOAR FIG. 17

|◄ Net Abstractions from river > 5 Ml/d
|► Net Discharge to river > 5 Ml/d
◇ Flow measurment stations
Vertical Scale 1cm = 5km
Horizontal Scale 5cm = 200Ml/d

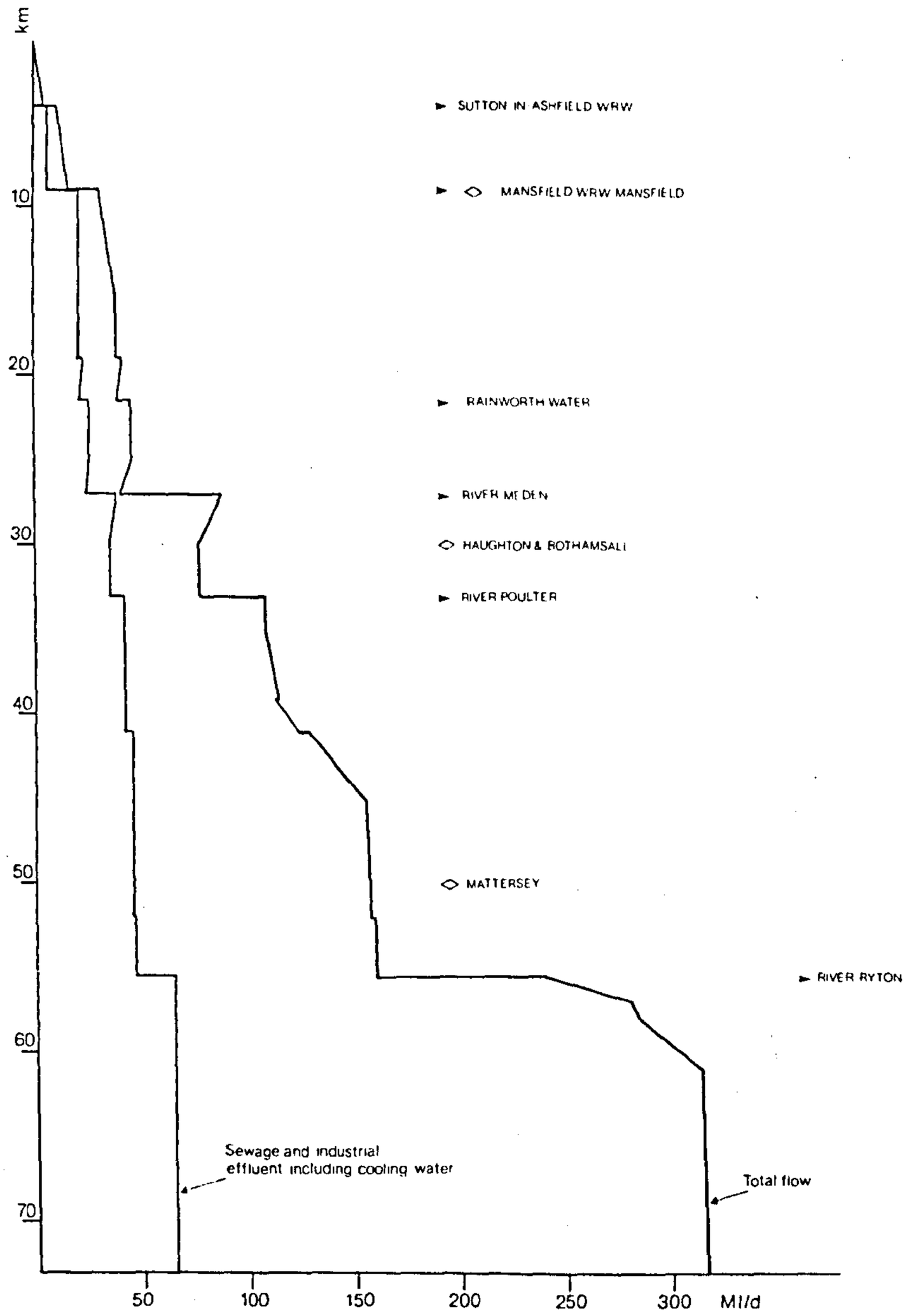


J.P. 1980

RESIDUAL FLOW DIAGRAM
DRY WEATHER FLOW CONDITIONS
RIVER IDLE FIG. 18

|◄ Net Abstractions from river > 5 Ml/d
|► Net Discharge to river > 5 Ml/d
◇ Flow measurment stations

Vertical Scale 1cm = 5km
Horizontal Scale 5cm = 200Ml/d



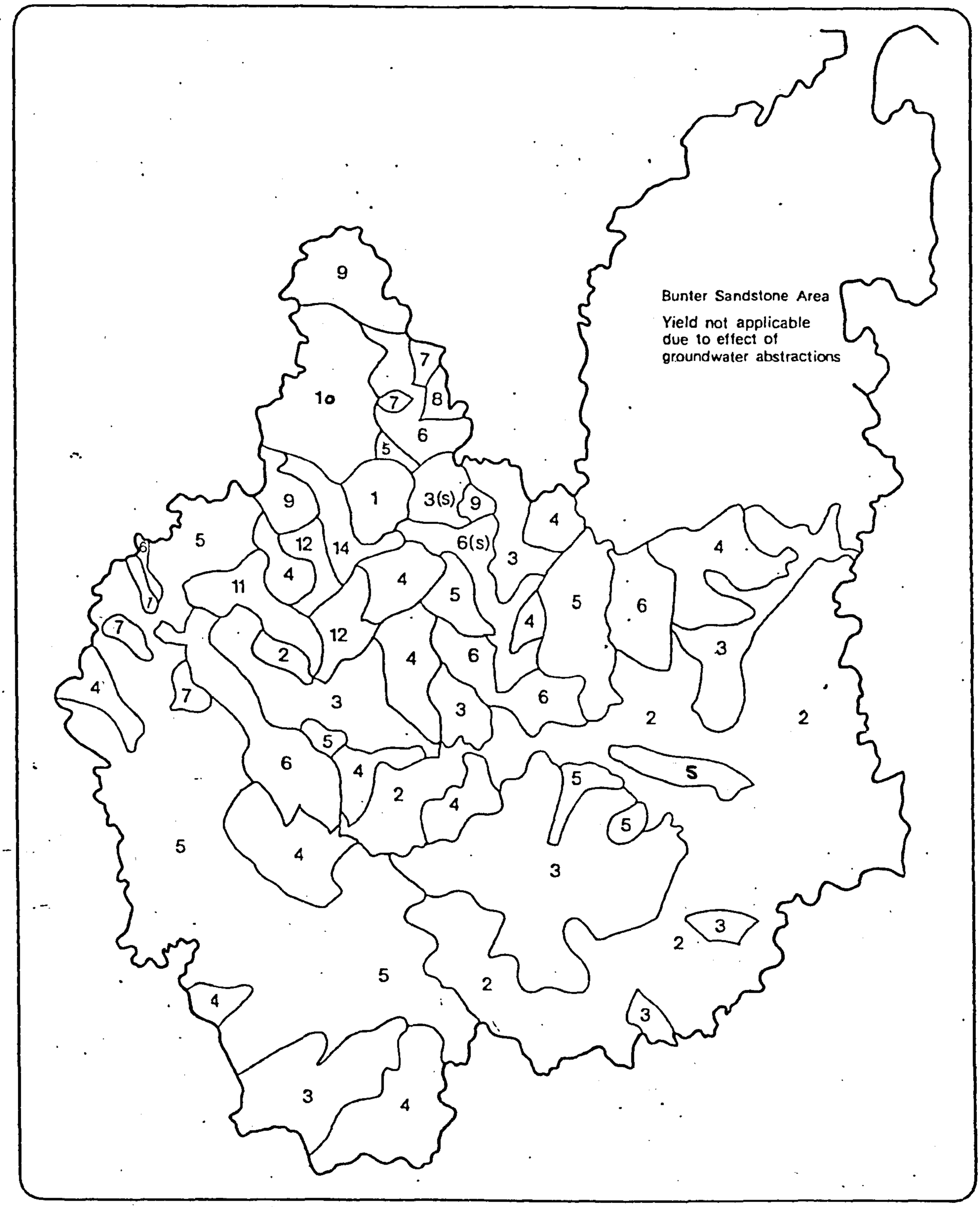
1	0·01 - 0·04	Mld/km^2	8	0·35 - 0·39
2	0·05 - 0·09		9	0·40 - 0·44
3	0·10 - 0·14		10	0·45 - 0·49
4	0·15 - 0·19		11	0·50 - 0·54
5	0·20 - 0·24		12	0·55 - 0·59
6	0·25 - 0·29		13	0·60 - 0·64
7	0·30 - 0·34		14	0·65 - 0·7

(s) influenced by soughs

TRENT AREA

RUNOFF COEFFICIENTS
DRY WEATHER FLOW CONDITION

FIG 19



0 10 20 30 Kilometres

FIGURE 20

FLOW DURATION CURVE ANALYSIS FOR R DERWENT AT YORKS BRIDGE (NAT)

FOR PERIOD 1.69 TO 11.81

ALL MONTHS ANALYSED

CLASS INTERVAL : FLOW IN CUMECS	NUMBER OF : OBSERVATIONS	ACCUMULATED : NO OF OBS	% TIME LOWER : LIMIT EXCEEDED
<0.05	2	4717	100.000
0.05 TO <0.10	1	4715	99.958
0.10 TO <0.20	4	4714	99.936
0.20 TO <0.30	5	4710	99.852
0.30 TO <0.35	10	4705	99.746
0.35 TO <0.40	22	4695	99.534
0.40 TO <0.45	20	4673	99.067
0.45 TO <0.50	45	4653	98.643
0.50 TO <0.70	163	4608	97.689
0.70 TO 1.00	368	4445	94.234
1.00 TO <2.00	1208	4077	86.432
2.00 TO <3.00	763	2869	60.823
3.00 TO <5.00	968	2106	44.647
5.00 TO<10.00	754	1138	24.125
10.00 TO<15.00	227	384	8.141
15.00 TO<20.00	86	157	3.328
20.00 TO<30.00	52	71	1.505
30.00 TO<40.00	8	19	0.403
40.00 TO<50.00	7	11	0.233
50.00 TO<70.00	3	4	0.085
70.00 TO<80.00	1	1	0.021
GREATER THAN 80.00	0	0	0.000

MEAN FLOW FOR PERIOD = 4·090 CUMECS

NO OF DAYS FLOW LESS THAN OR EQUAL TO ZERO 0

FIG. 21

FLOW FREQUENCY CURVES

(DERWENT, WREAKE)

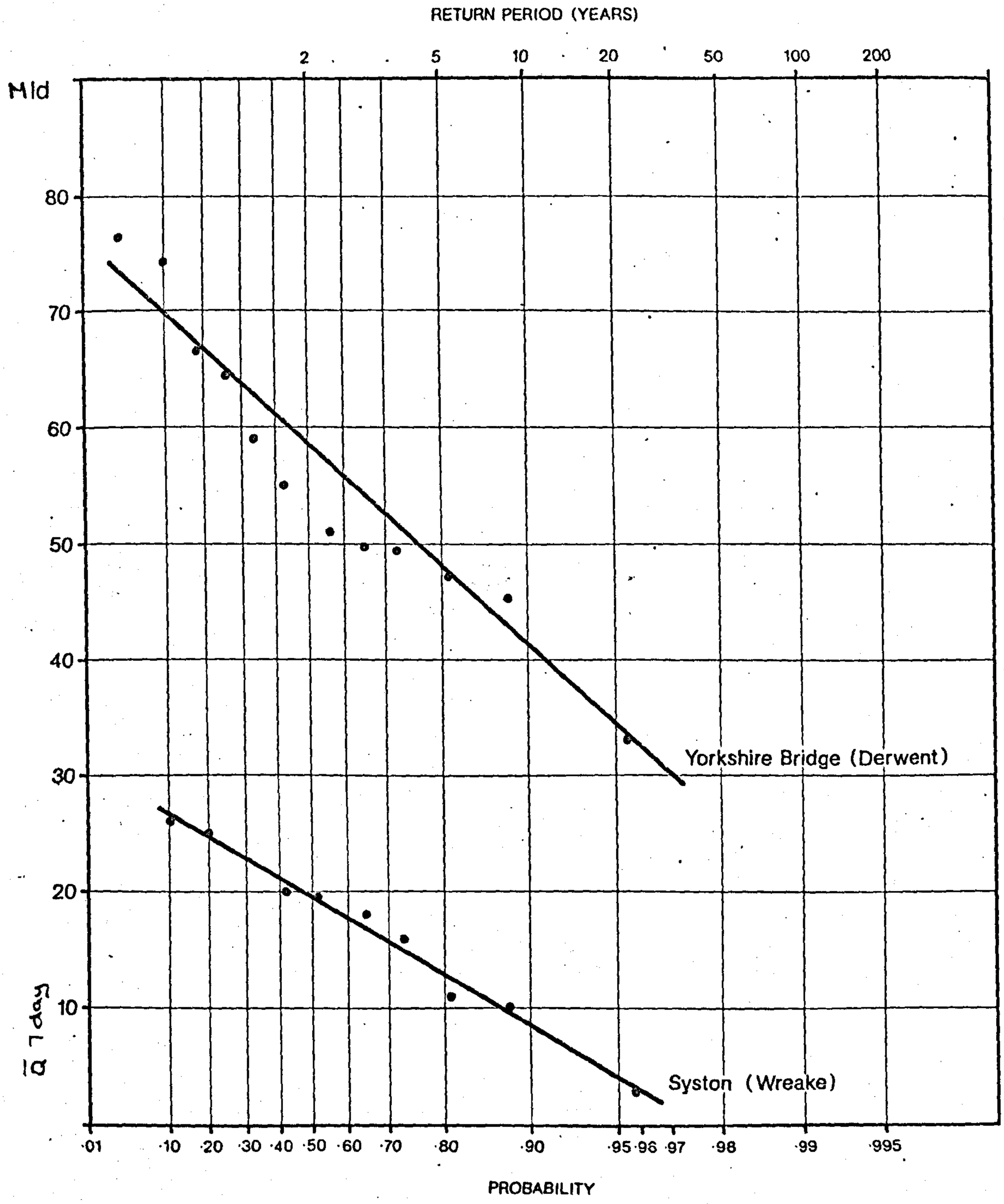


FIG. 22

FLOW FREQUENCY CURVES

(DOVE, CHURNET)

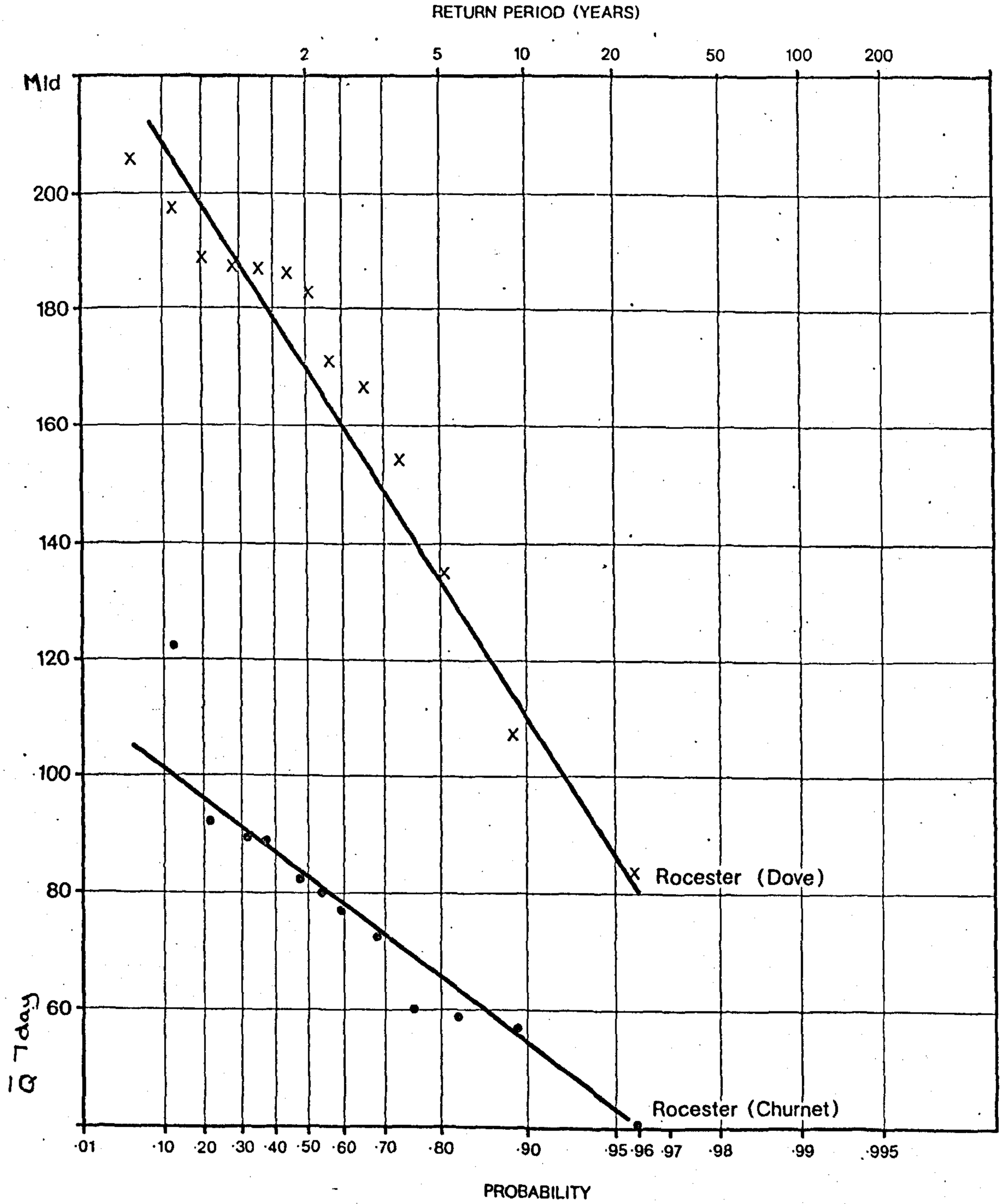


FIG. 23

FLOW FREQUENCY CURVES
(MANIFOLD, ANKER, SENCE, HAMPS)

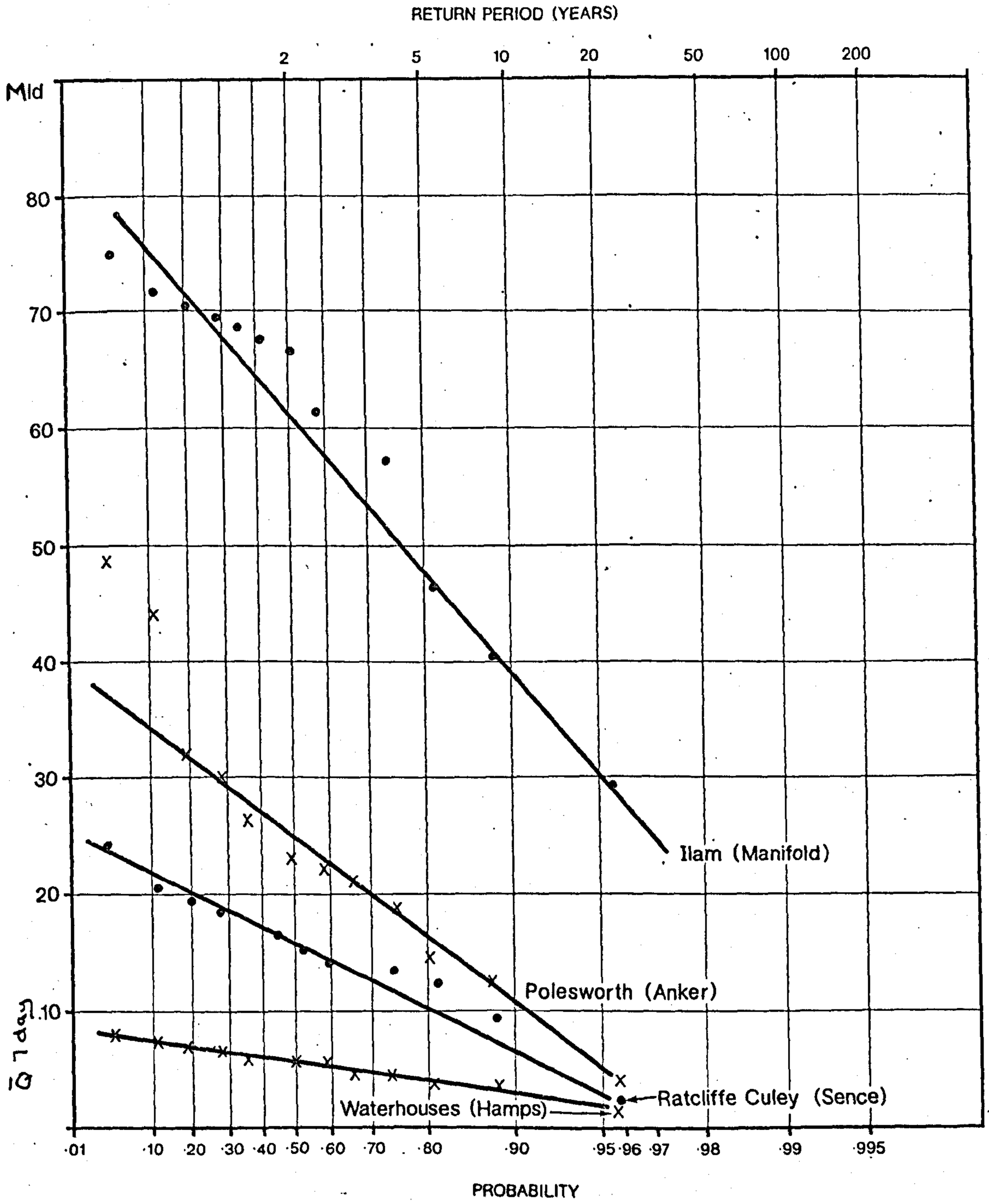


FIG. 24

FLOW FREQUENCY CURVES

(DOVE, REA)

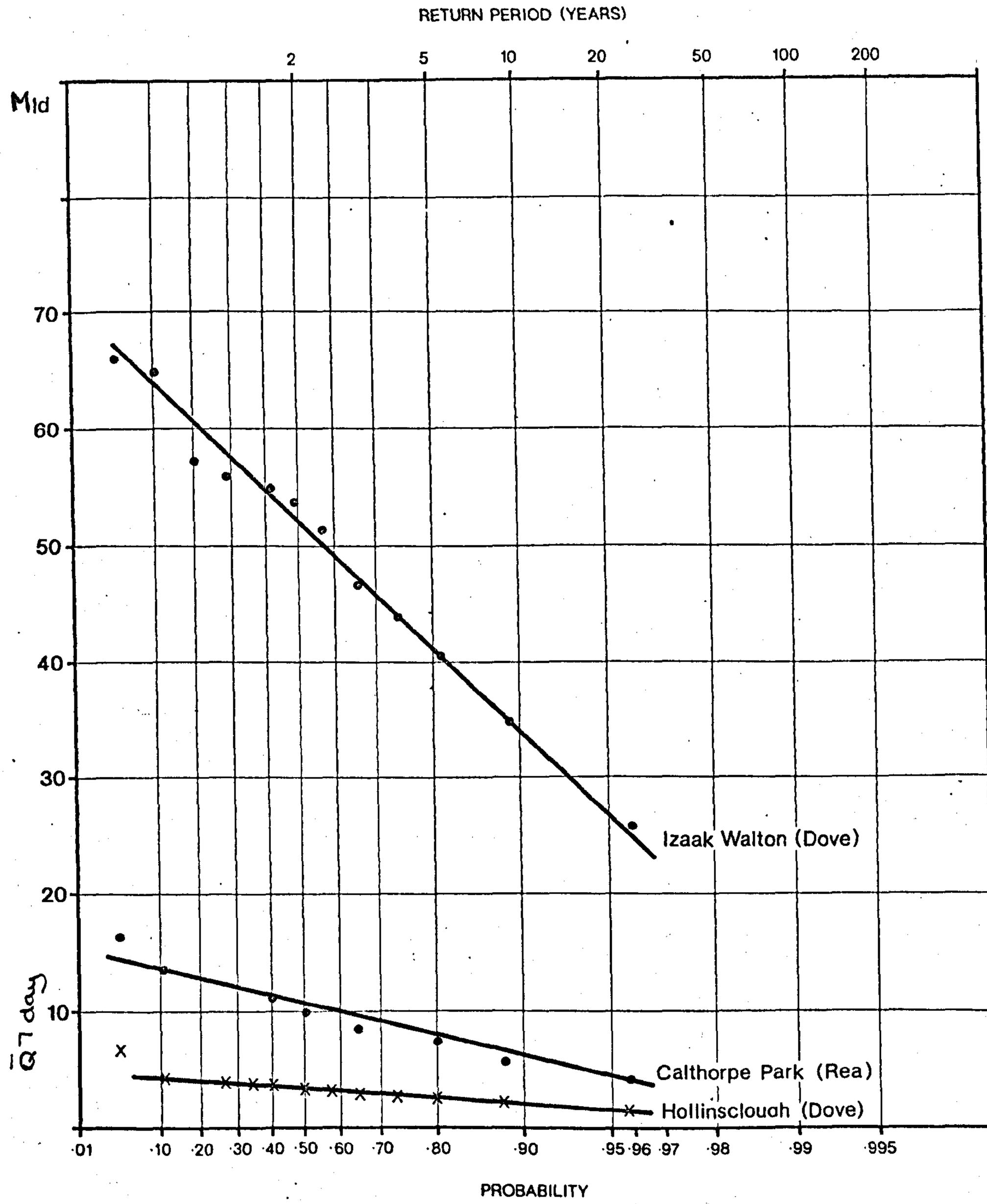


FIG. 25
FLOW DURATION CURVES
(DERWENT, WREAKE, REA)

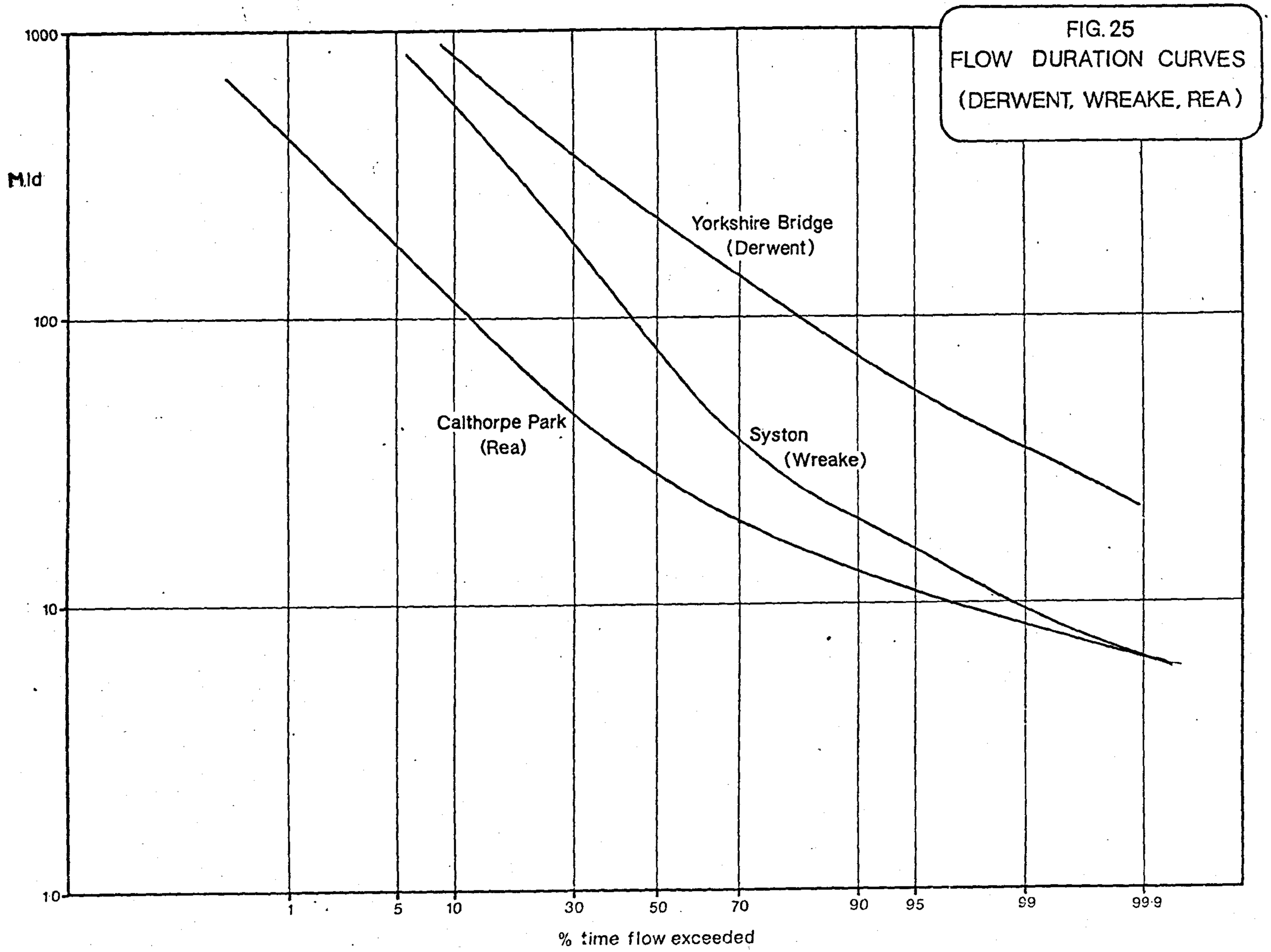


FIG. 26
FLOW DURATION CURVES
(DOVE, CHURNET)

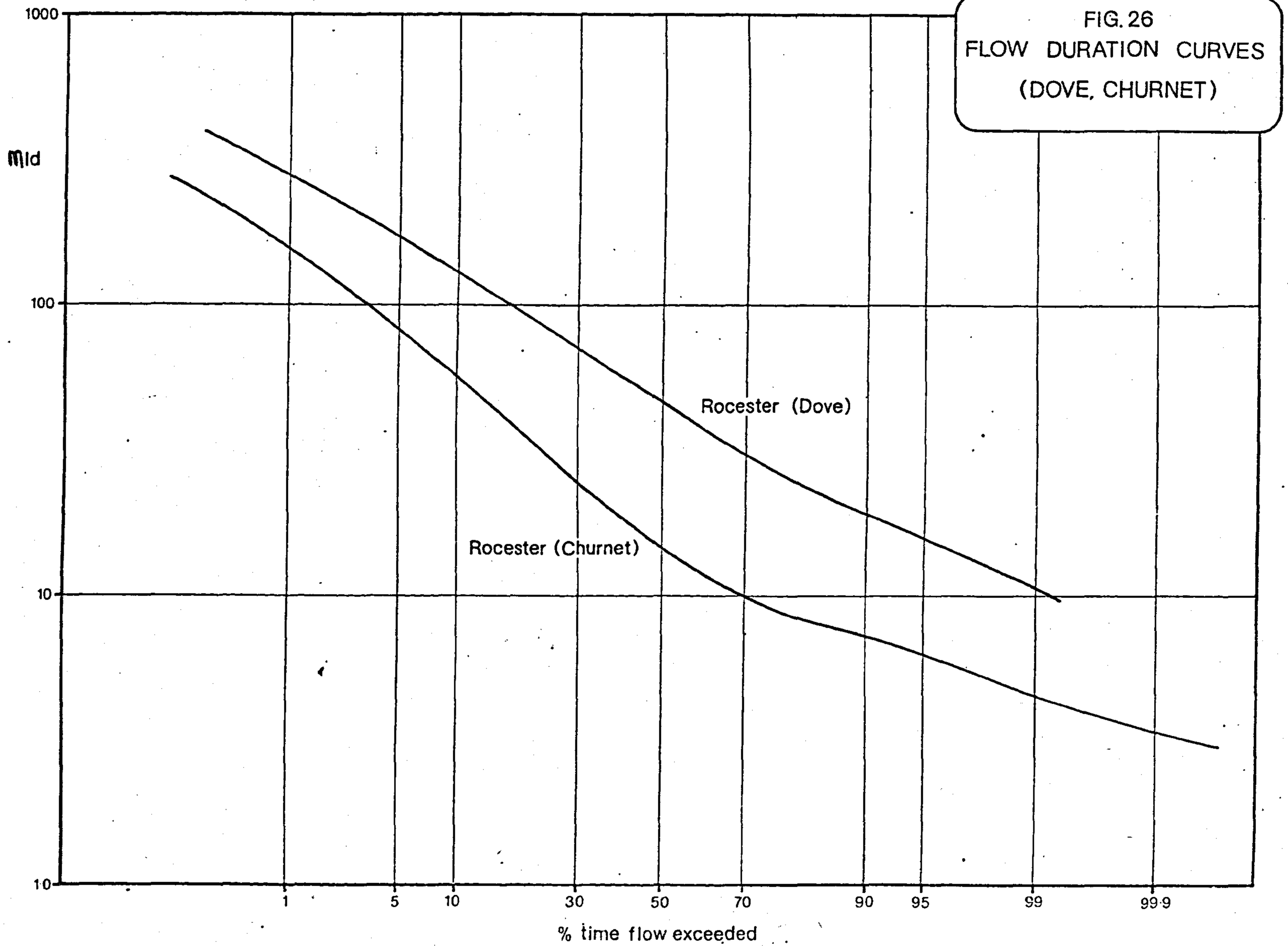


FIG. 27
FLOW DURATION CURVES (MANIFOLD, ANKER, SENCE, HAMPS)

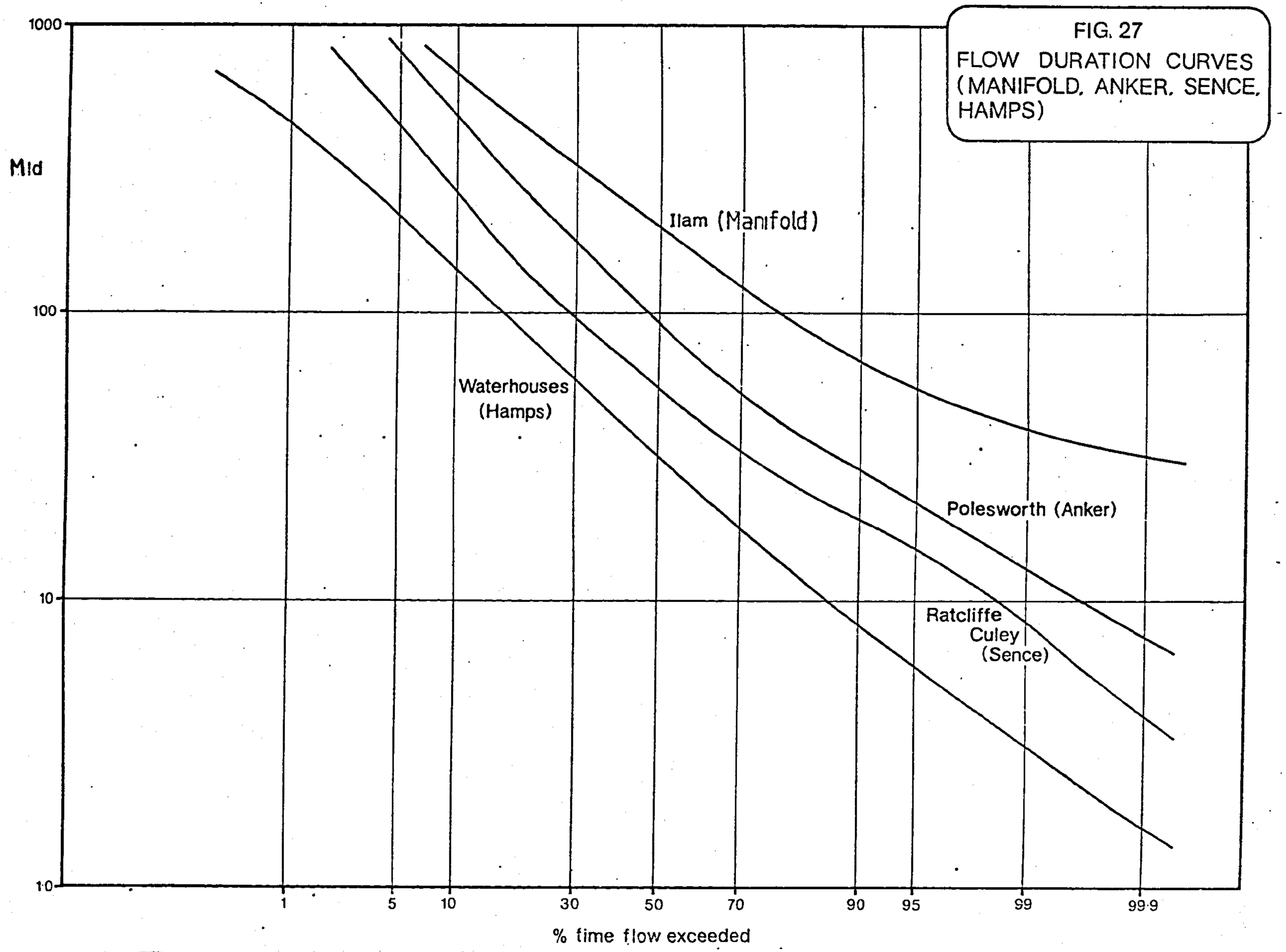


FIG.28
FLOW DURATION CURVES
(DOVE)

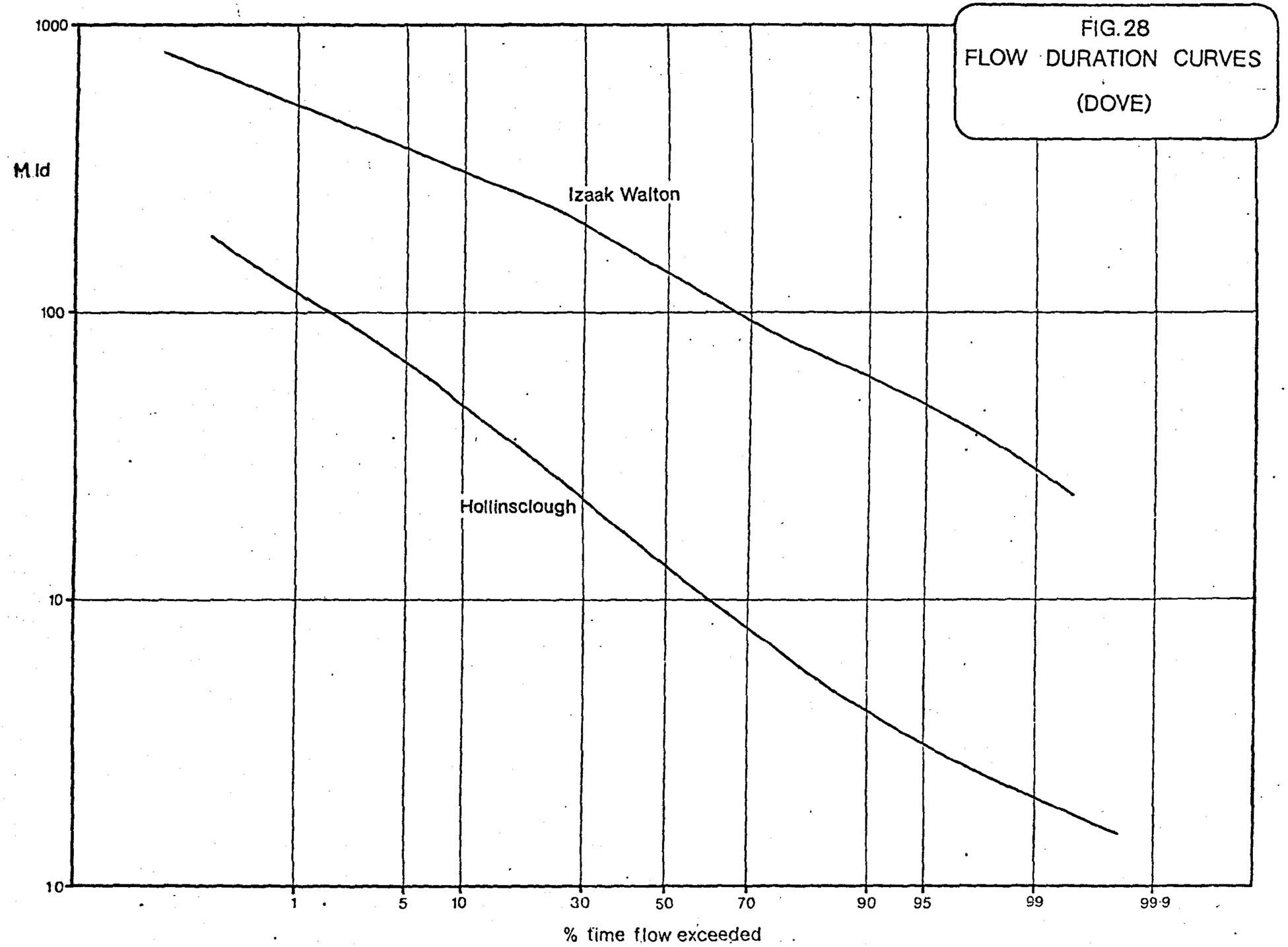
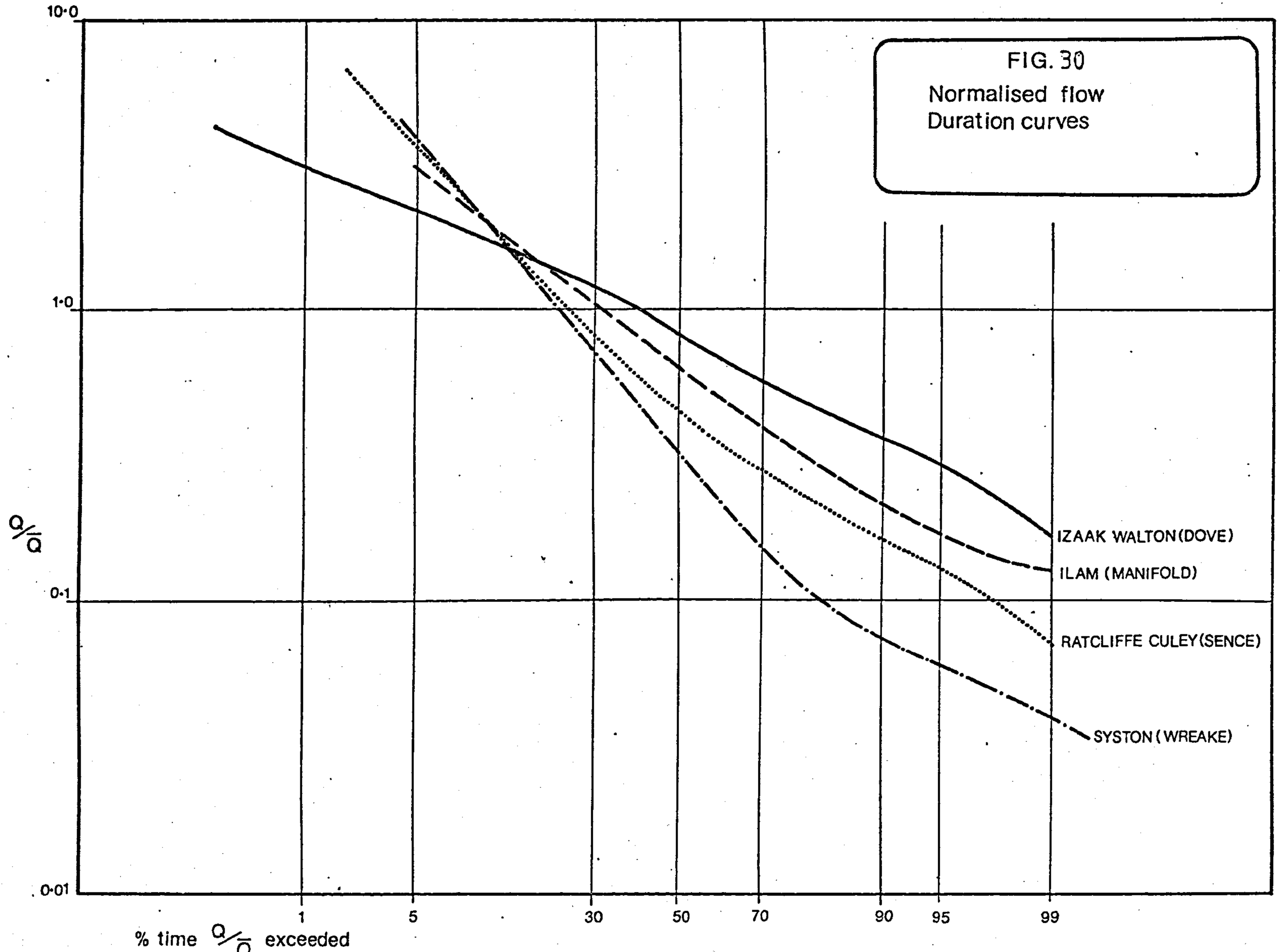


FIG 29.

Flow Frequency Curve (14 day)

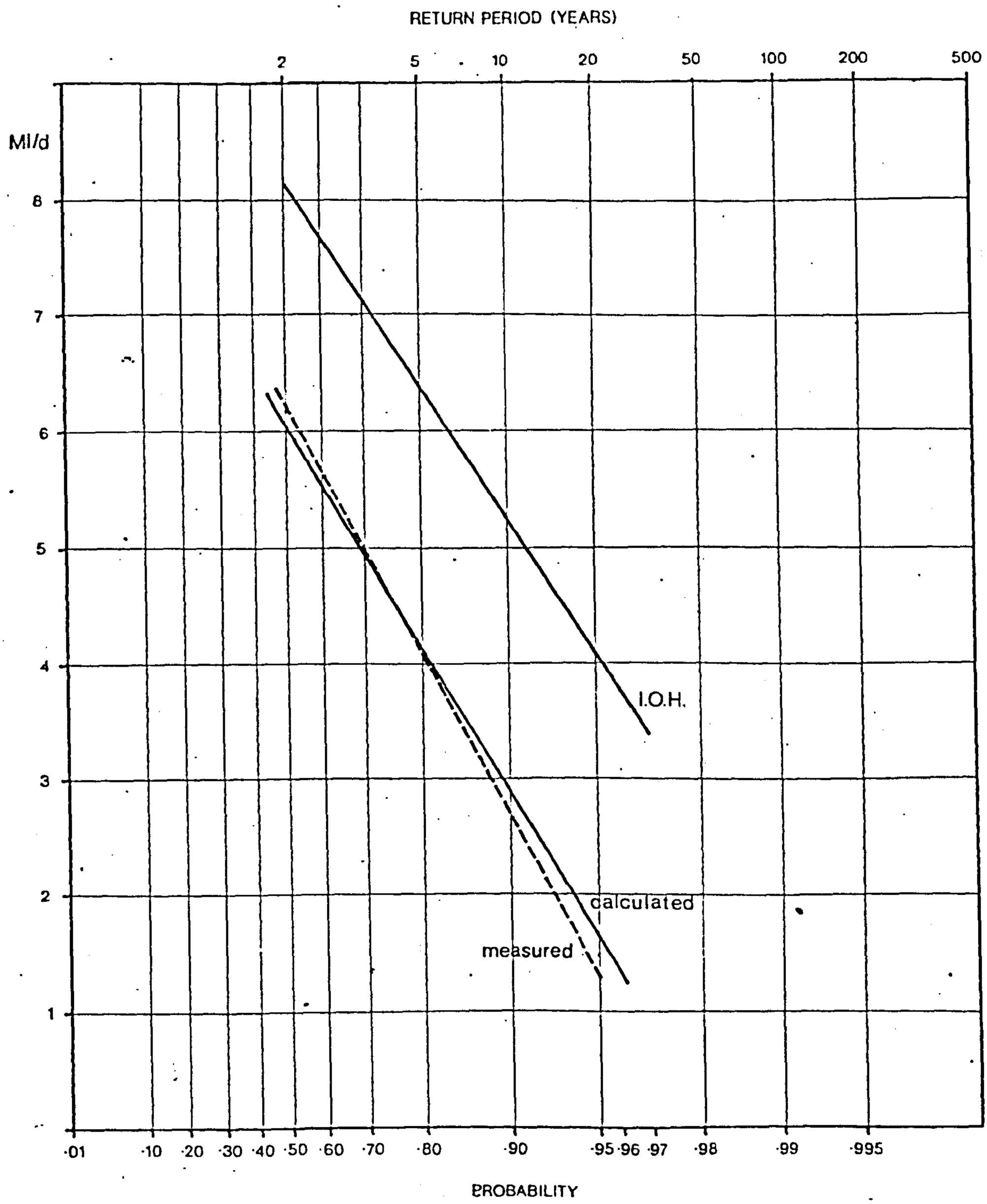
FIG. 30

Normalised flow
Duration curves



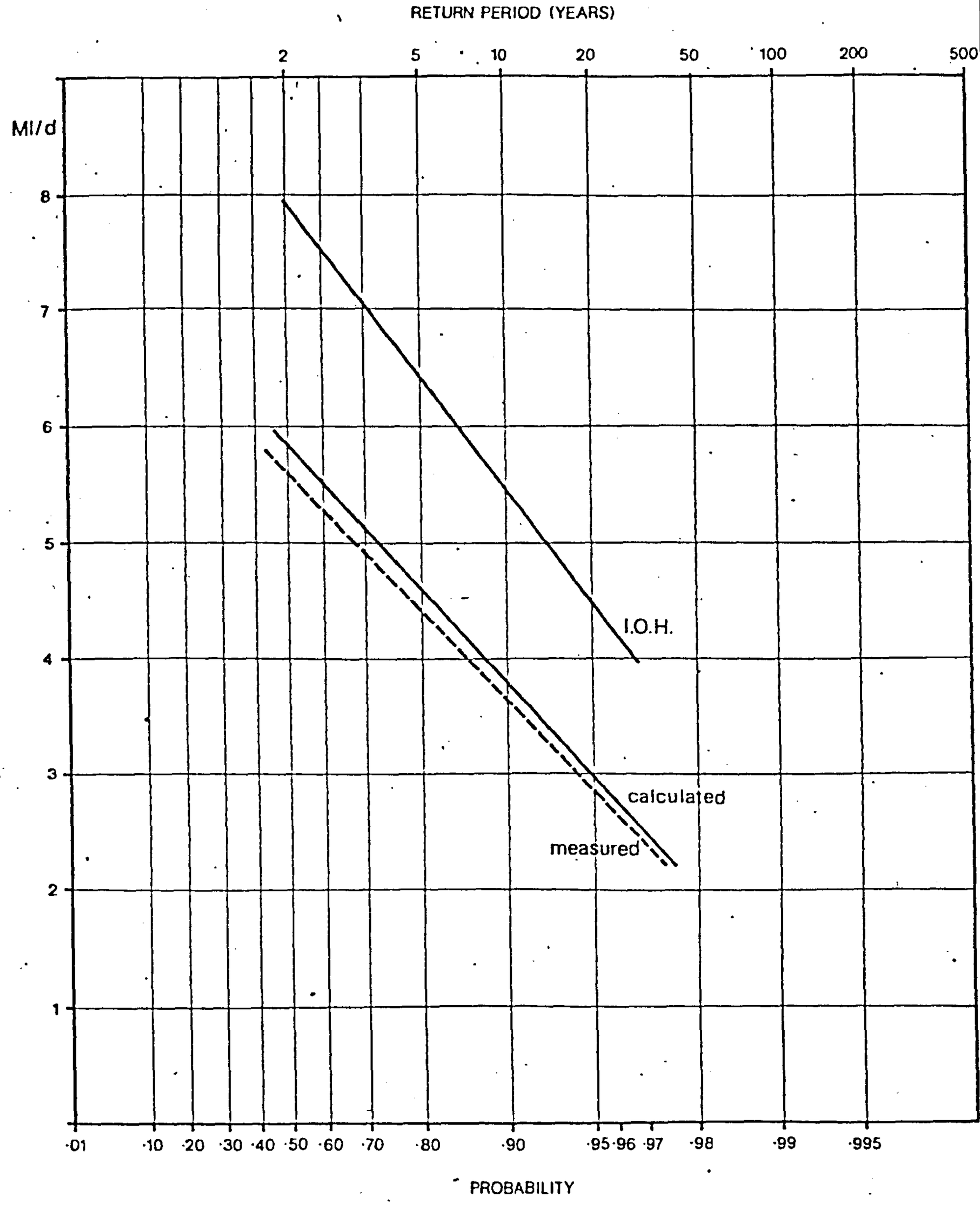
COMPARISON OF FLOW
FREQUENCY CURVES – BLABY

FIG. 31



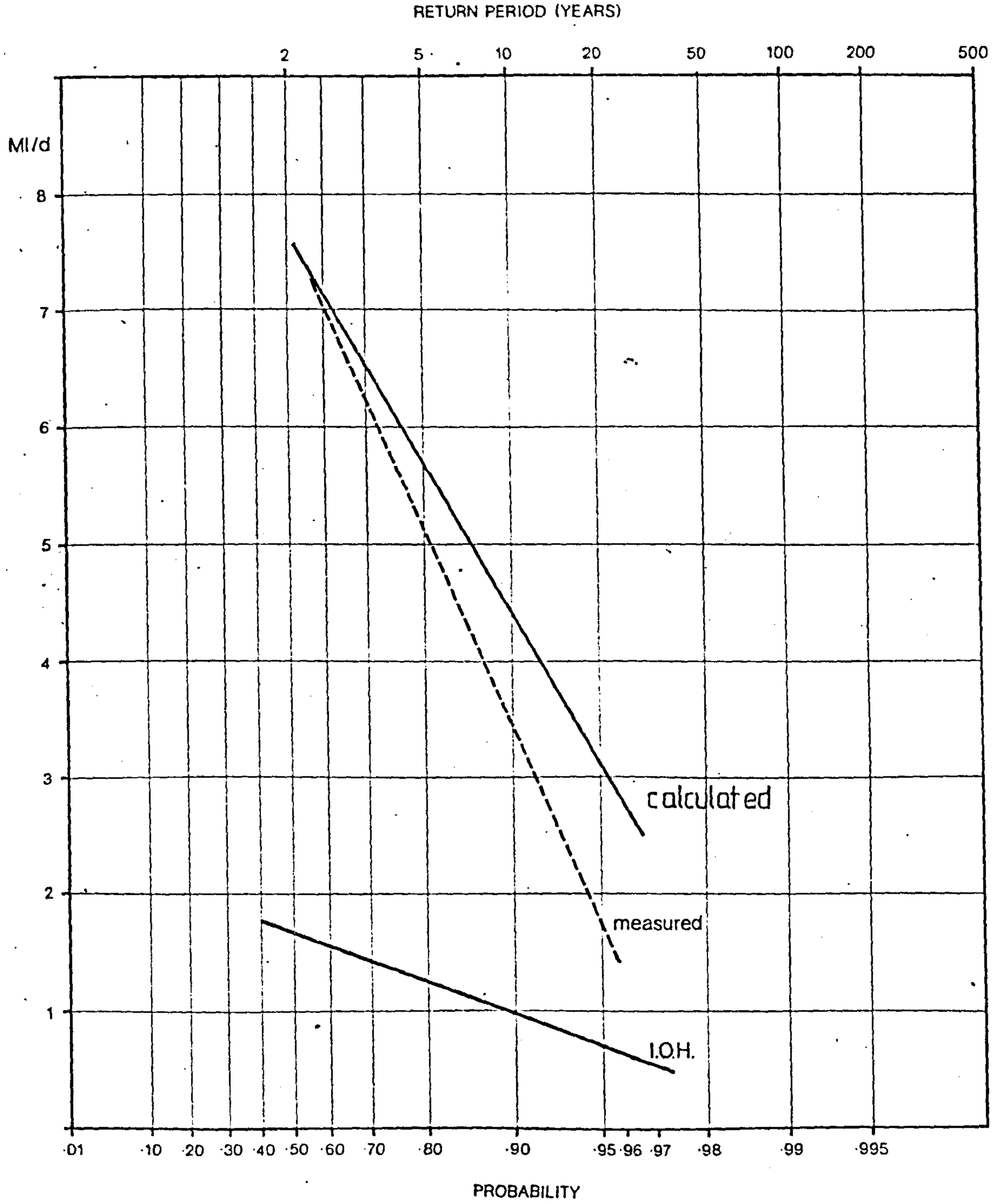
COMPARISON OF FLOW
FREQUENCY CURVES—ASHBOURNE

FIG 32



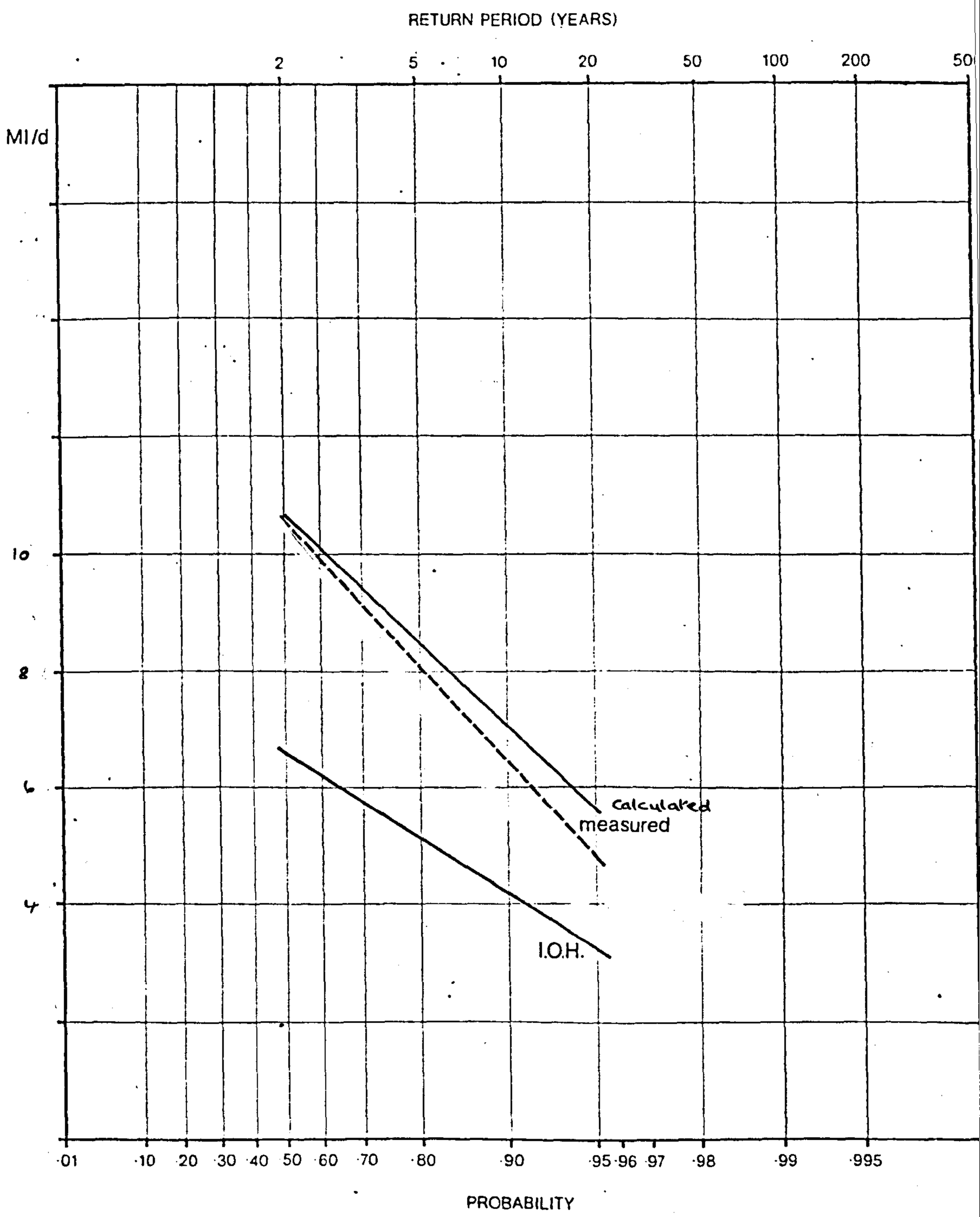
COMPARISON OF FLOW
FREQUENCY CURVES – ROTHLEY

FIG. 33



COMPARISON OF FLOW
FREQUENCY CURVES— DUFFIELD

FIG. 34



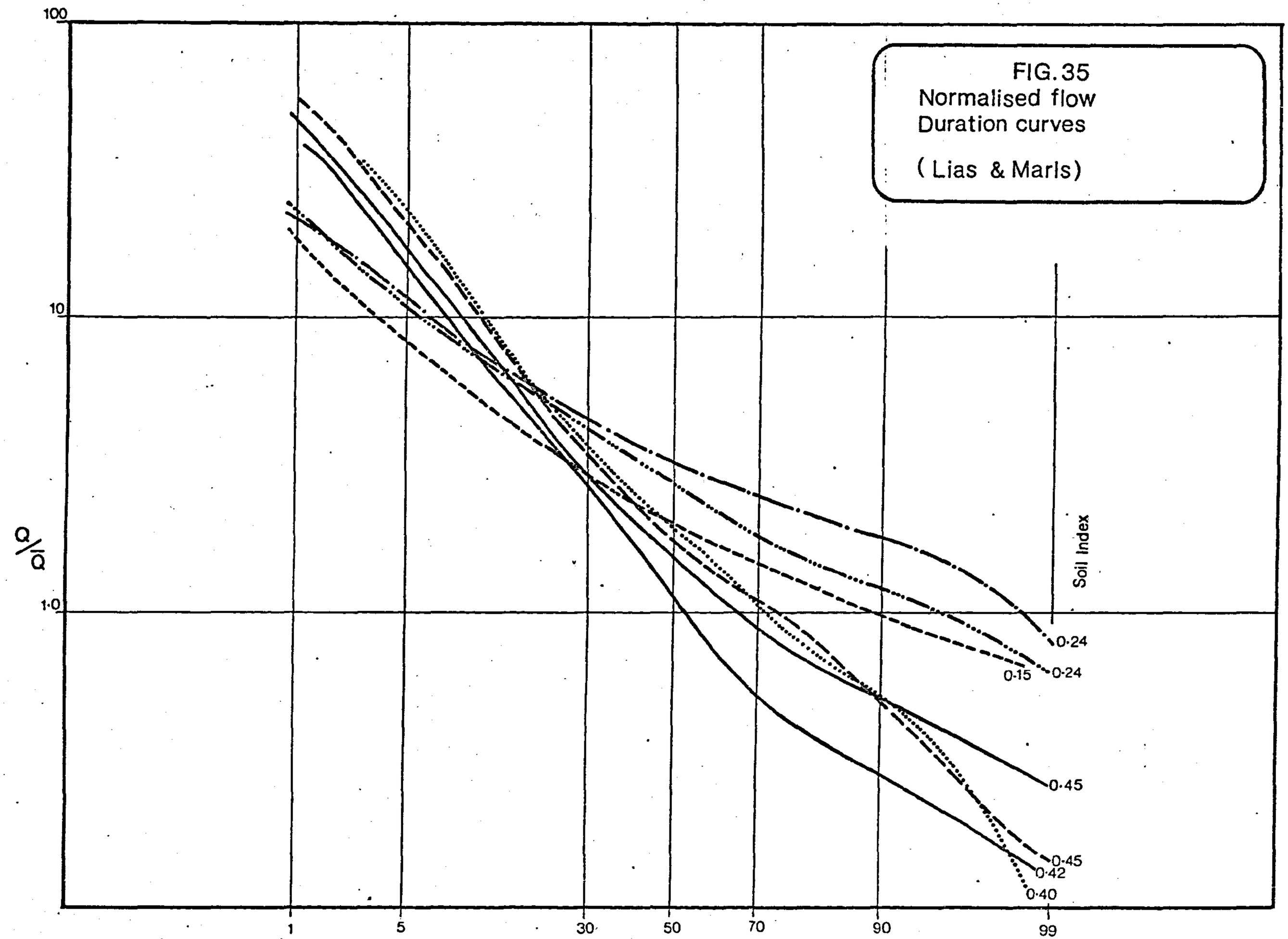
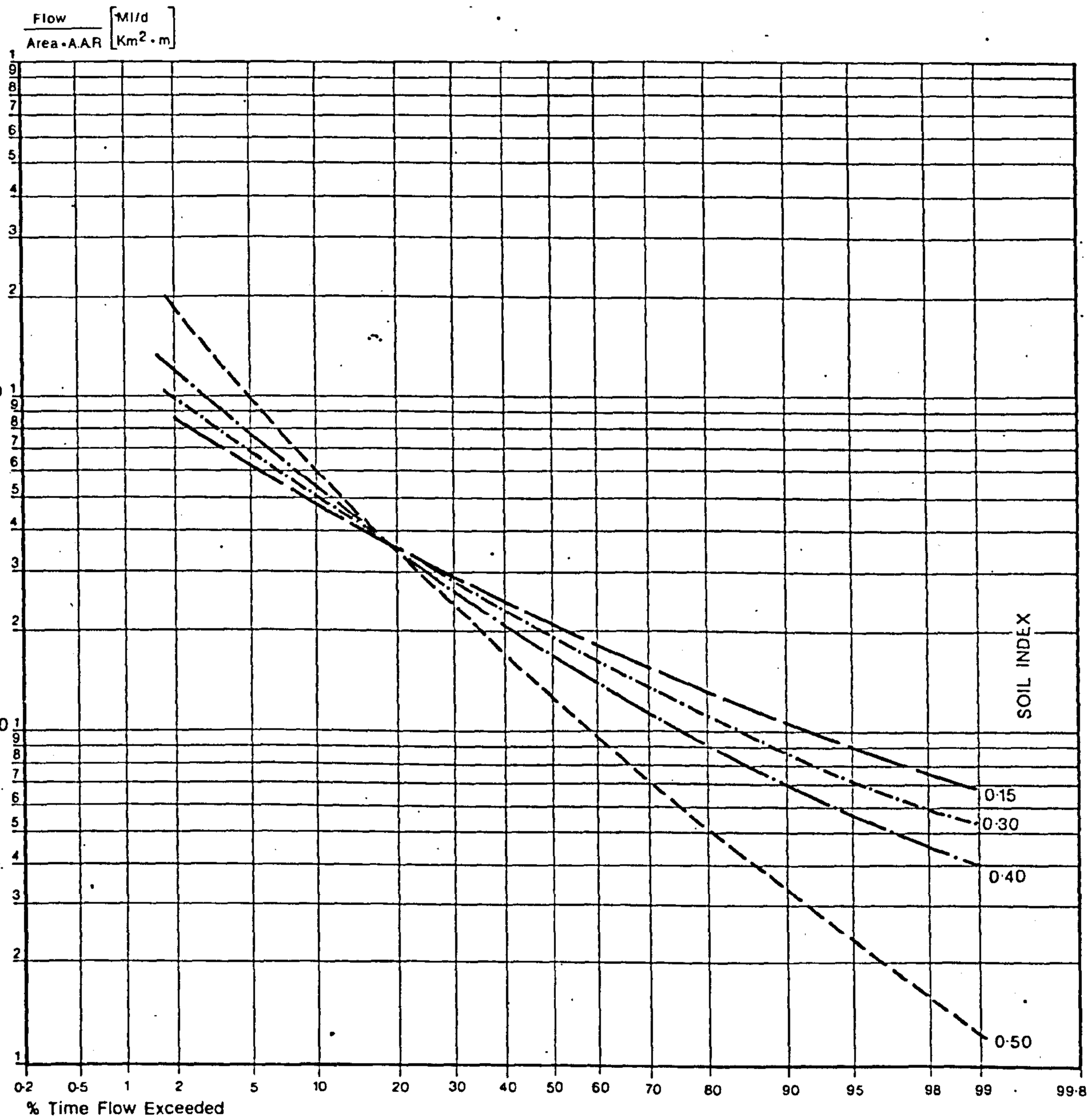


FIG. 35
Normalised flow
Duration curves
(Lias & Marls)
100
10
1·0
Q/Q̄
Soil Index
0·24
0·15
0·24
0·45
0·45
0·42
0·40
1
5
30
50
70
90
99
% time flow exceeded

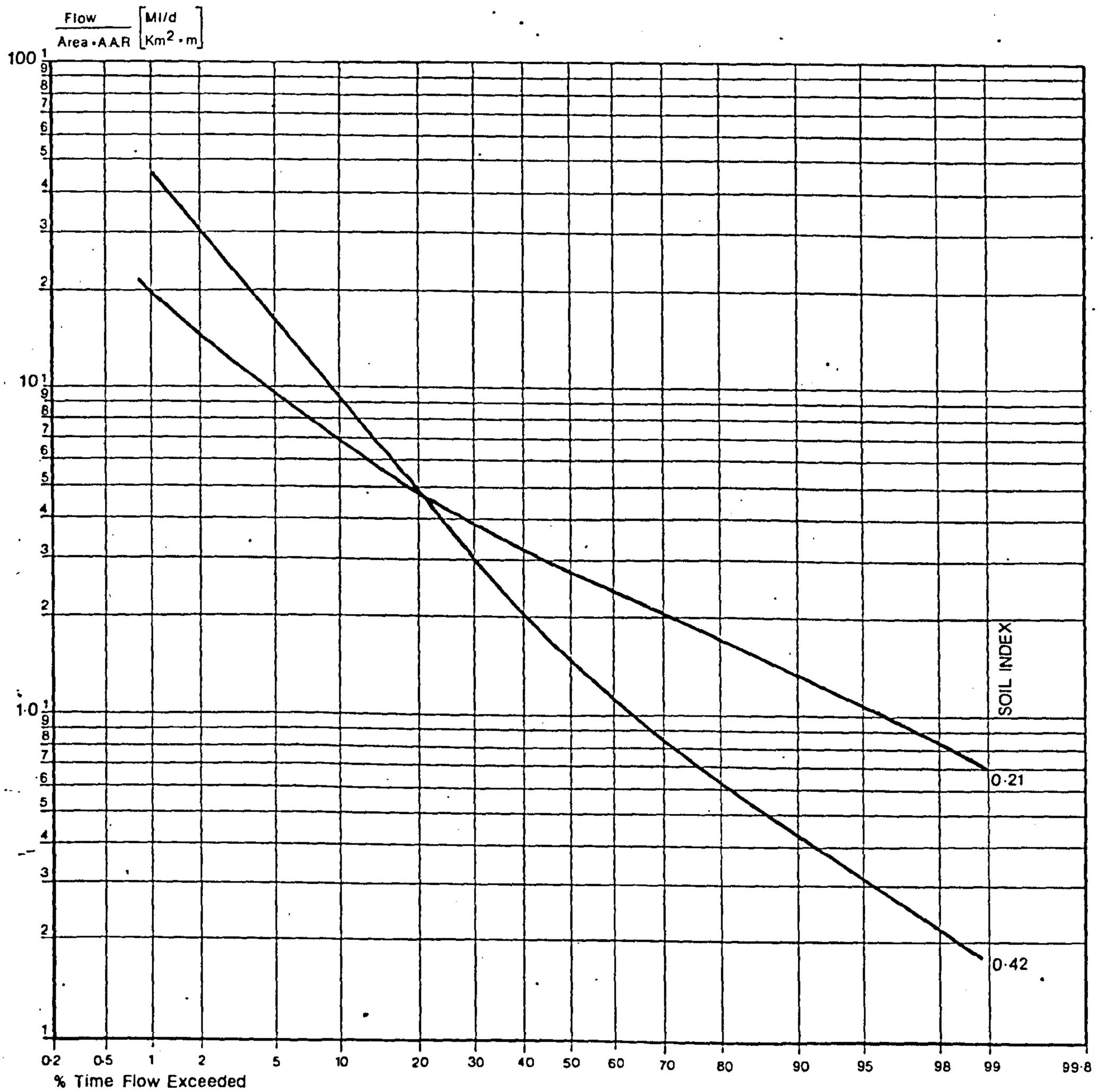
Normalised Base Curve:
Carboniferous Rocks

FIG. 36



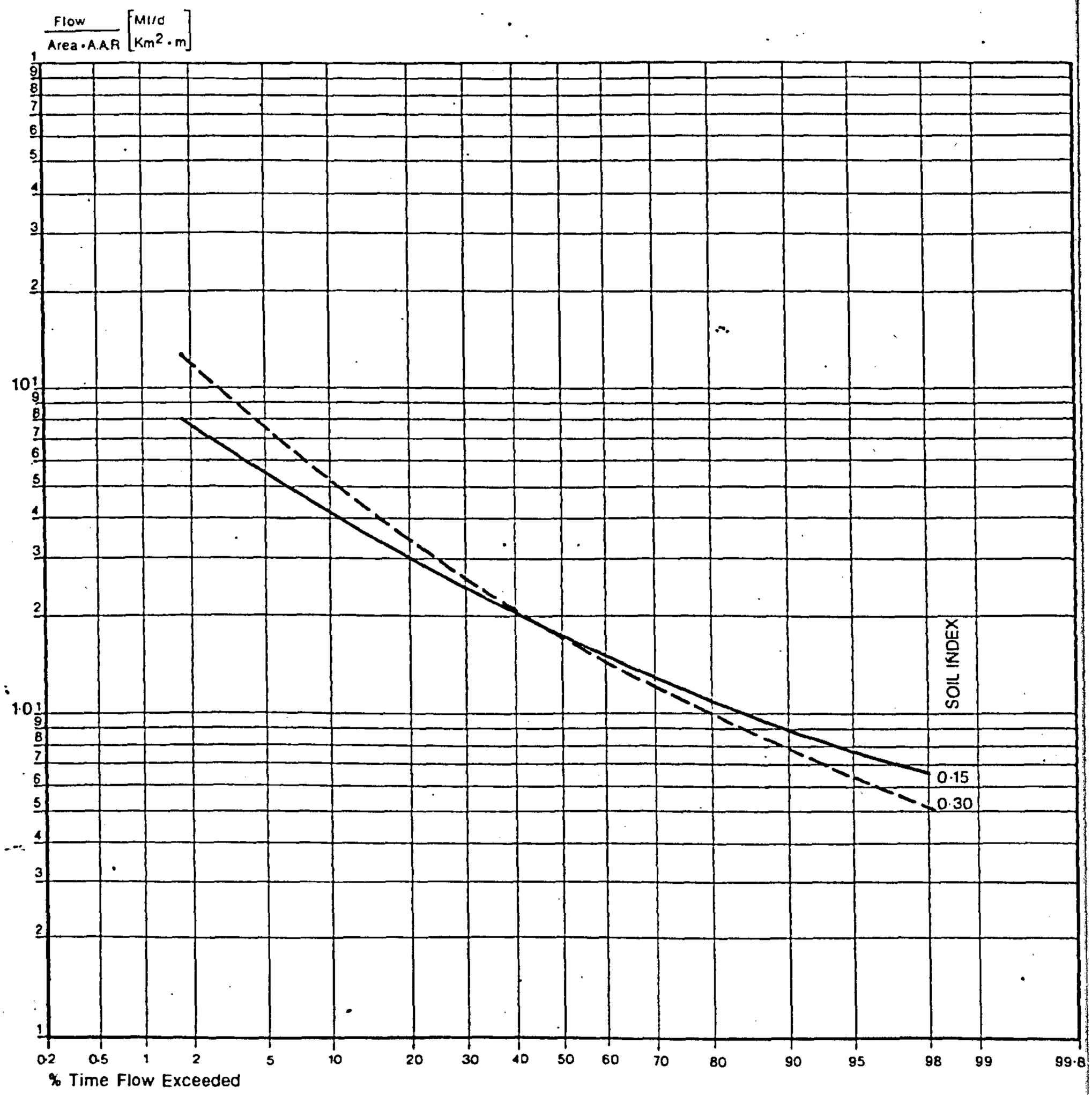
Normalised Base Curve
Lias & Keuper Marl

FIG.37



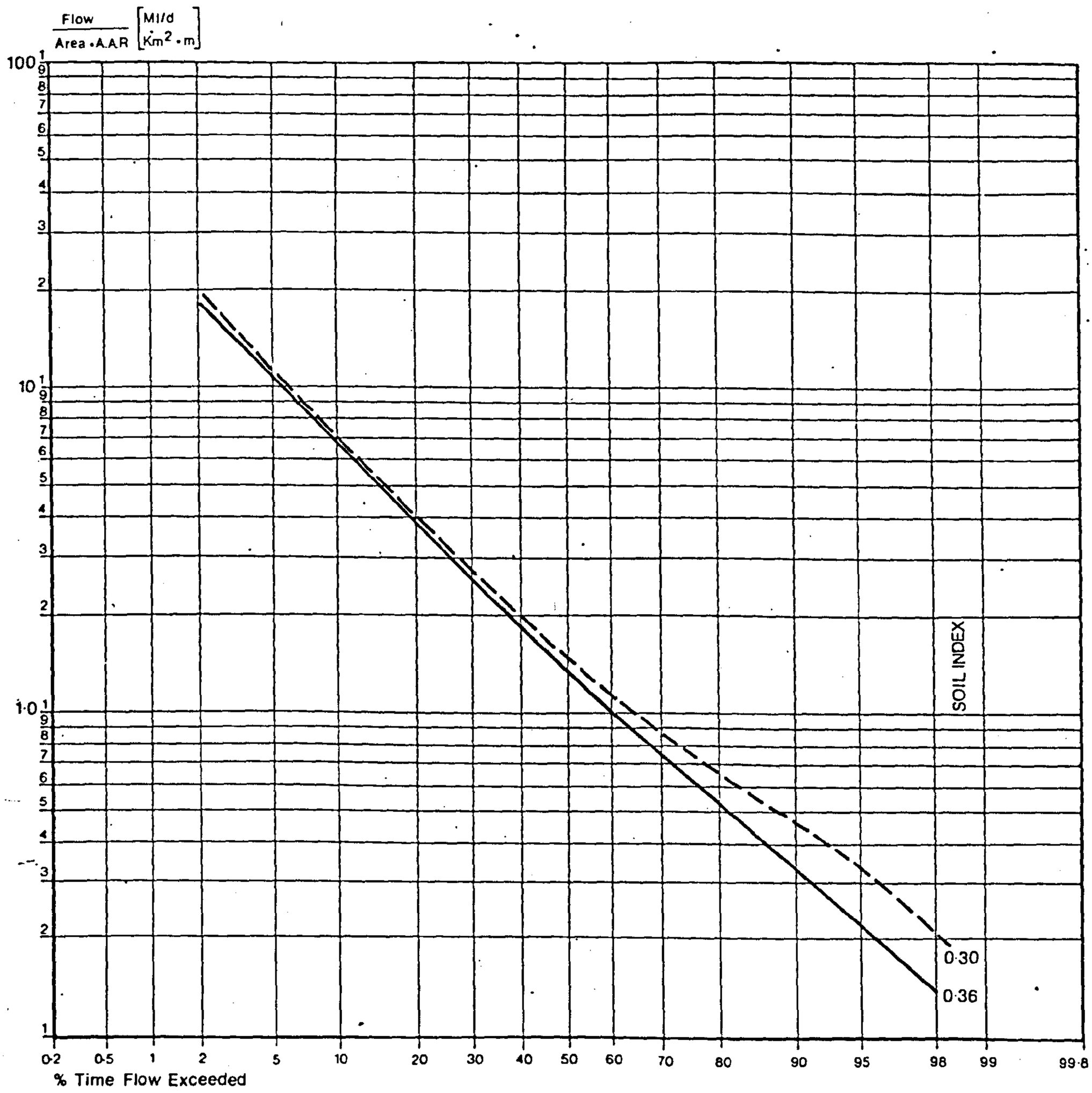
Normalised Base Curve
Sandstones

FIG. 38



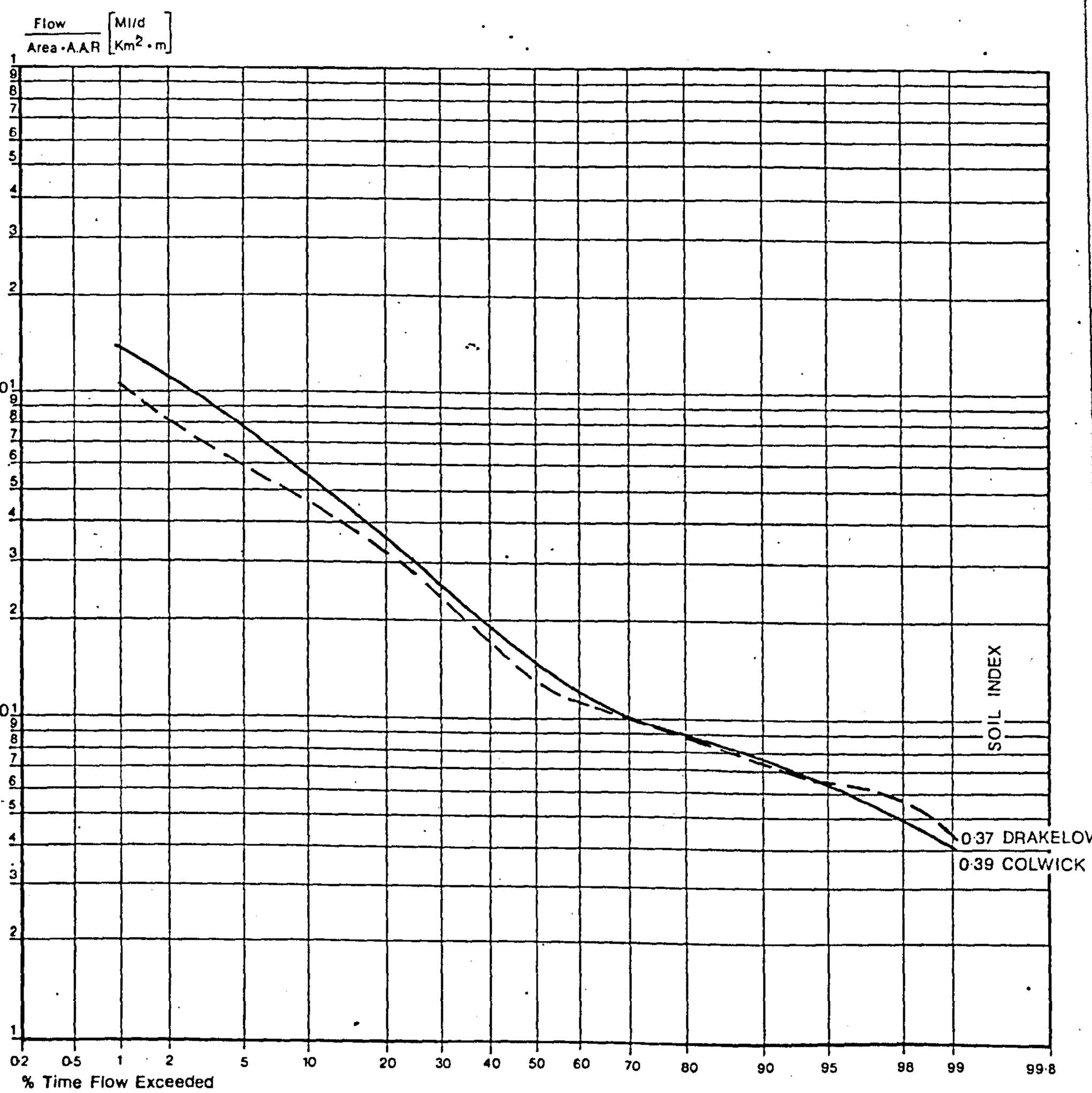
Normalised Base Curve
'Old' Rocks

FIG.39



Normalised Base Curve:
Large Catchments

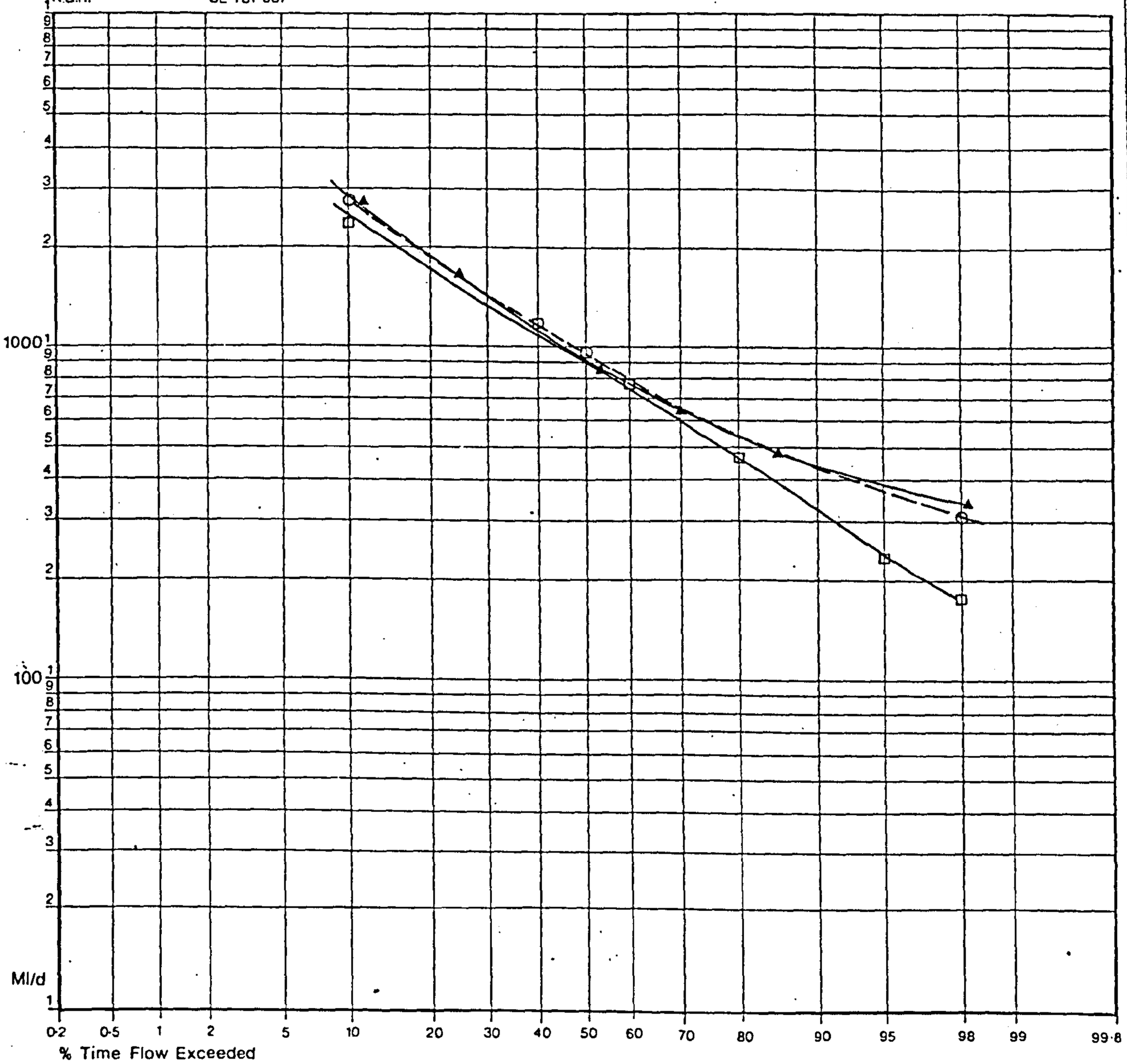
FIG.40



COMPARISON OF METHODS
R. Derwent
Buttercrambe (Y.W.A.)
FIG.41

Section 5
Measured
I.O.H.

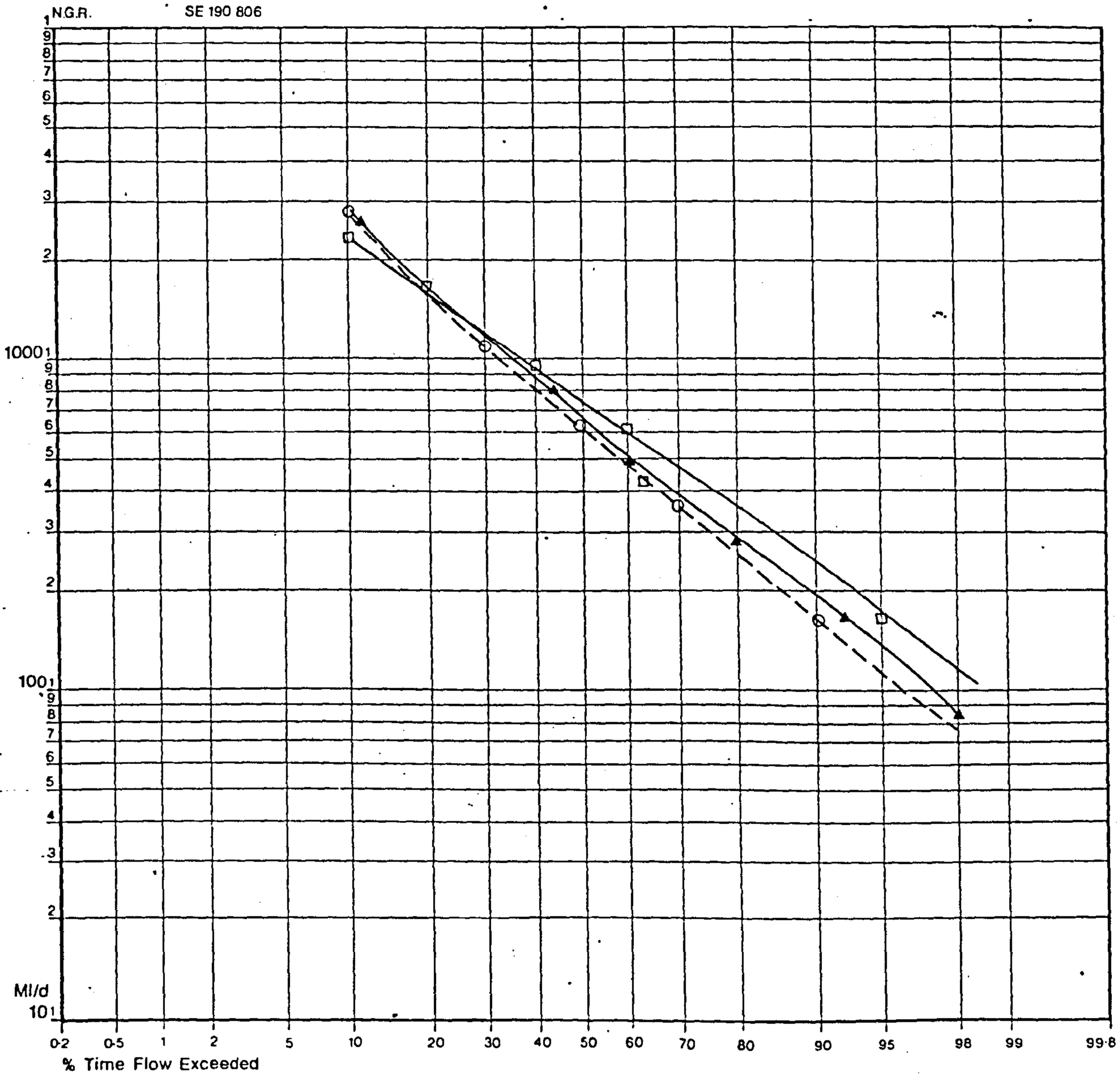
Catchment Area - 1586 km^2
Measurement Type - Crump Weir
Catchment Geology - Mixed (Corallian Limestone, Shales, Clay & Gravels)
N.G.R. - SE 731 587



COMPARISON OF METHODS
R.Ure
Kilgram (Y.W.A.)
FIG.42

Section 5
Measured
I.O.H.

Catchment Area 510km^2
Measurement Type Rated Open Channel
Catchment Geology Carboniferous Limestones & Millstone Grit
N.G.R. SE 190 806

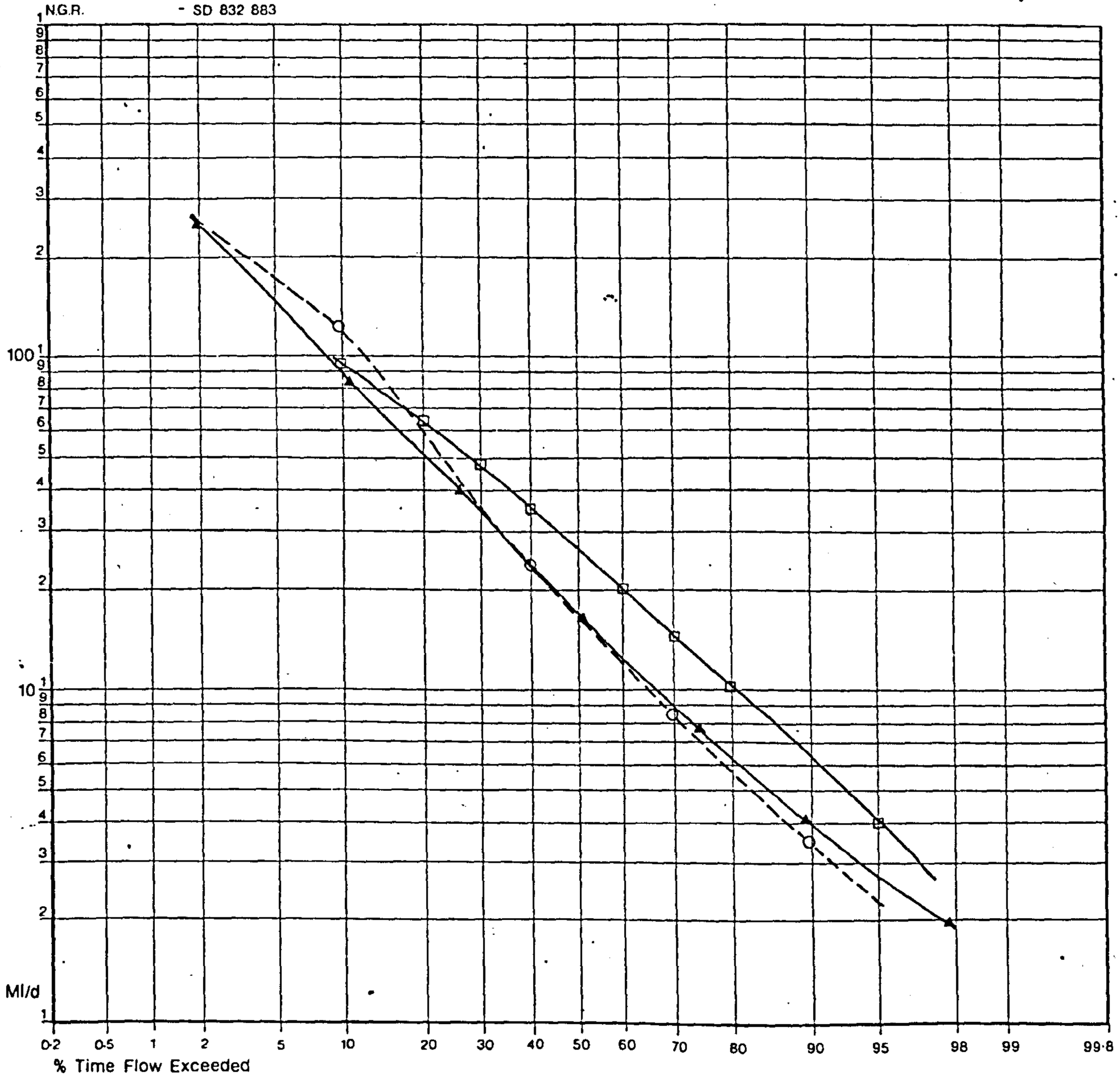


COMPARISON OF METHODS
Snaizeholme Beck
Low Houses (Y.W.A.)

FIG.43

Section 5
Measured
I.O.H.

Catchment Area - 10km^2
Measurement Type - Trapezoidal Flume
Catchment Geology - Carboniferous Limestone
N.G.R. - SD 832 883

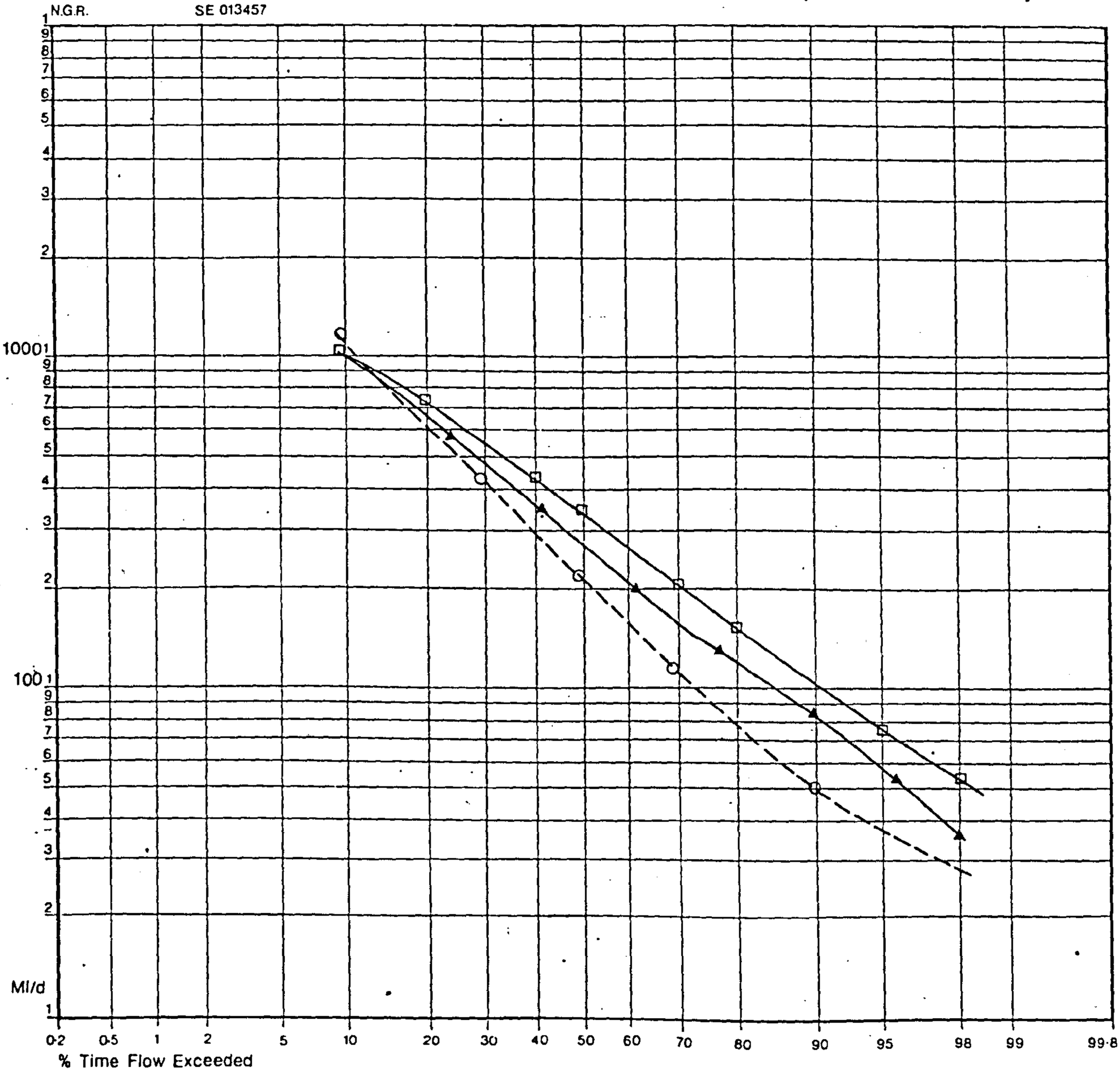


COMPARISON OF METHODS
R. Aire
Kildwick (Y.W.A.)

FIG. 44

Section 5
Measured
I.O.H.

Catchment Area 282 km^2
Measurement Type Rated Open Channel
Catchment Geology Carboniferous Limestone & Millstone Grit
N.G.R. SE 013457



COMPARISON OF METHODS
R. Wyre
Garstang (N.W.W.A.)

FIG.45

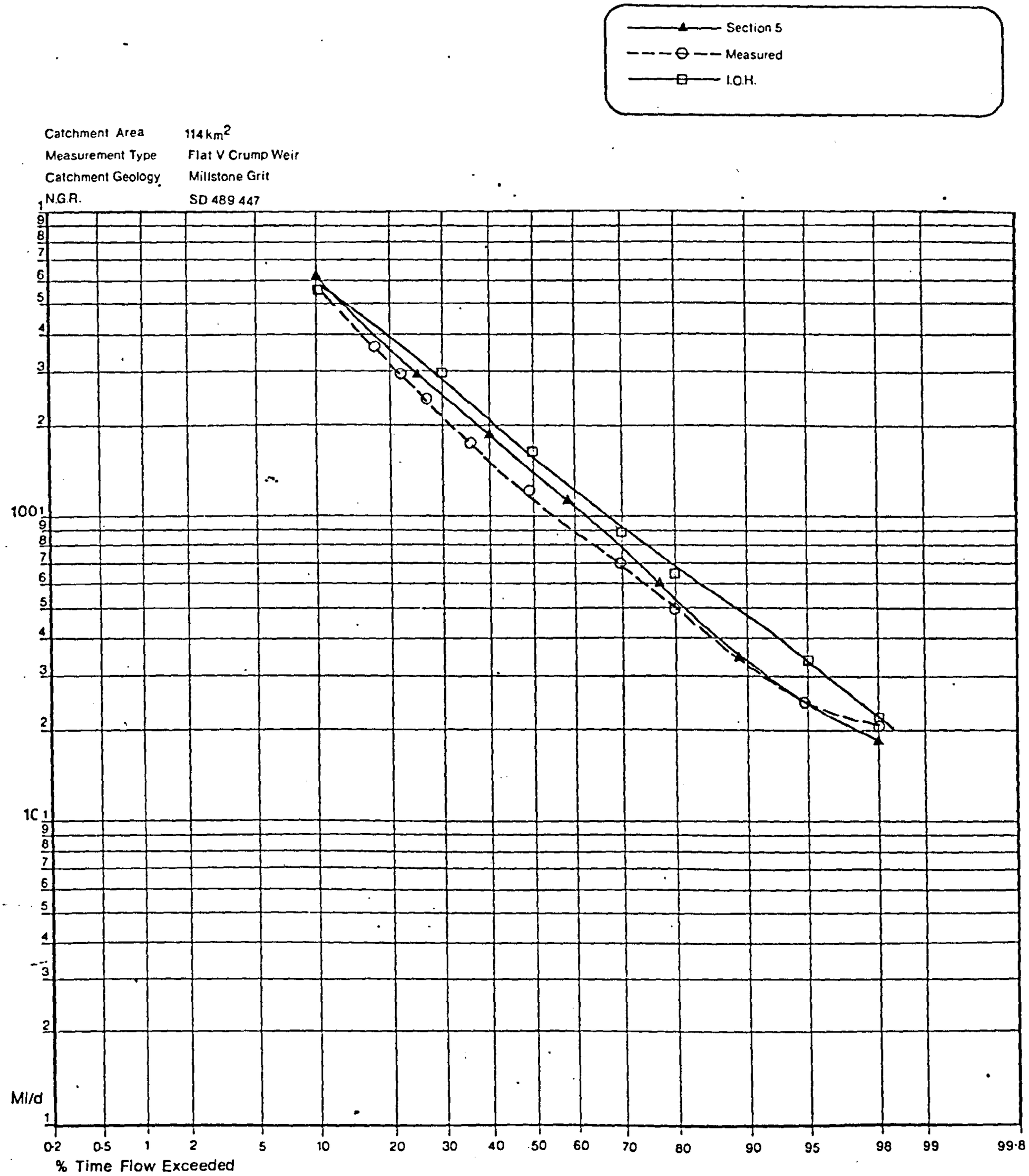


FIG. 46
Schematic representation of the general catchment model

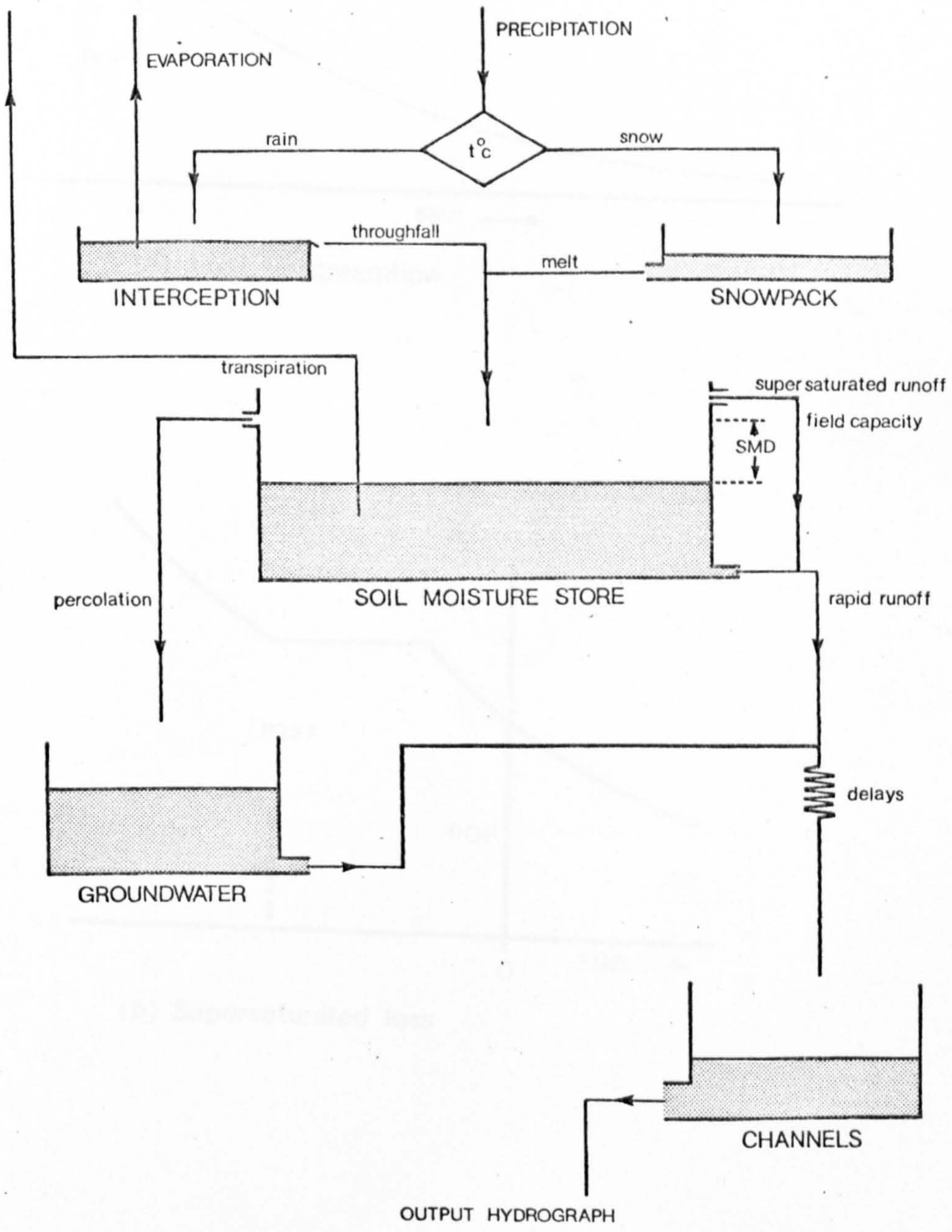
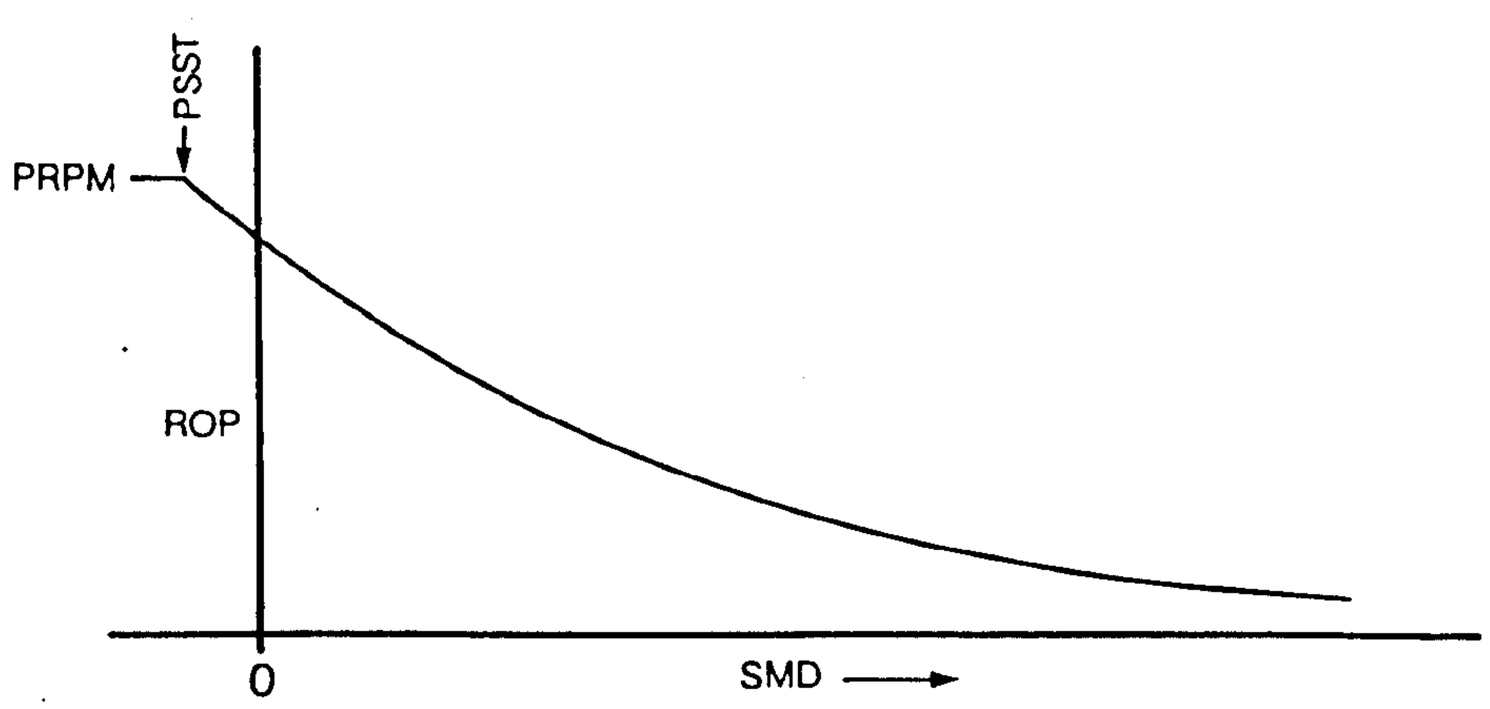
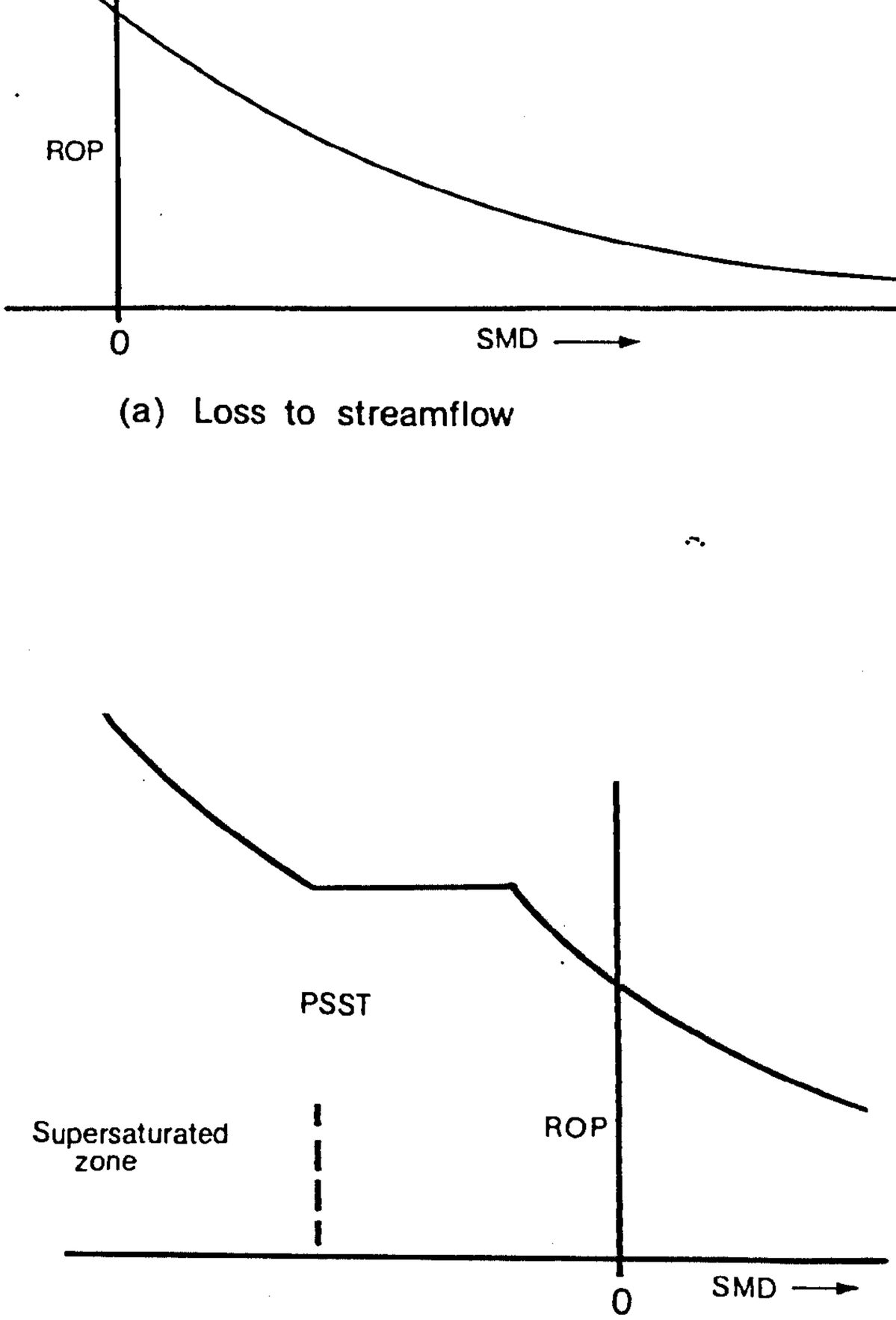


FIG. 47

Functional relationships within the soil moisture component of the rainfall – runoff model

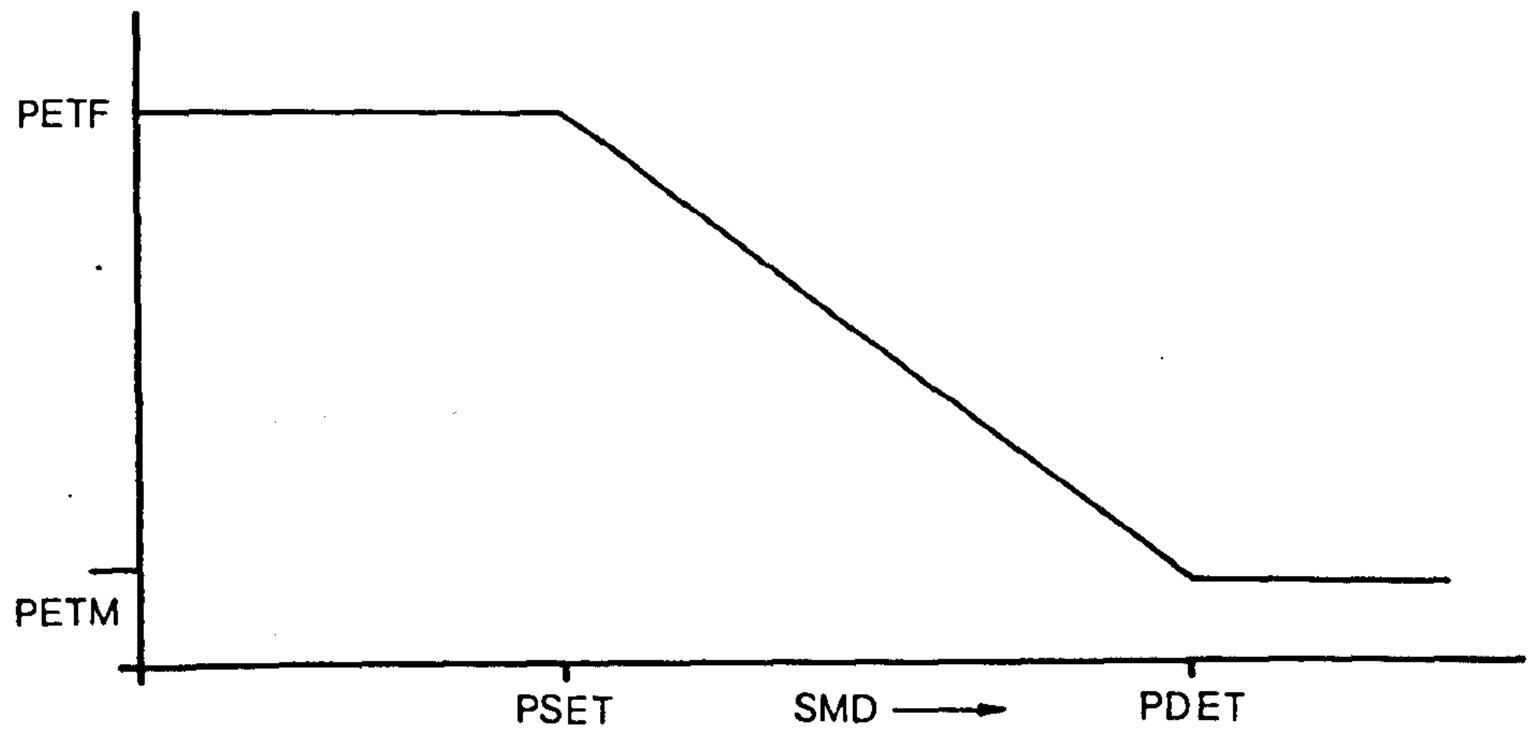


(a) Loss to streamflow

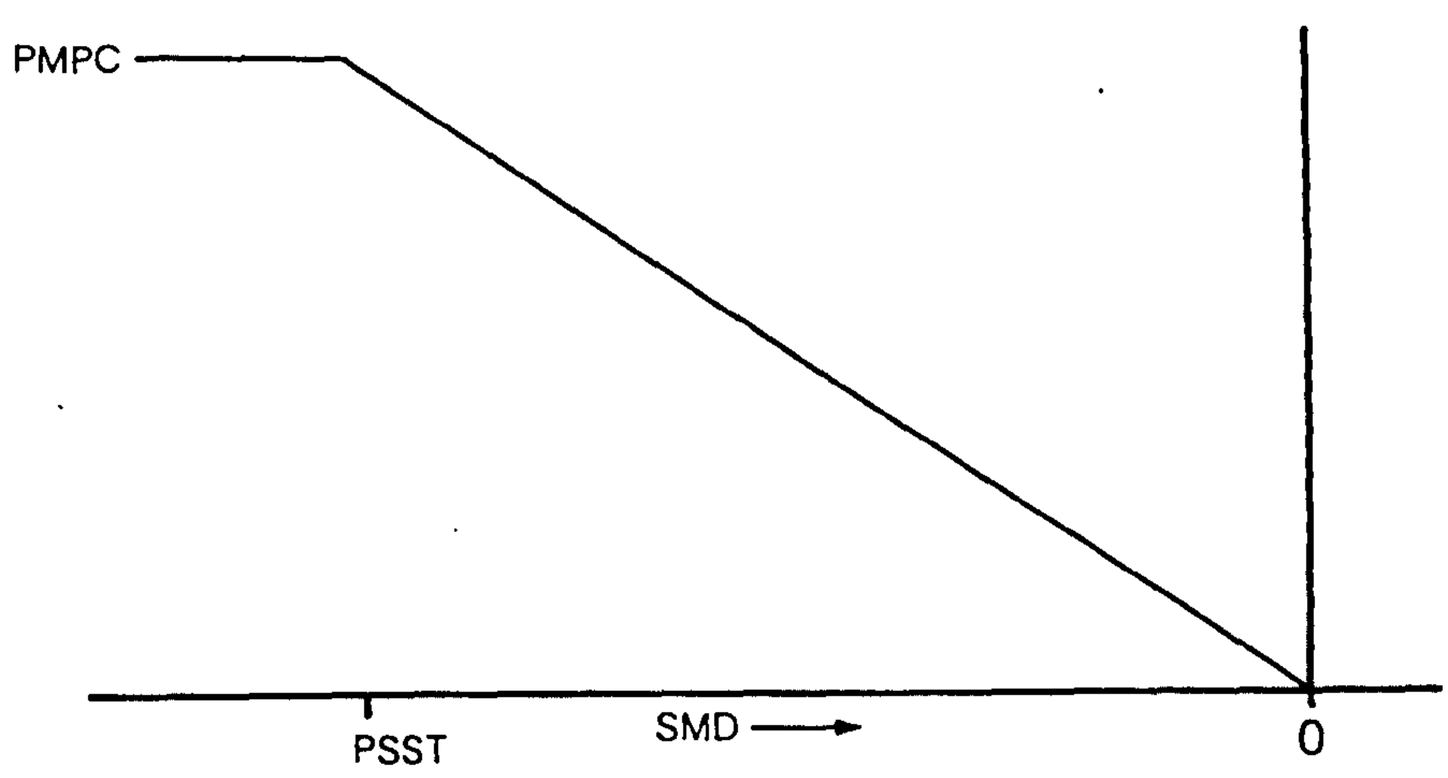


(b) Supersaturated loss

Fig.47(continued)



(c) Loss to transpiration



(d) Loss to groundwater

FIG. 48

The optimum value of one parameter

(after Douglas, 1974)

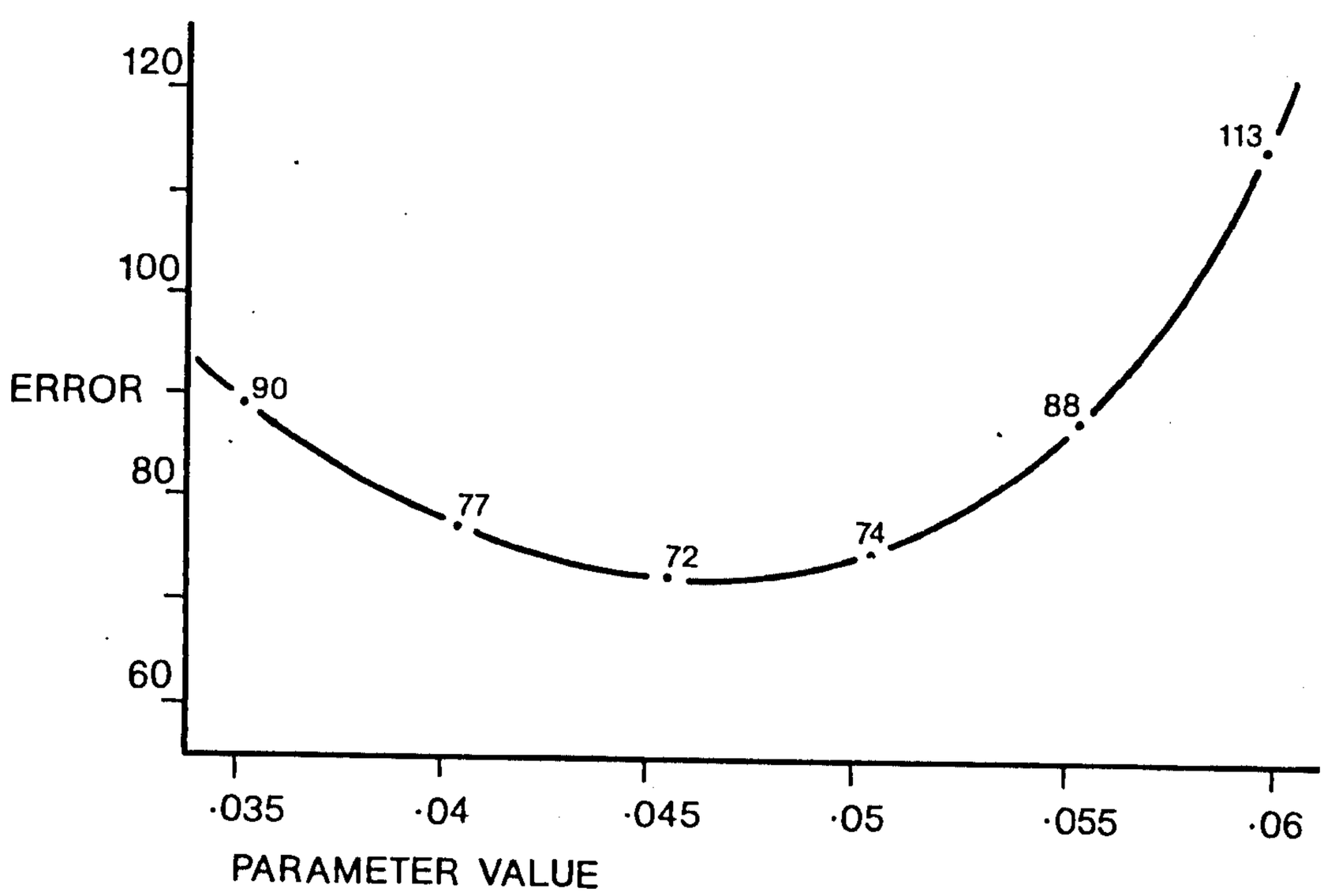


FIG.49

Error function surface for two parameters

(after Douglas, 1974)

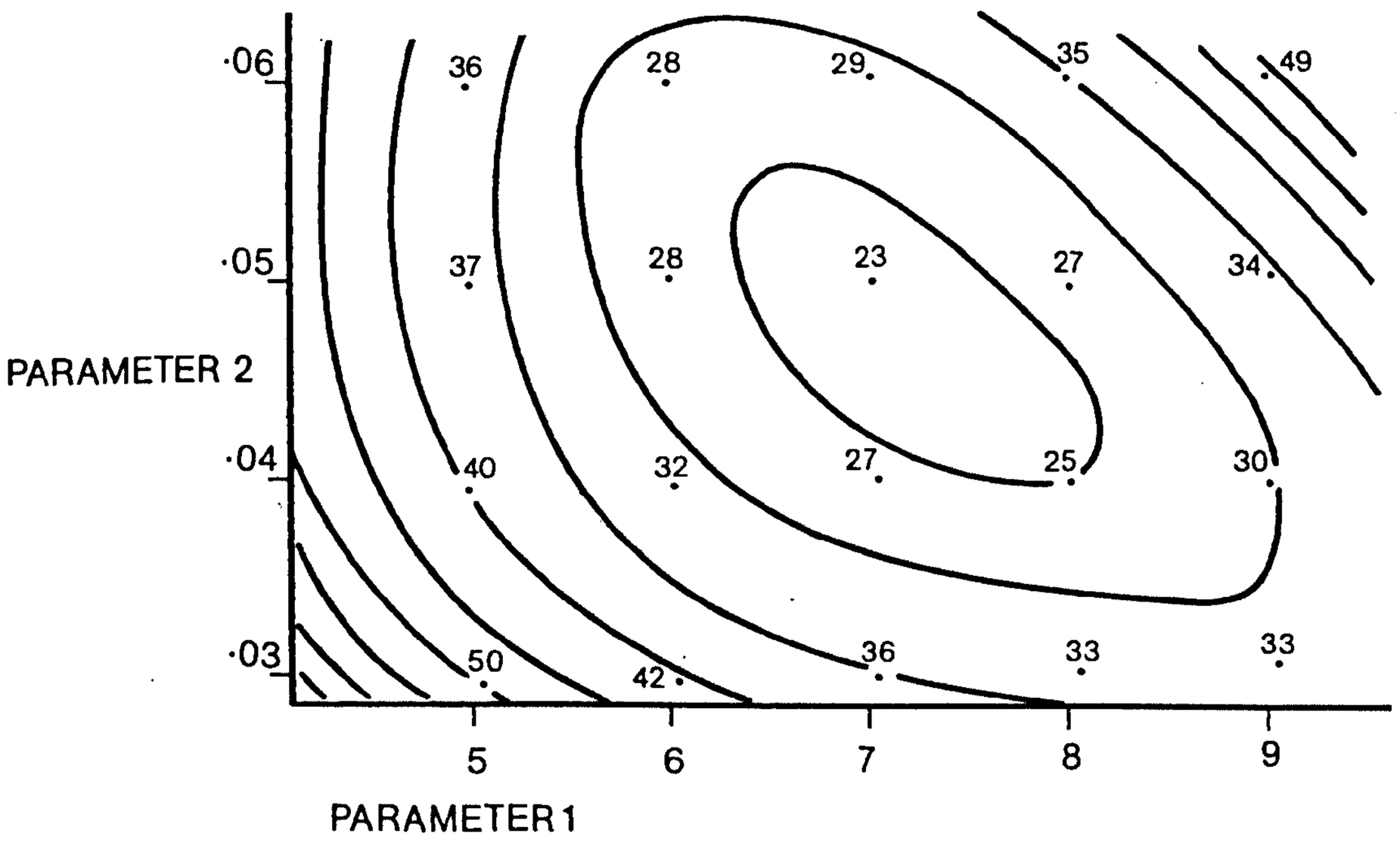


FIG. 50

General Pattern of Search
for Optimum

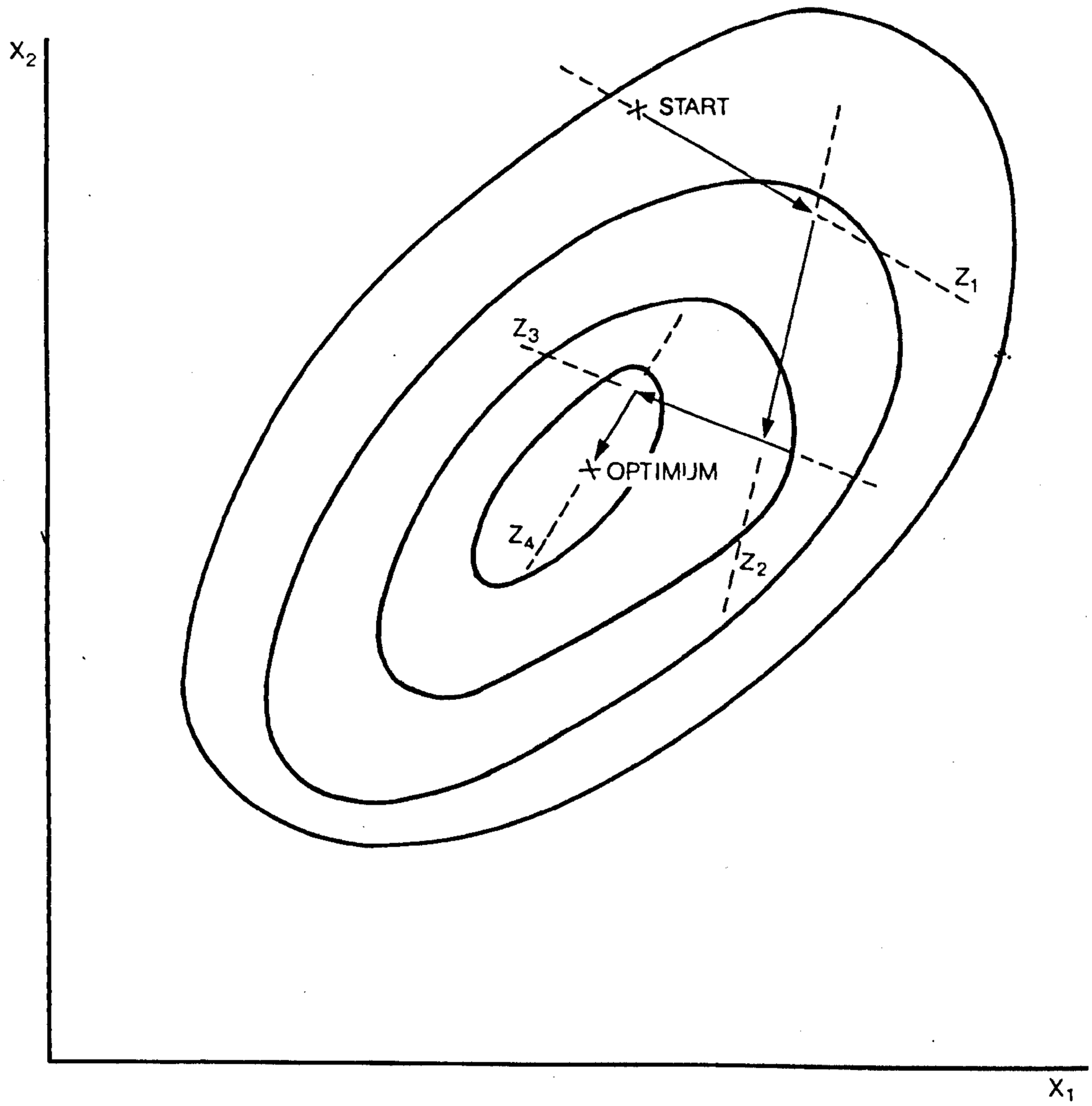
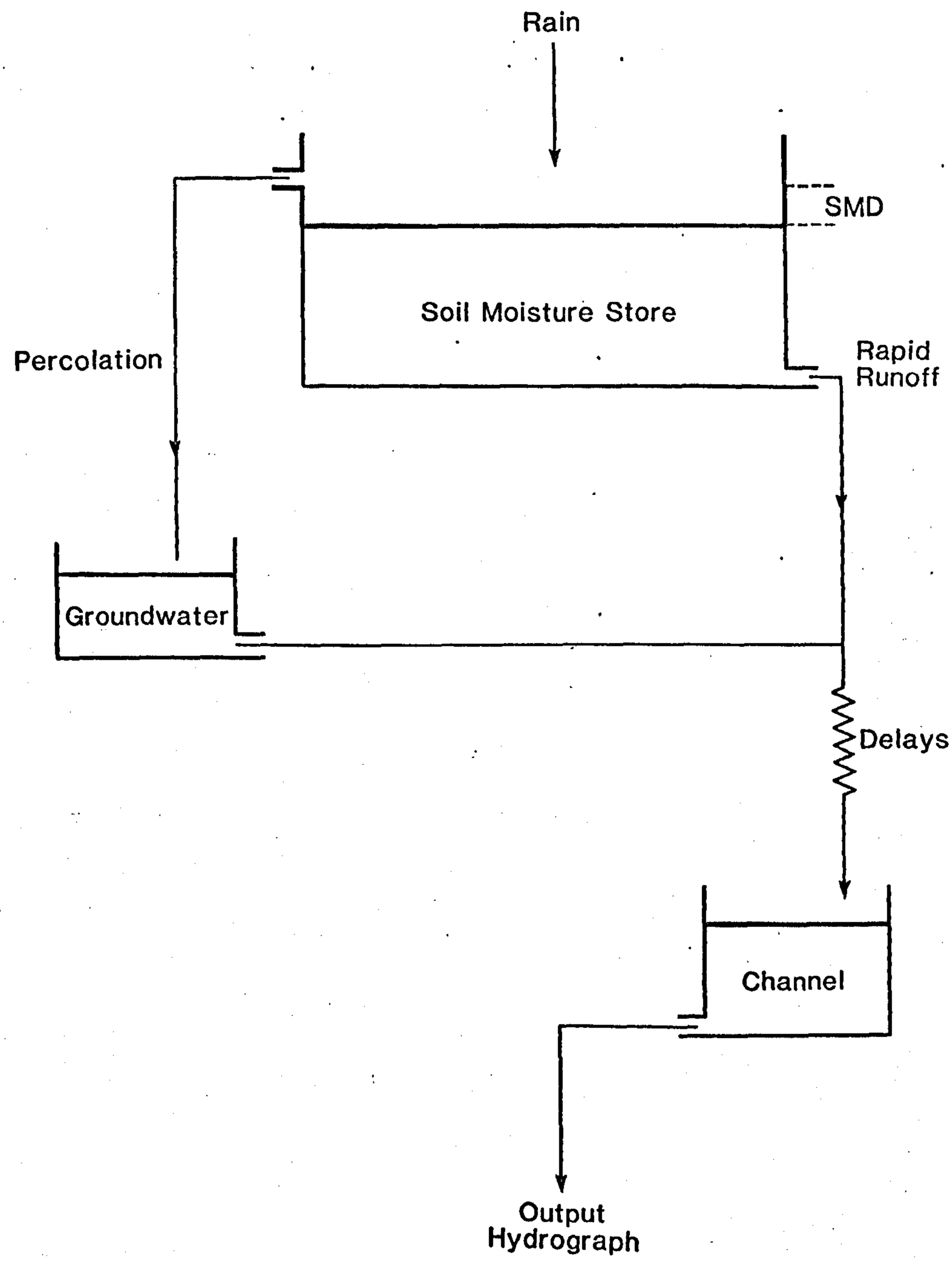


Figure 51
UCM Rainfall
Runoff Model



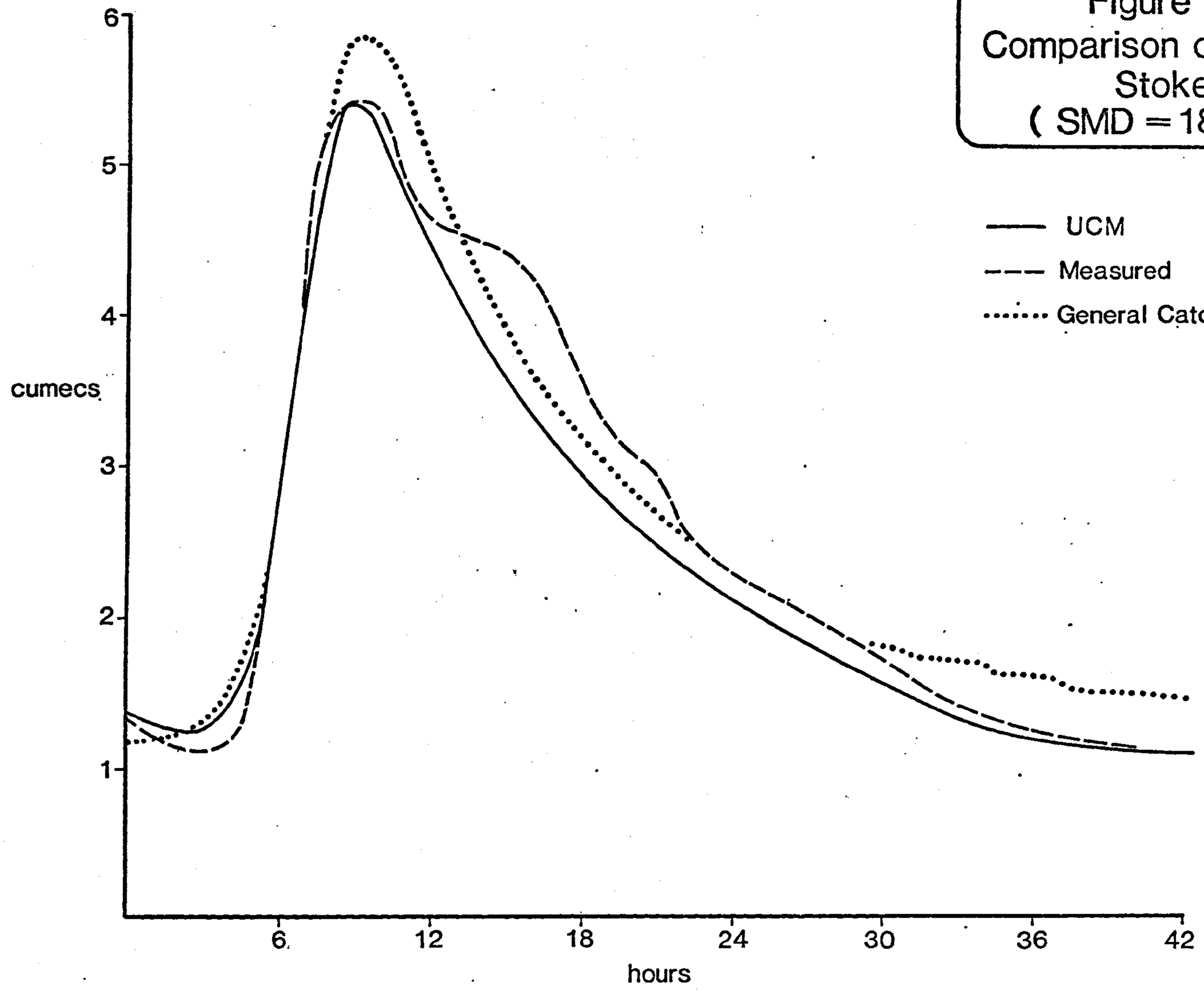


Figure 52
Comparison of Models
Stoke
(SMD = 18mm)

—— UCM

– – – Measured

····· General Catchment Model

Figure 53
Comparison of Models
Gt. Bridgford
(SMD 0.0)

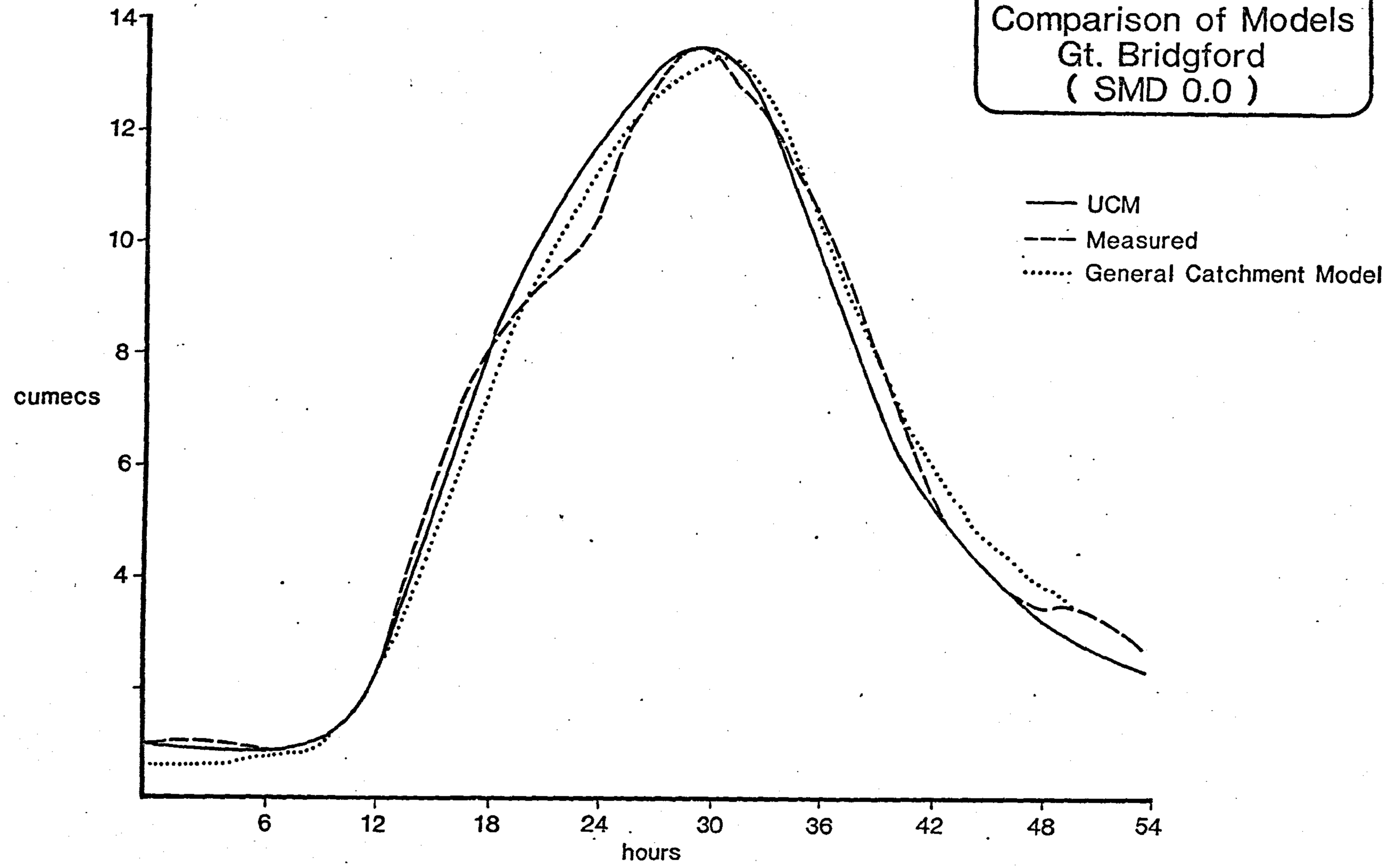


Figure 54
Comparison of Models
Wingfield Park
(SMD = 65.0mm)

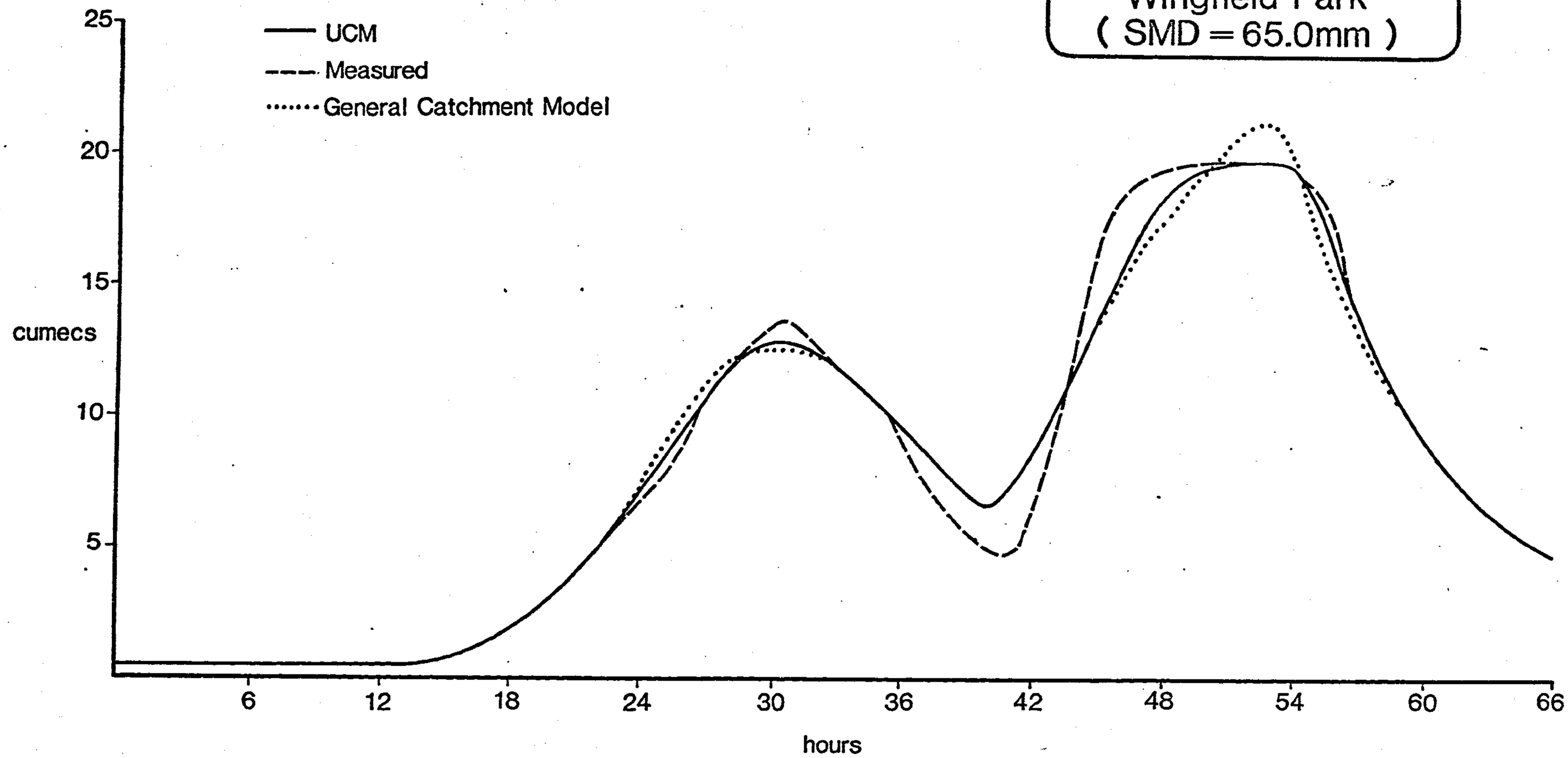


Figure 55
Comparison of Models
Izaak Walton
(SMD = 0.0)

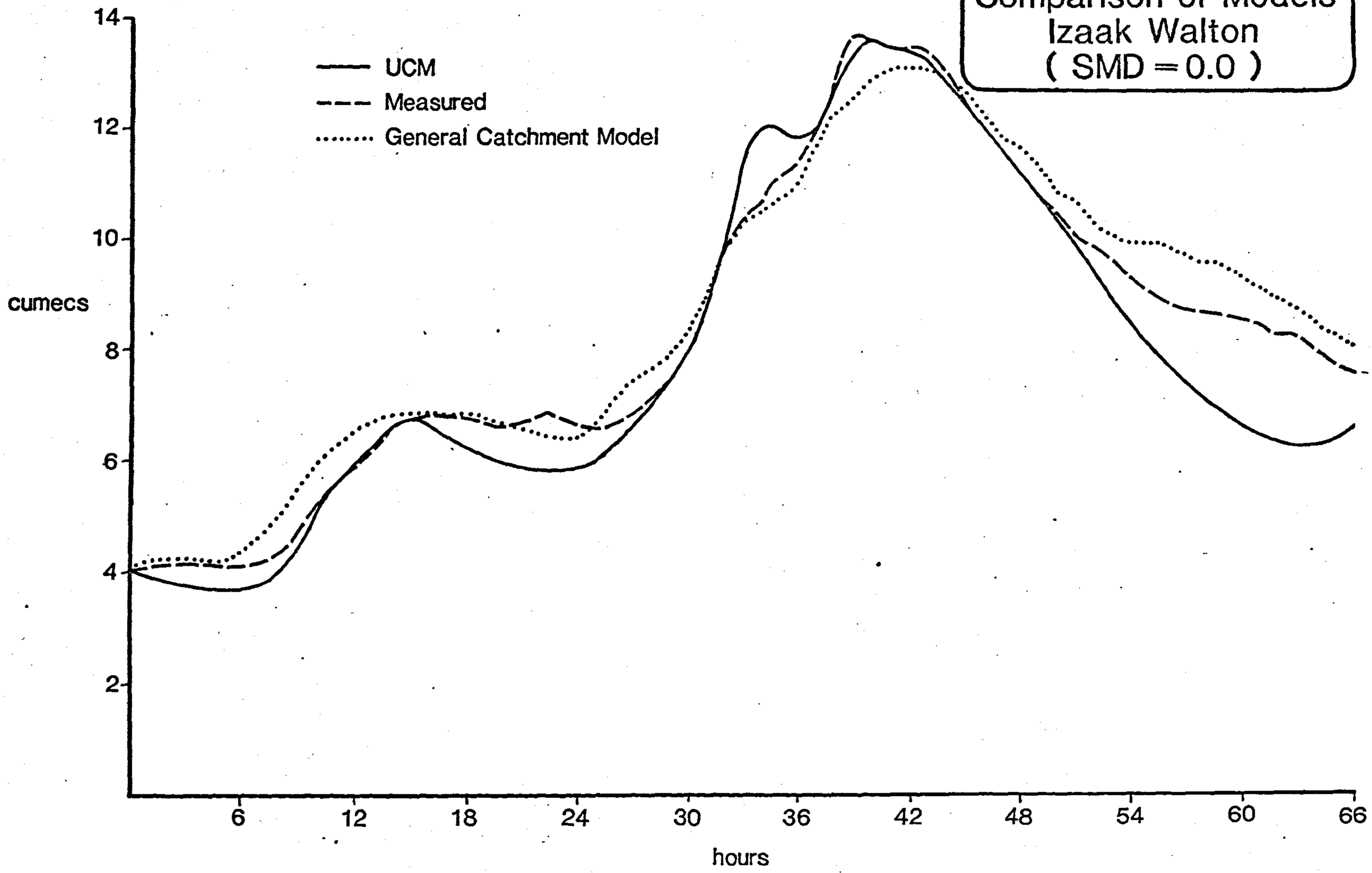


FIG. 56

River Soar - Narborough.

Rating Curve

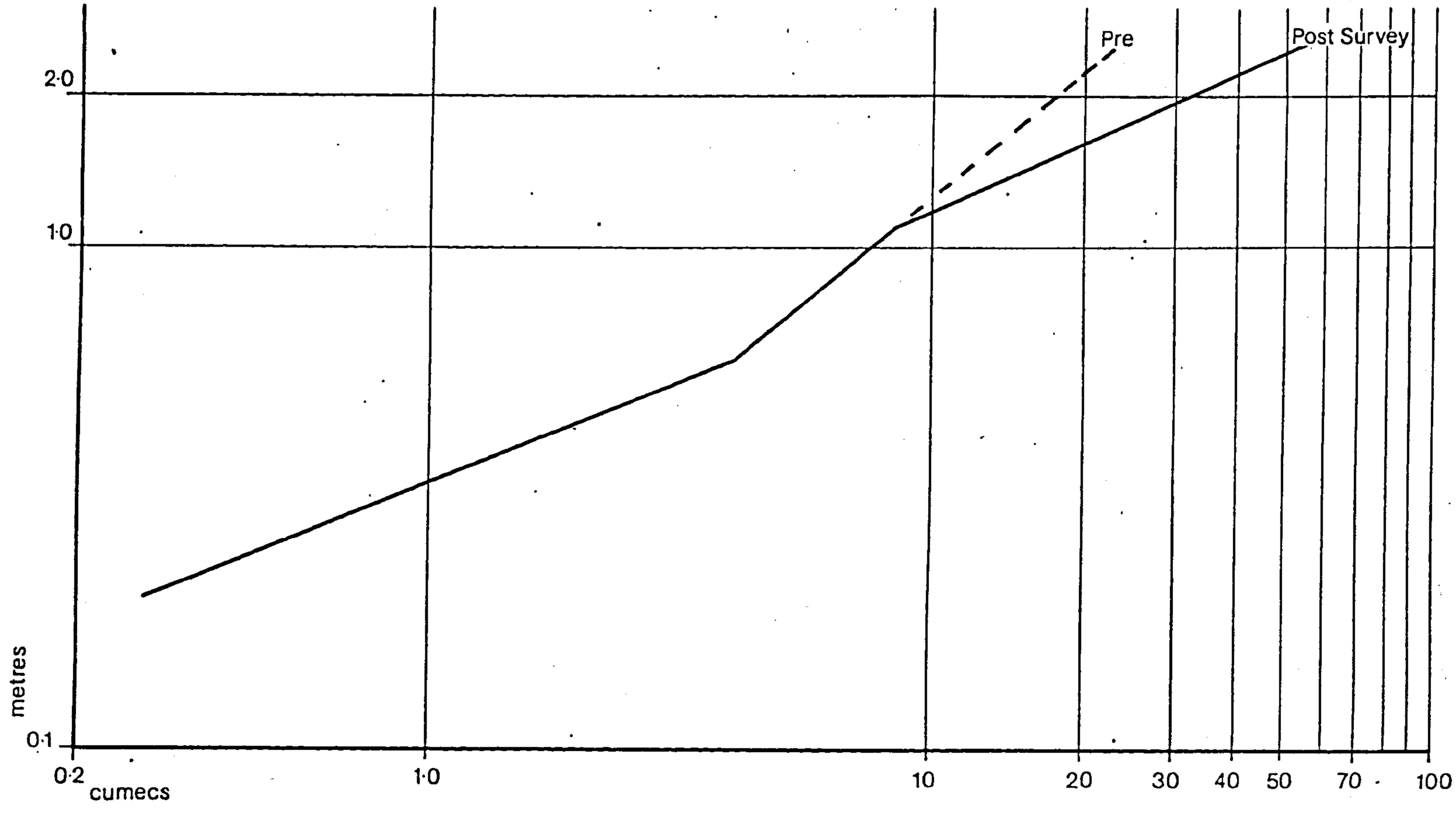


FIG. 57

Accumulated differences (mm) between actual & morecs rainfall May-Nov 1977 (after Pirt:et.al 1979)

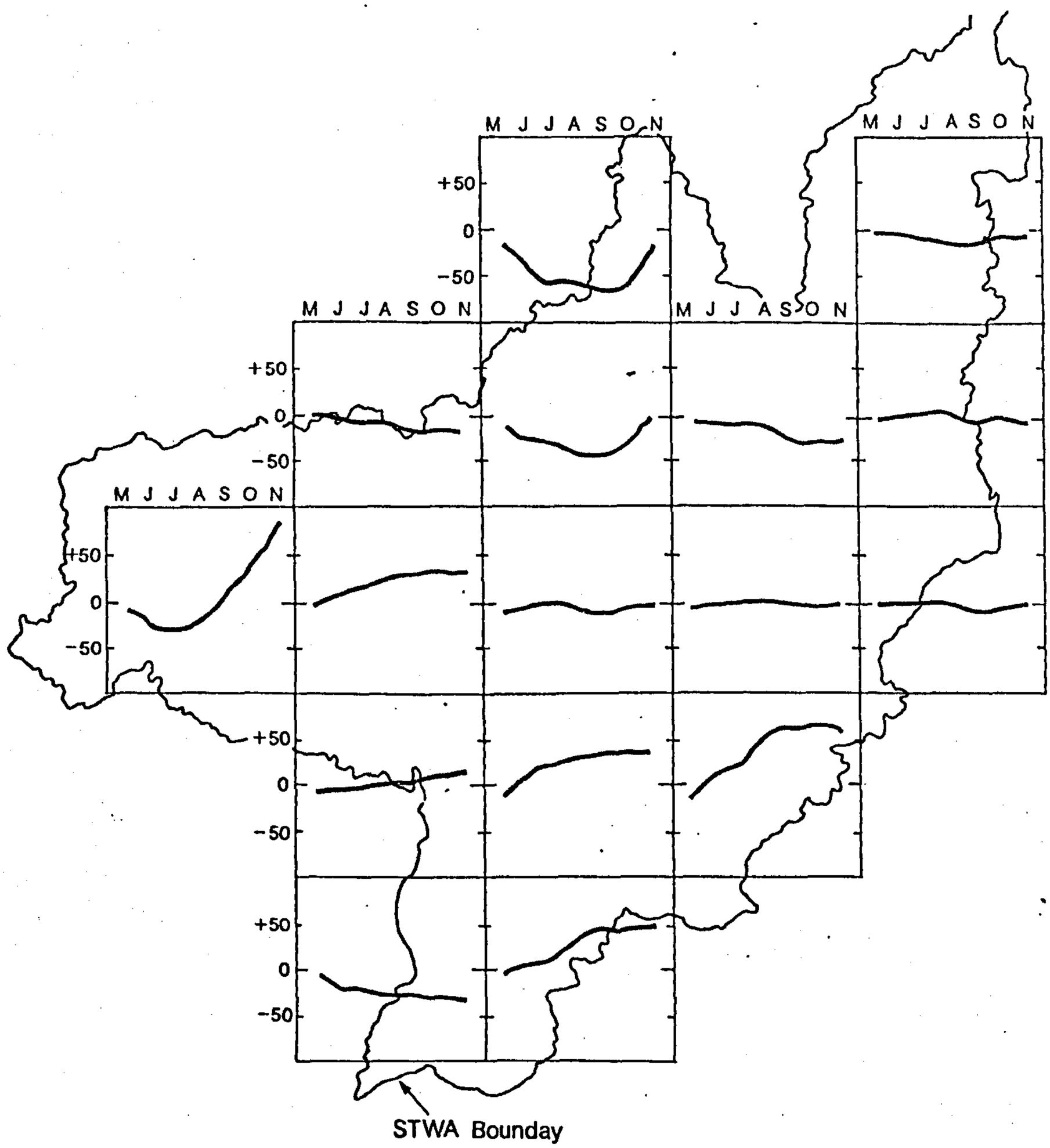
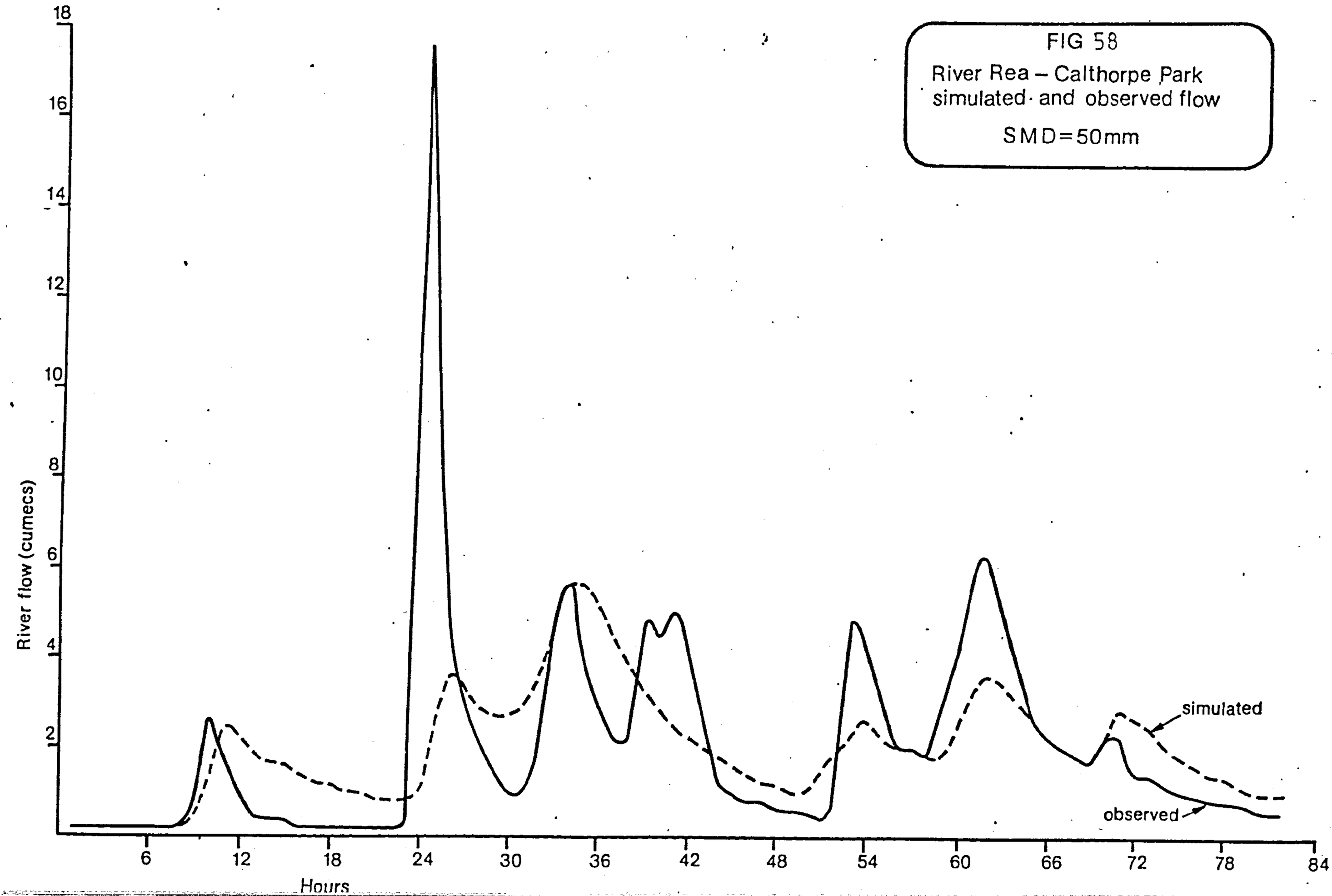


FIG 58

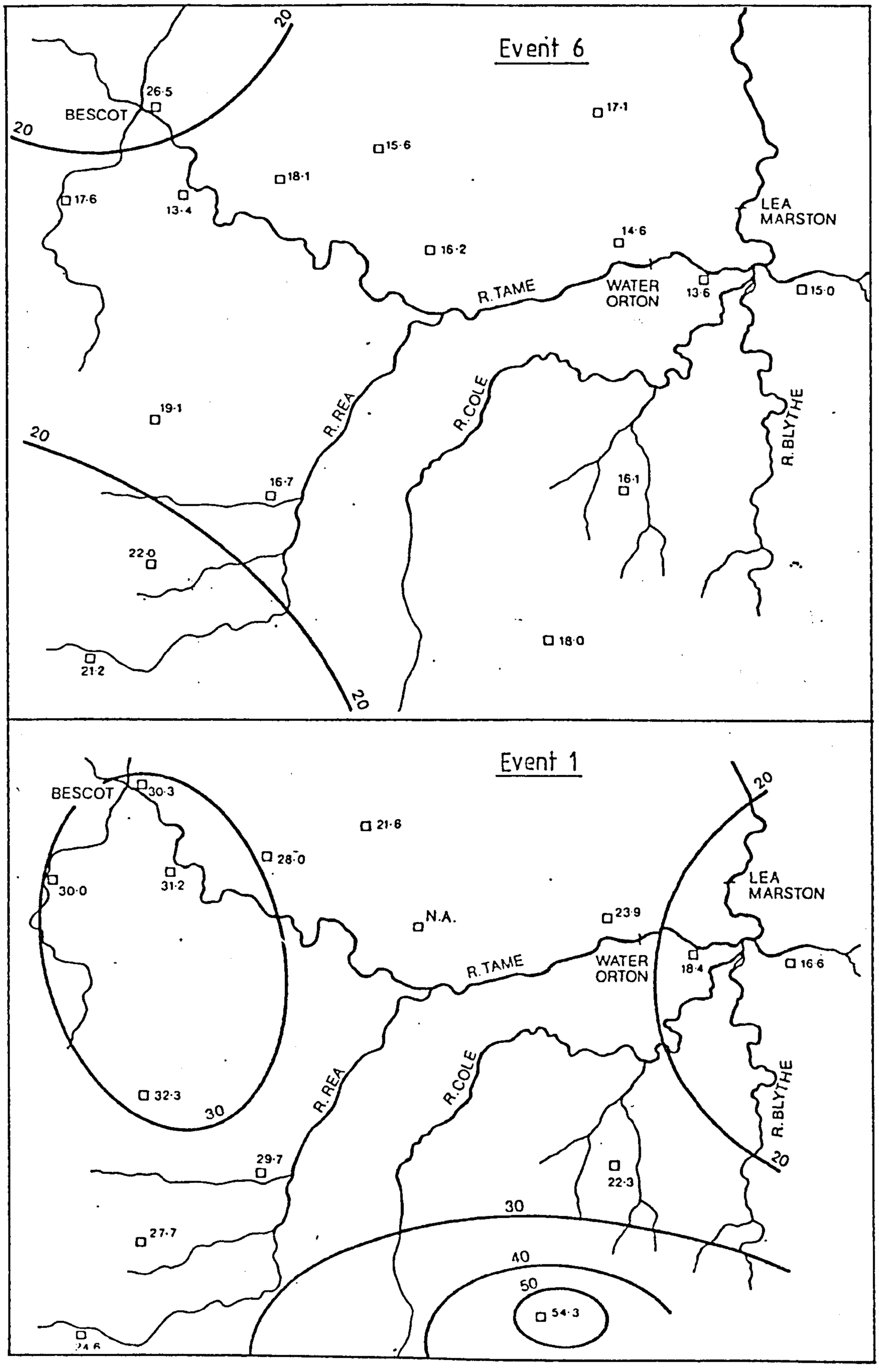
River Rea – Calthorpe Park
simulated and observed flow

SMD=50mm



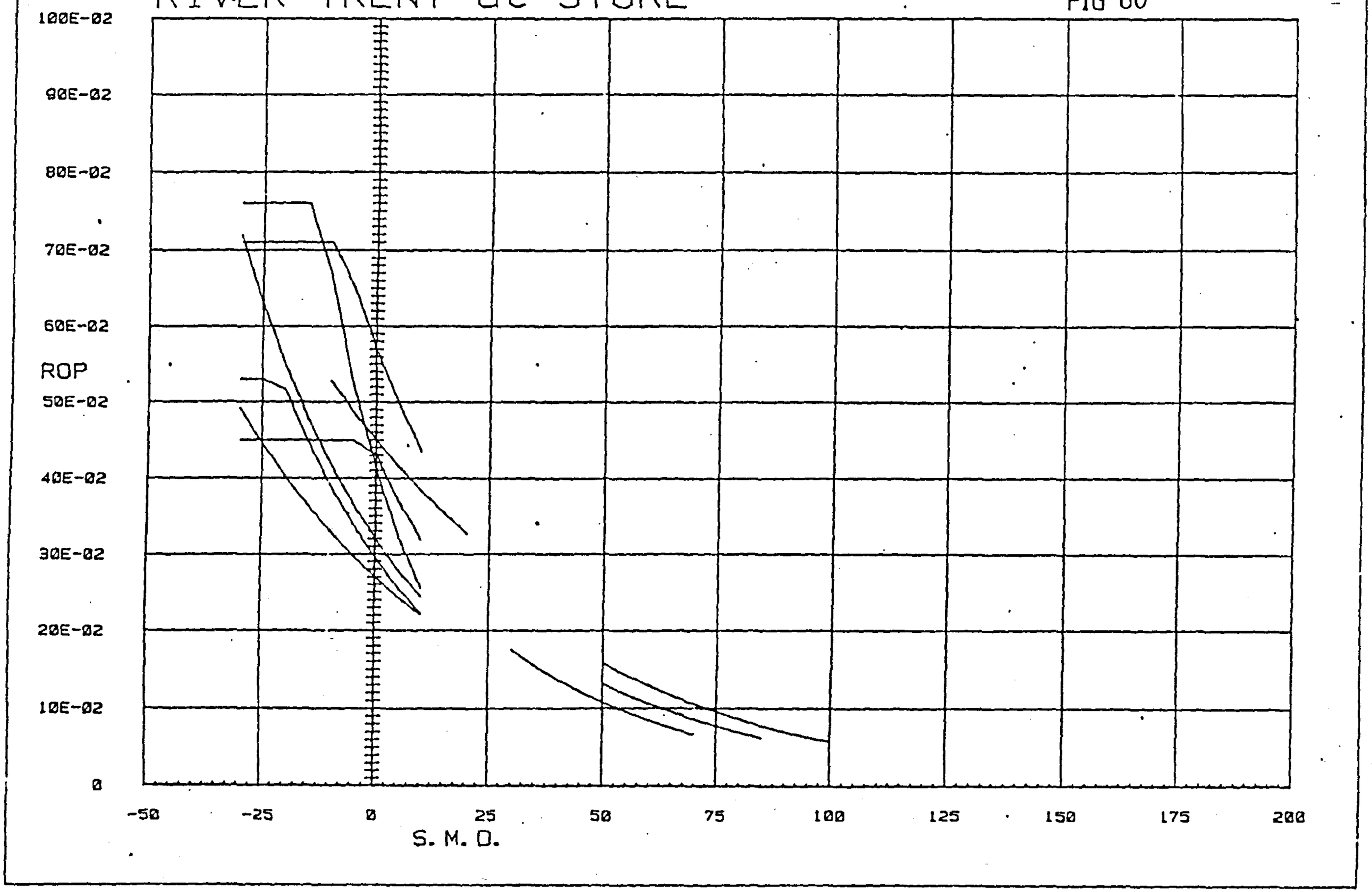
Rainfall pattern
from daily raingauges.
Falls and isohyets in mm's

FIG. 59

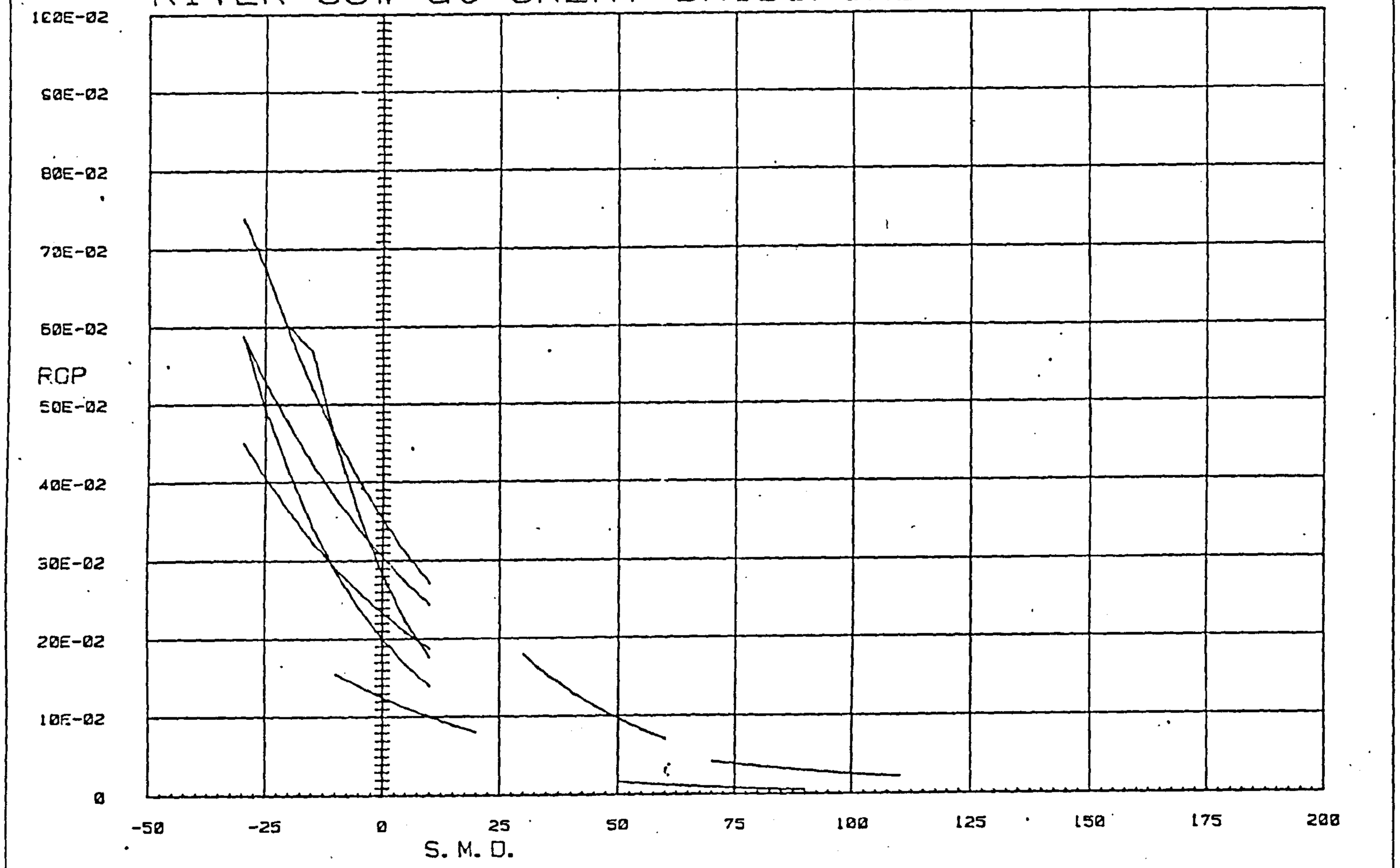


RIVER TRENT at STOKE

FIG 60

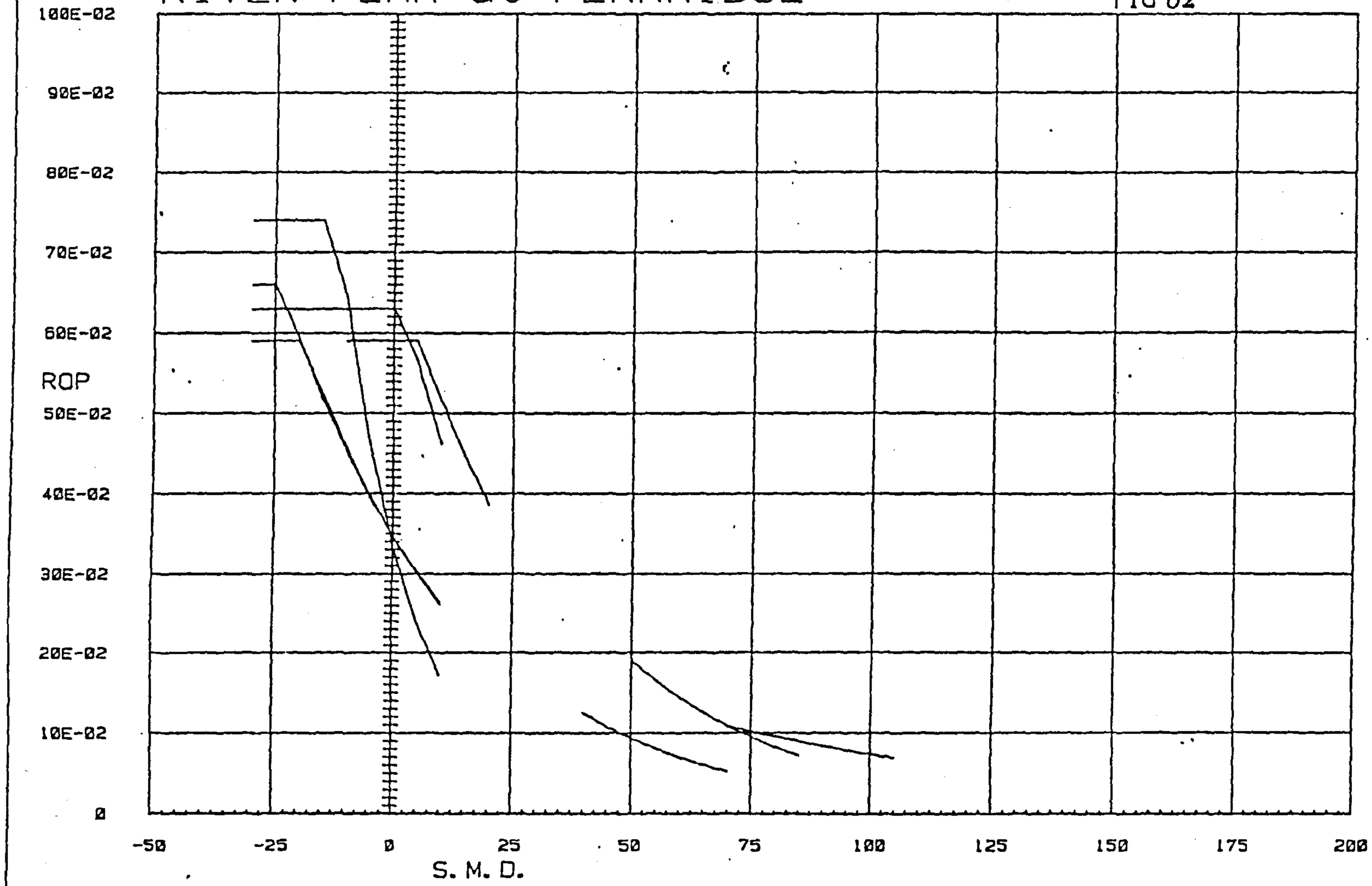


RIVER SOW at GREAT BRIDGFORD FIG61



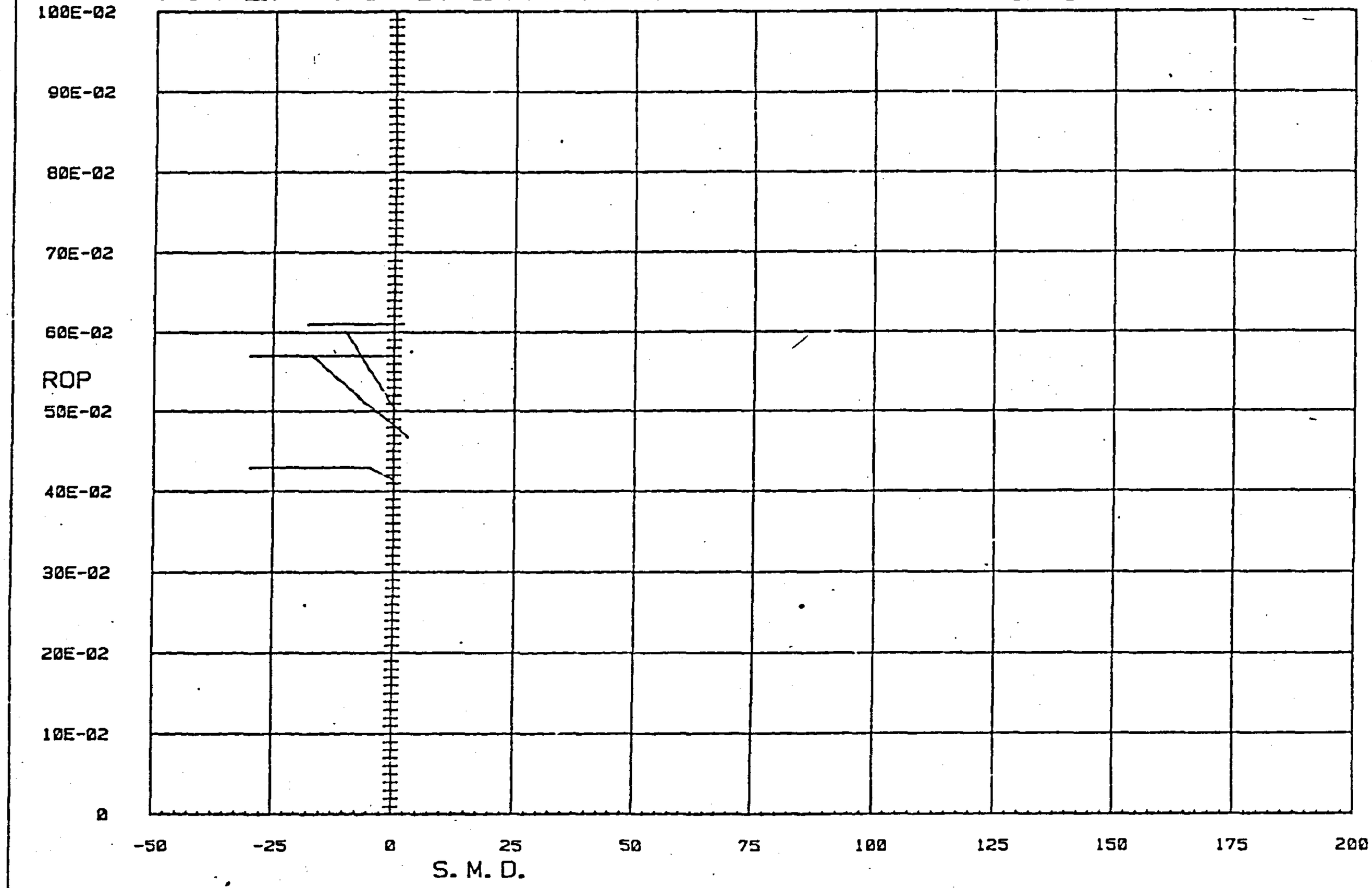
RIVER PENK at PENKRIDGE

FIG 62



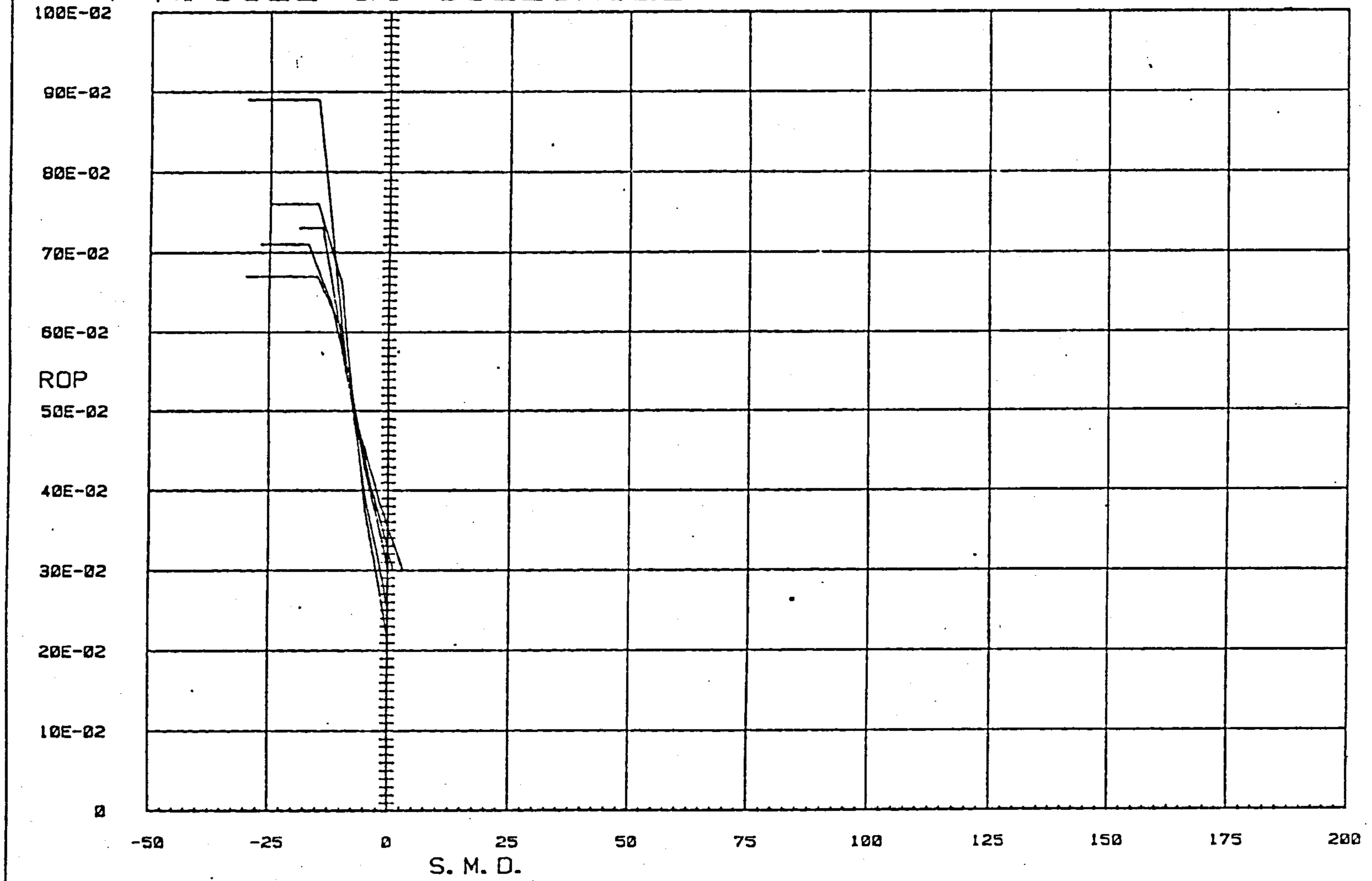
R. REA at CALTHORPE PARK

FIG 63



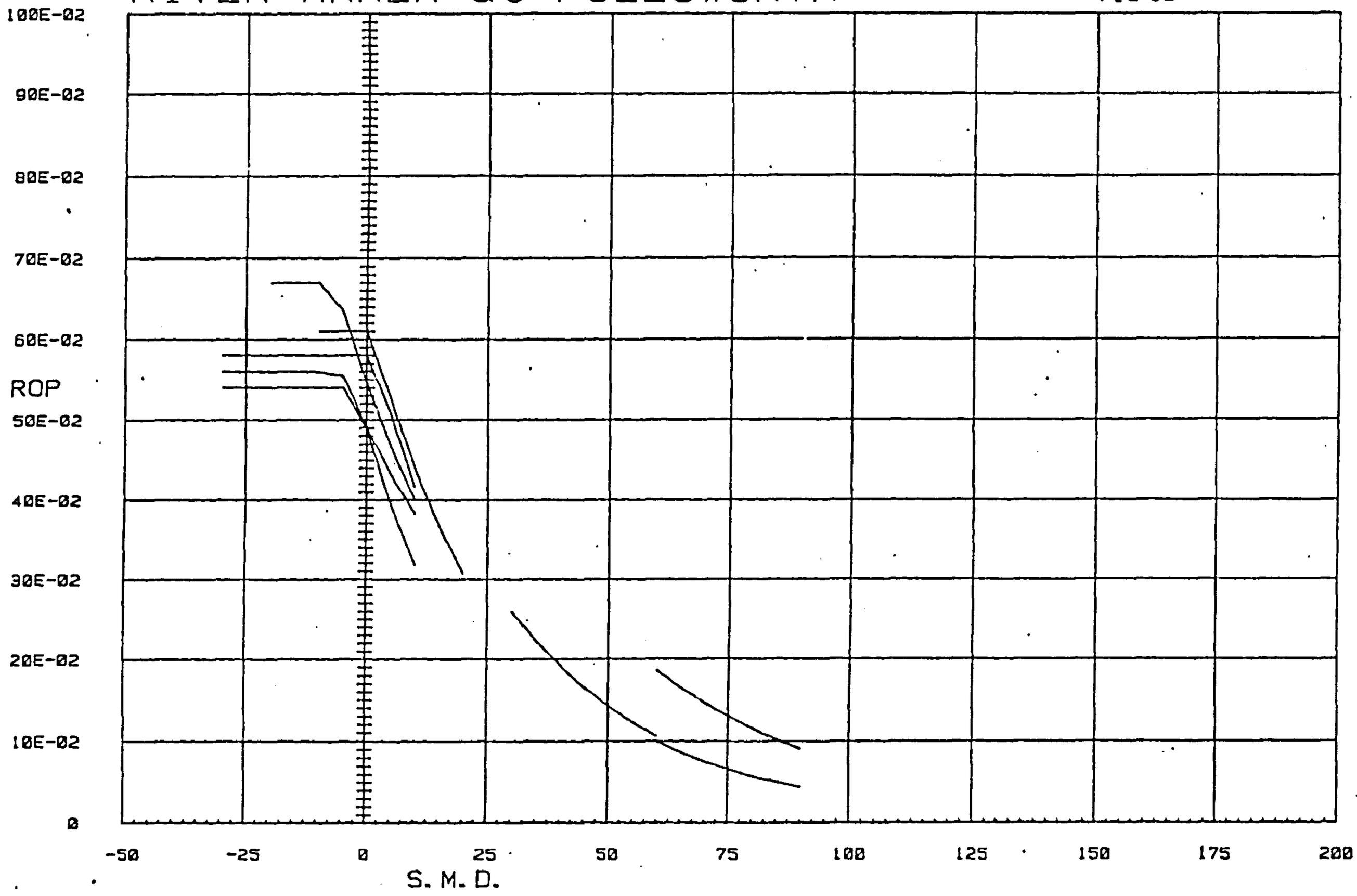
R. COLE at COLESHILL

FIG 64



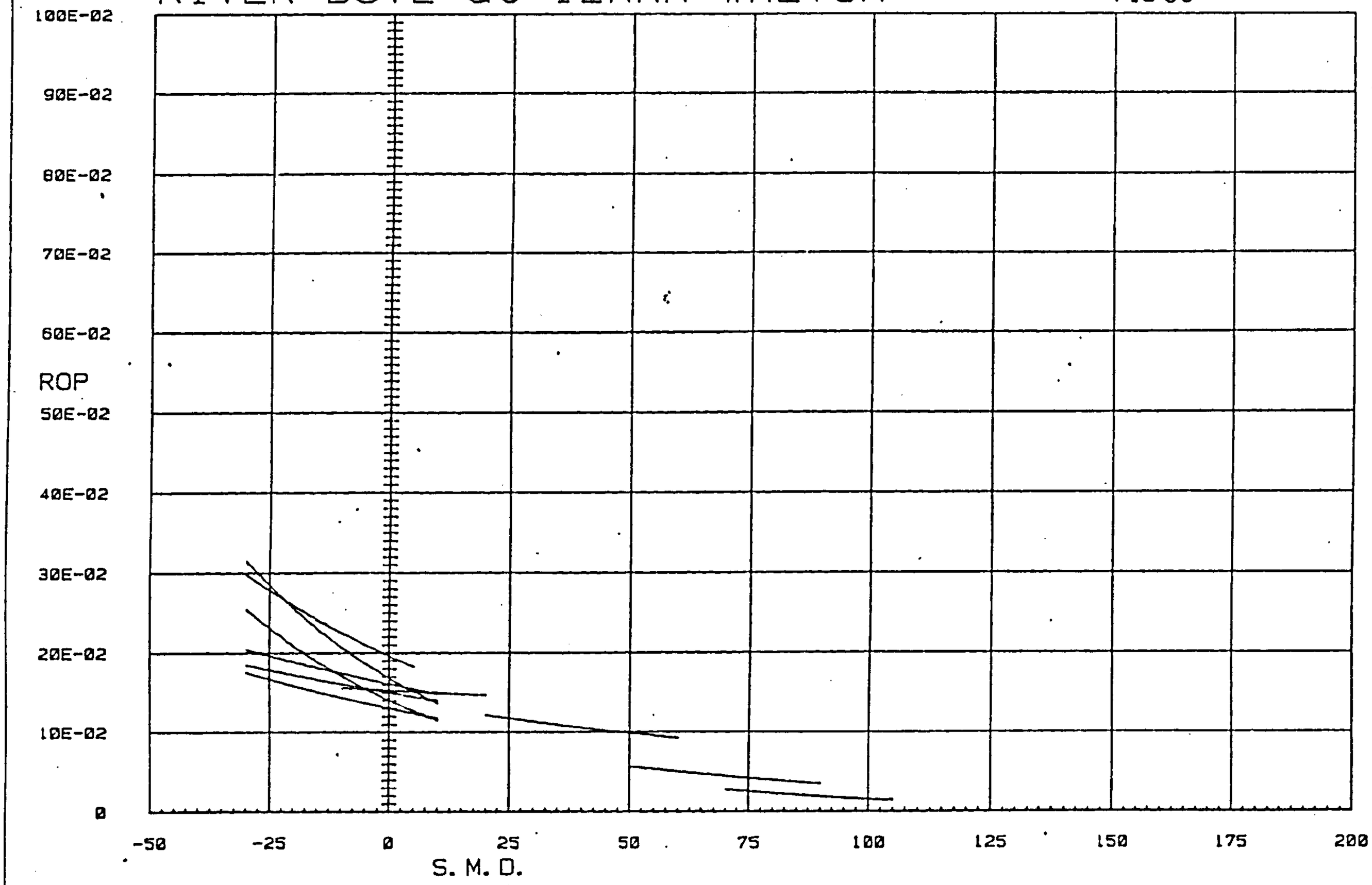
RIVER ANKER at POLESWORTH

FIG 65



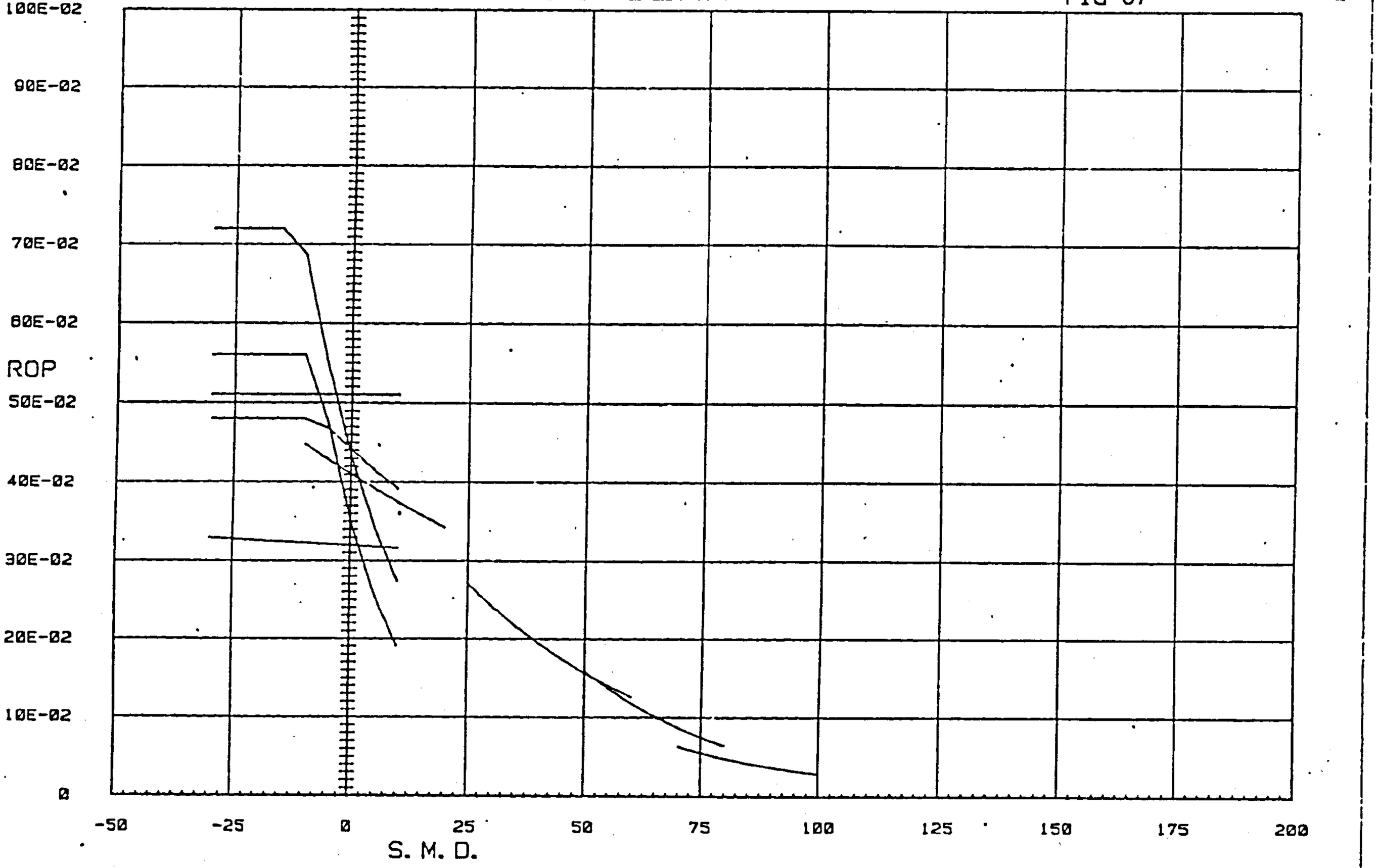
RIVER DOVE at IZAAK WALTON

FIG 66



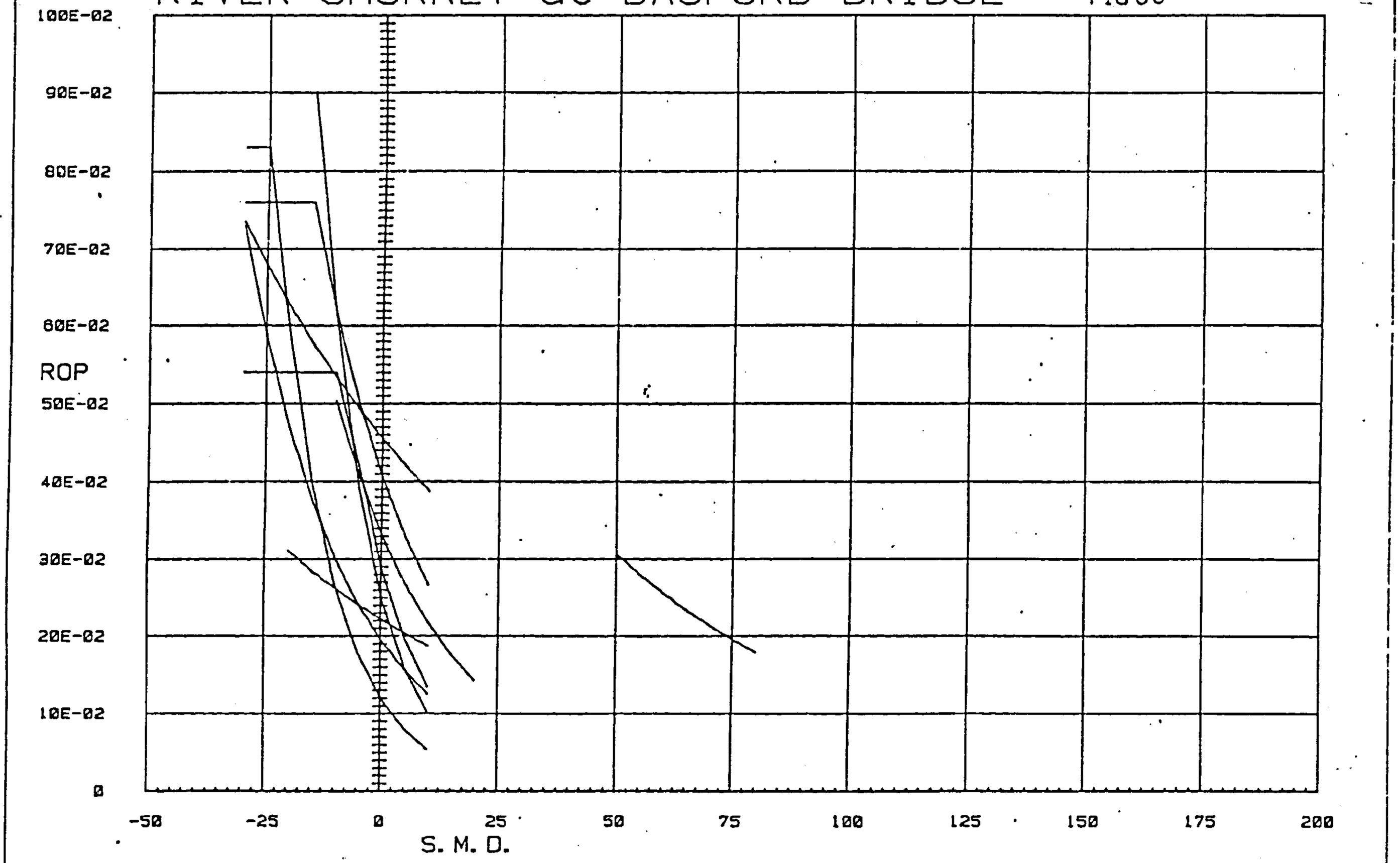
RIVER MANIFOLD at ILAM

FIG 67



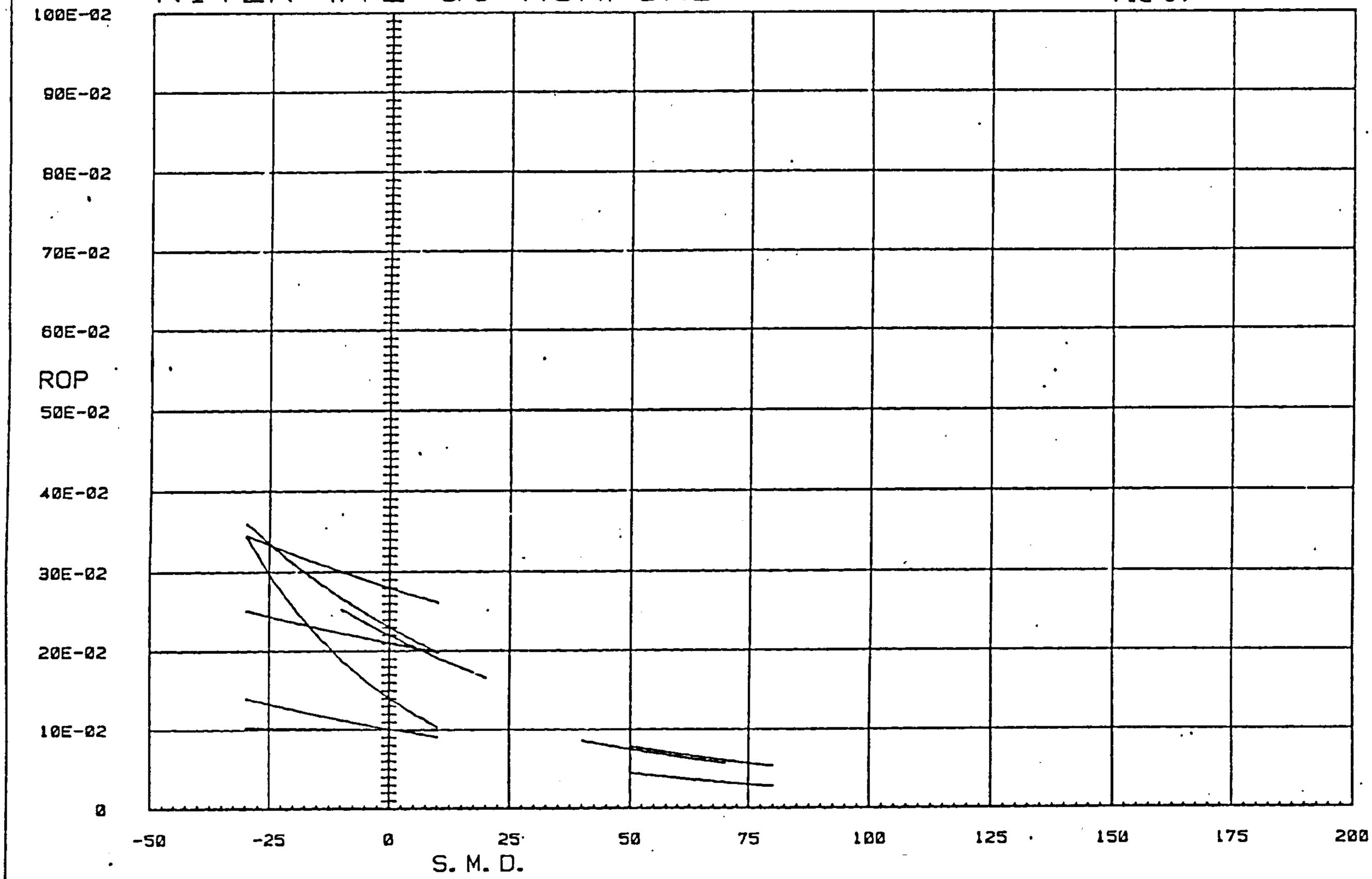
RIVER CHURNET at BASFORD BRIDGE

FIG 68



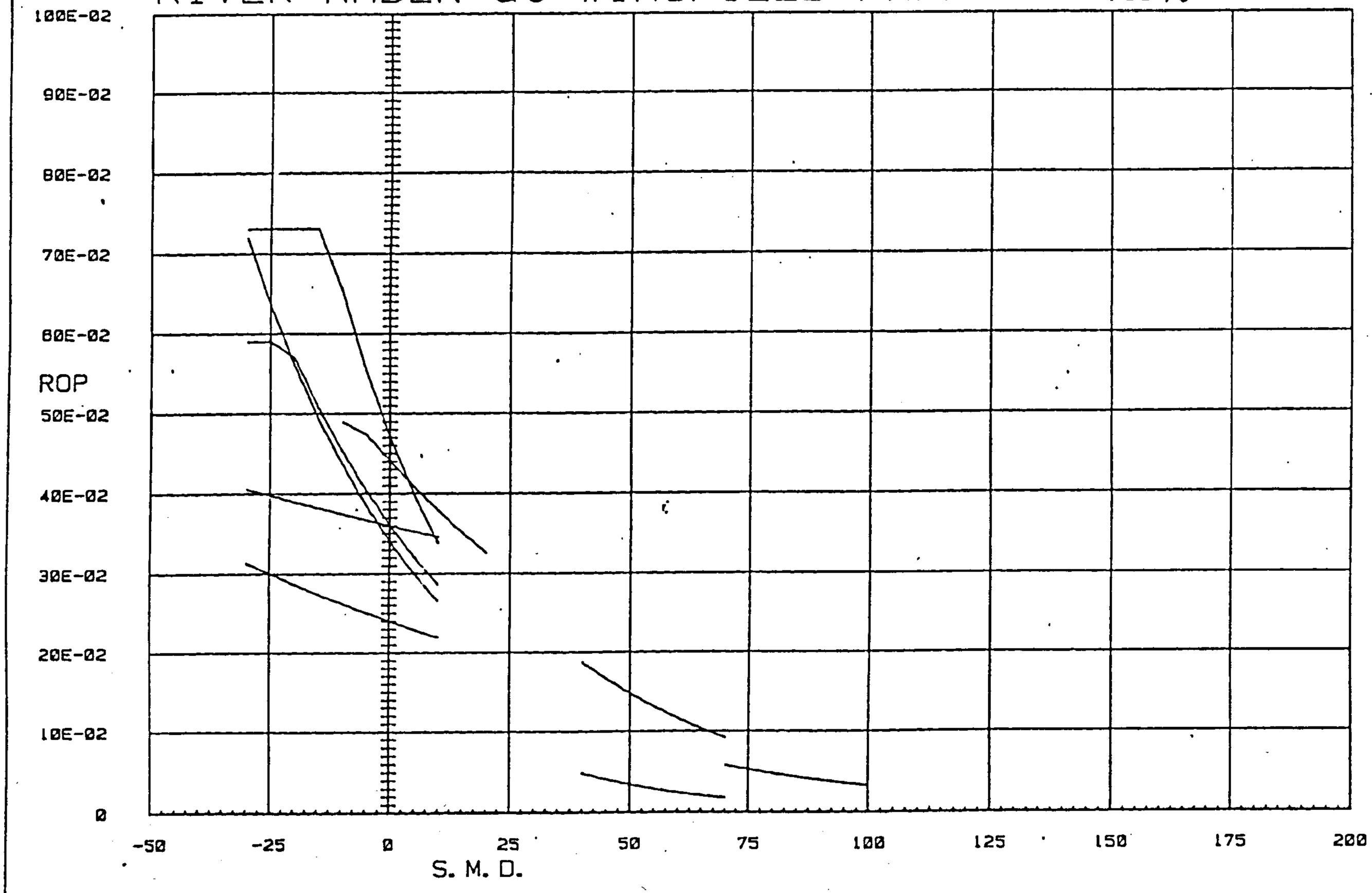
RIVER WYE at ASHFORD

FIG 69



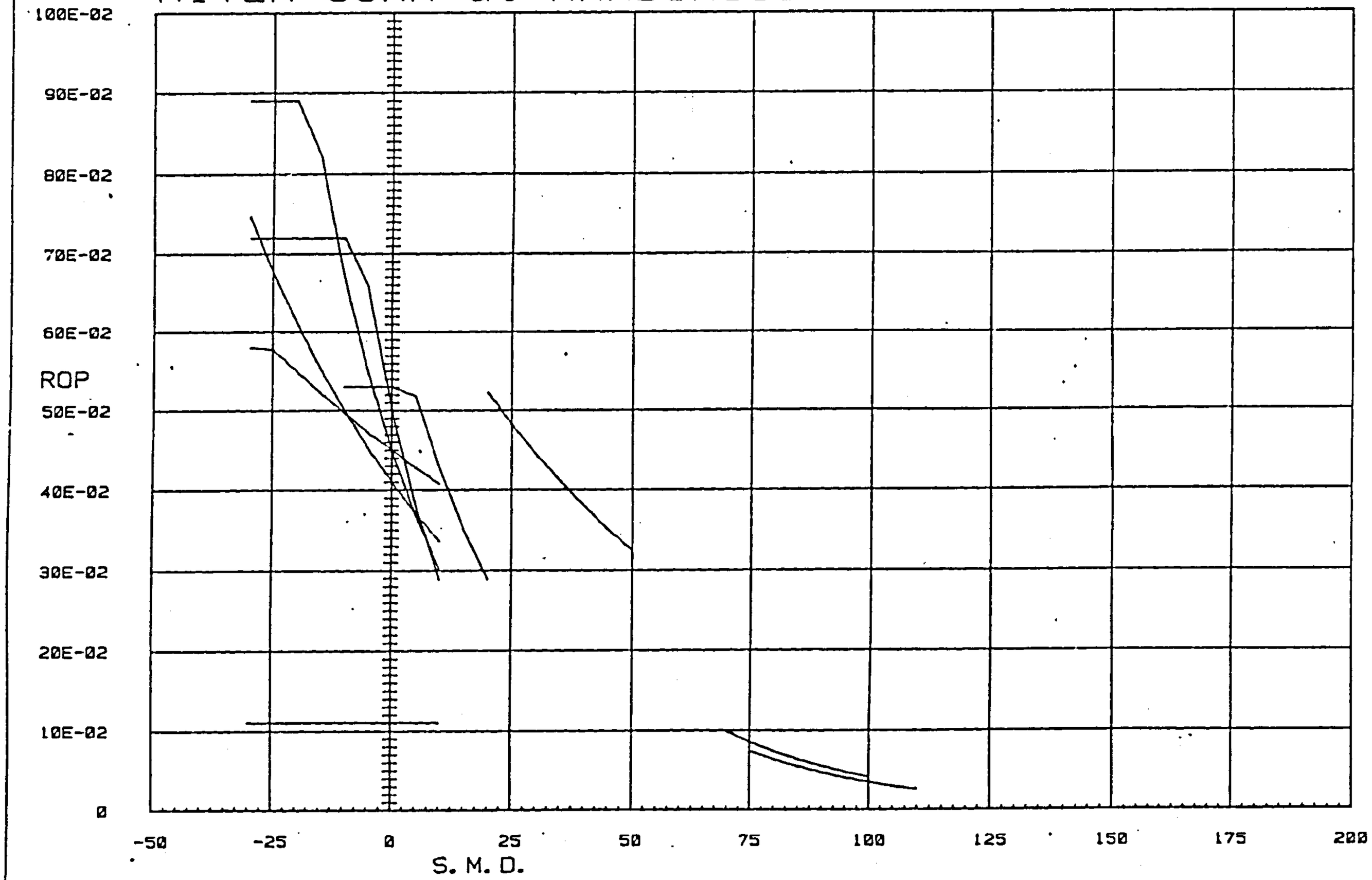
RIVER AMBER at WINGFIELD PARK

FIG 70



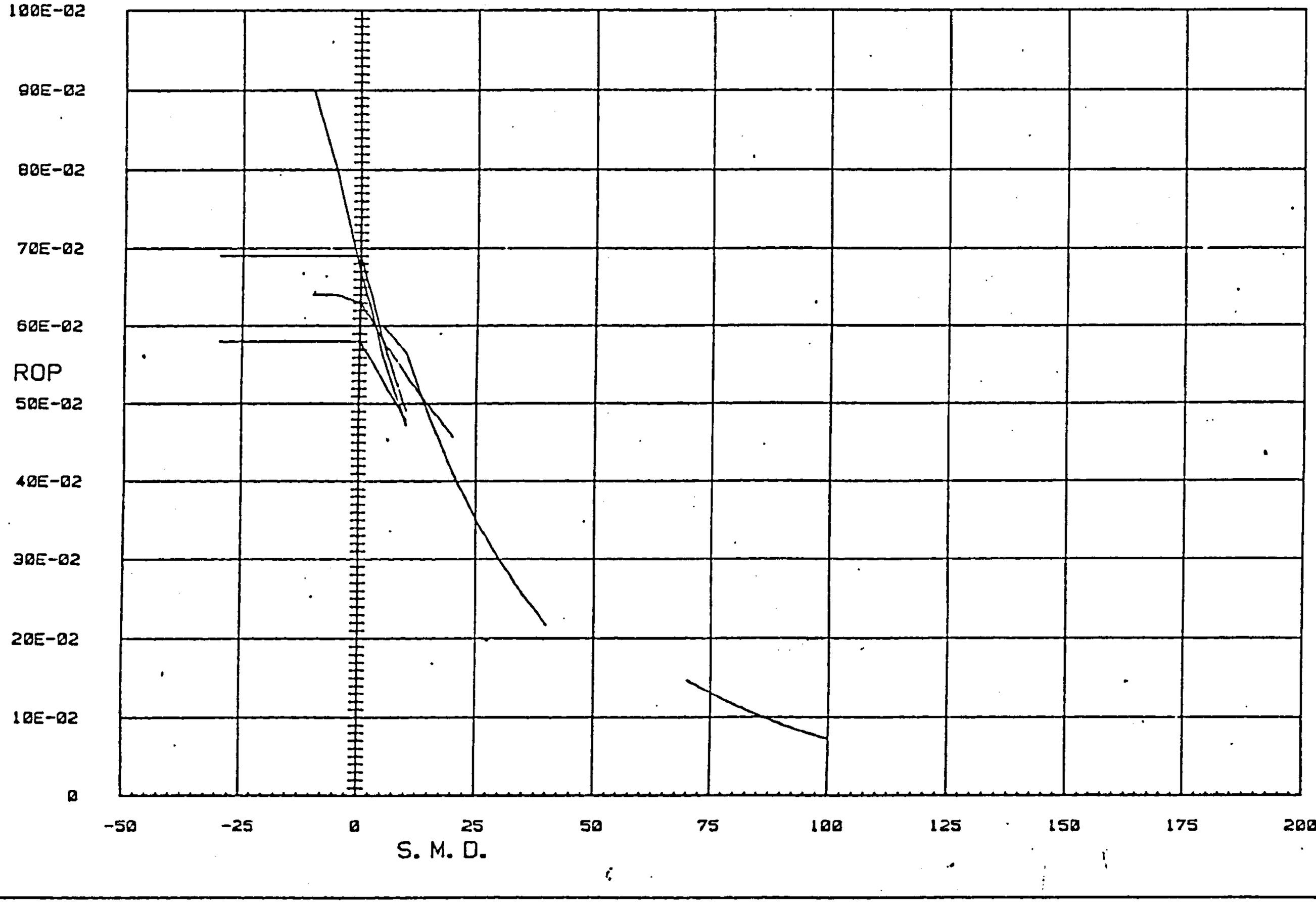
RIVER SOAR at NARBOROUGH

FIG 71



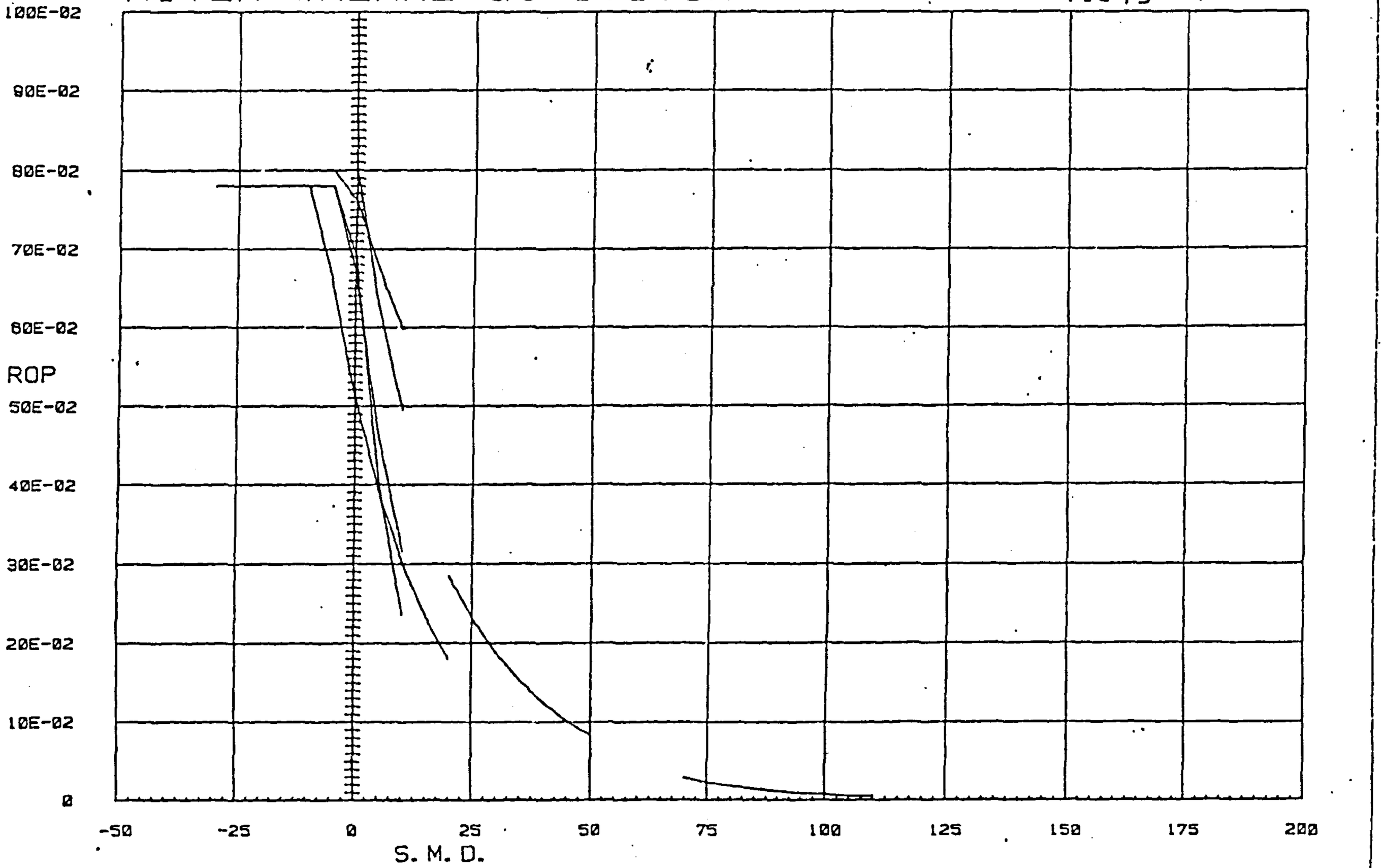
RIVER SENCE at BLABY

FIG 72

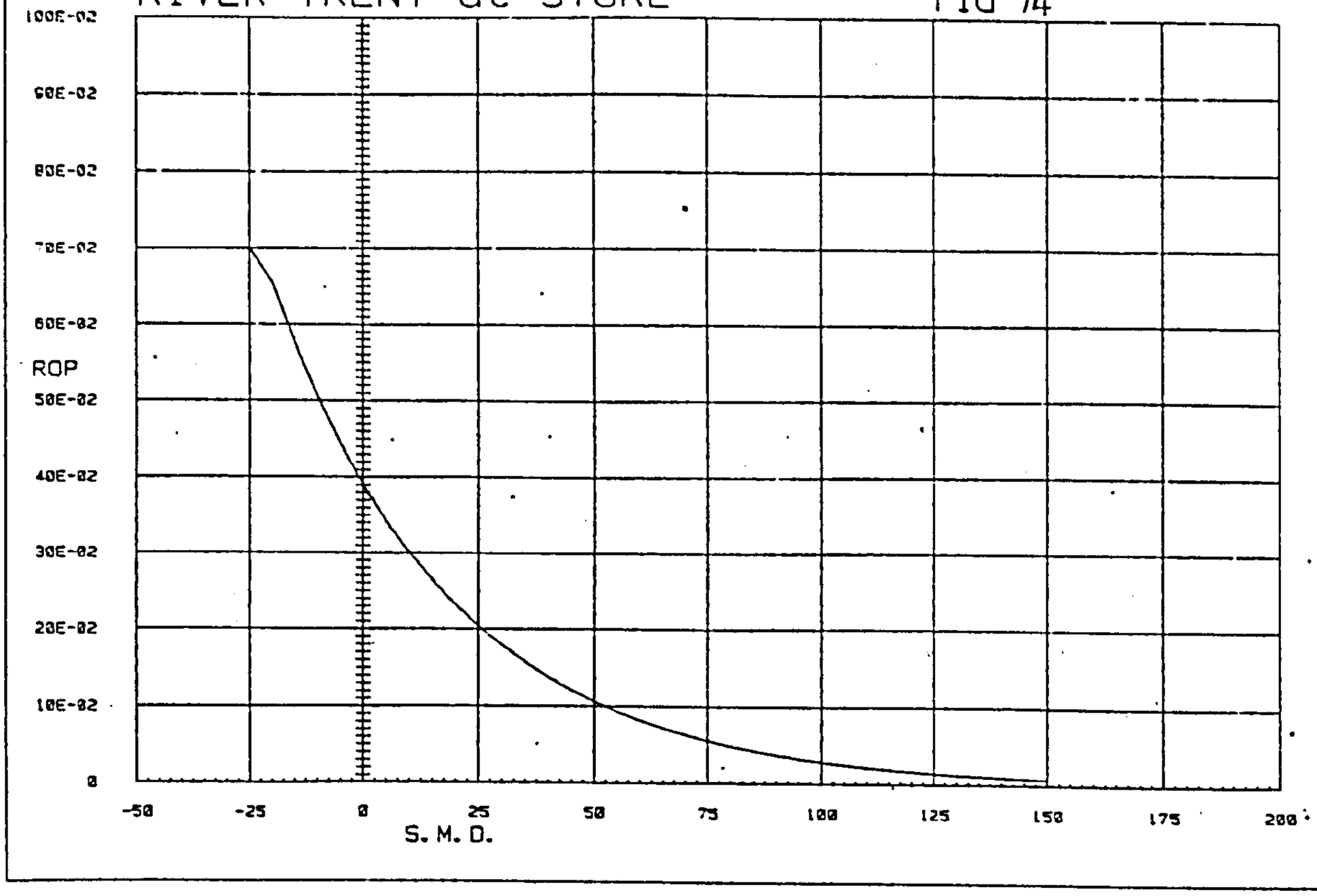


RIVER WREAKE at SYSTON

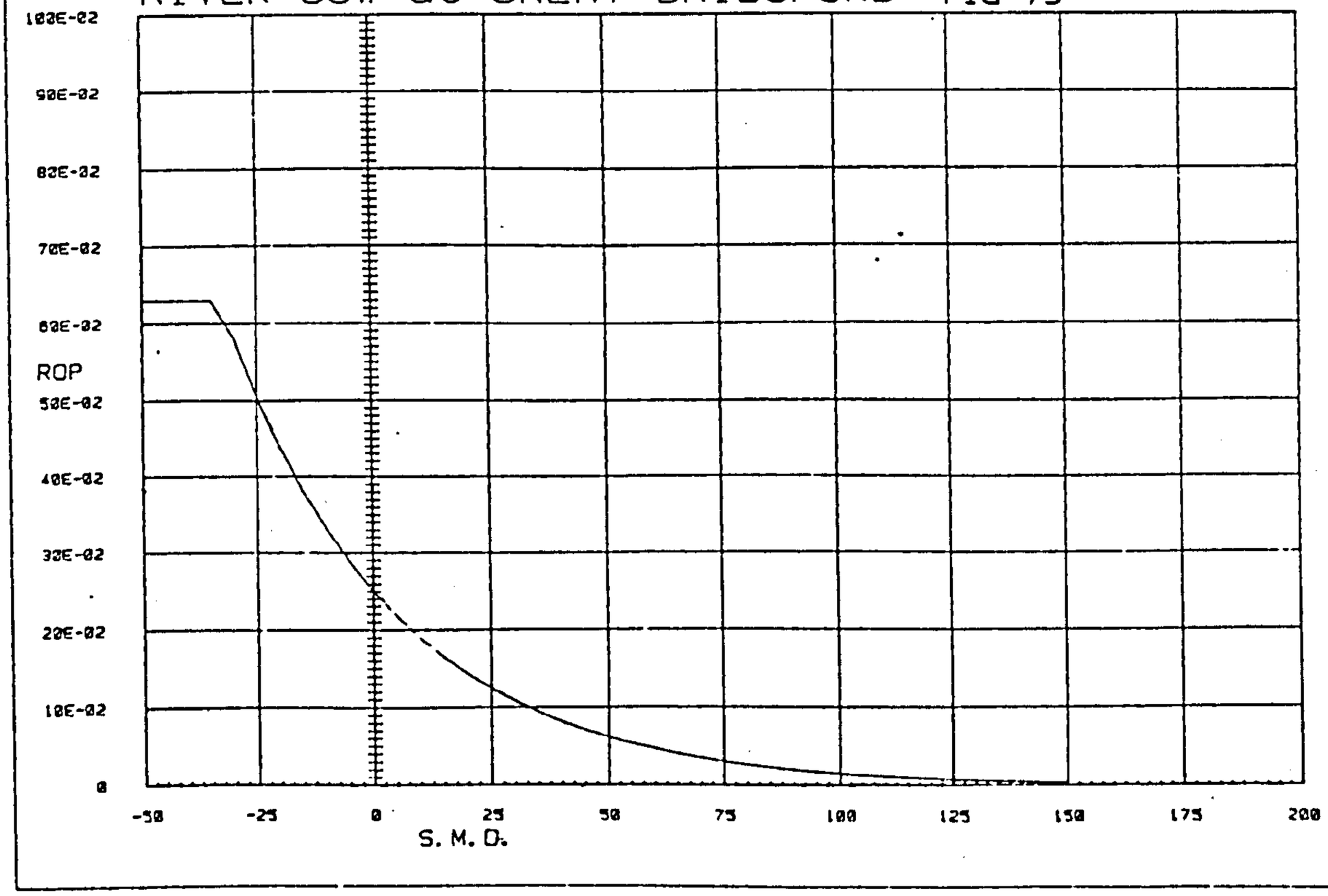
FIG 73



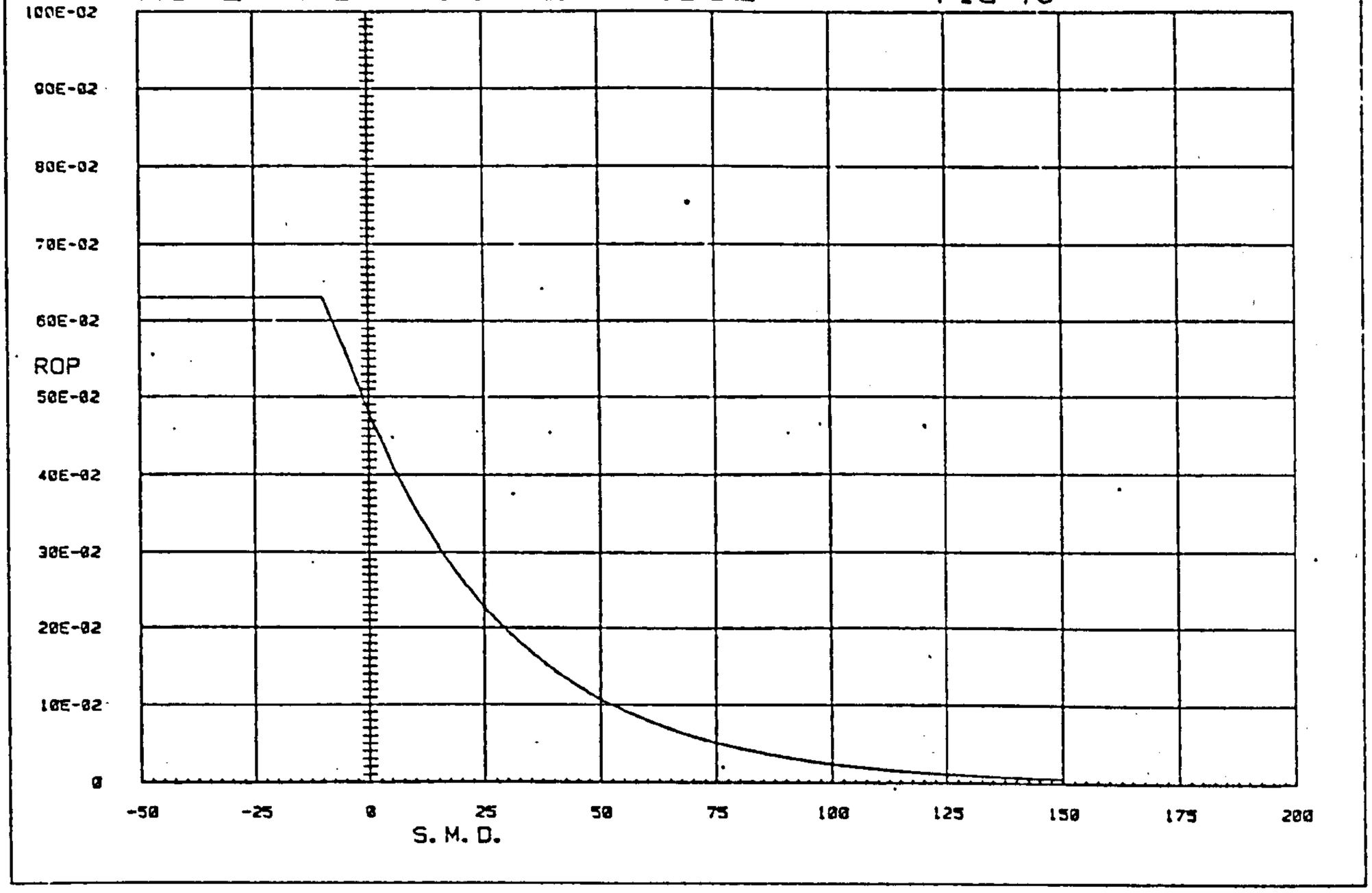
RIVER TRENT at STOKE FIG 74



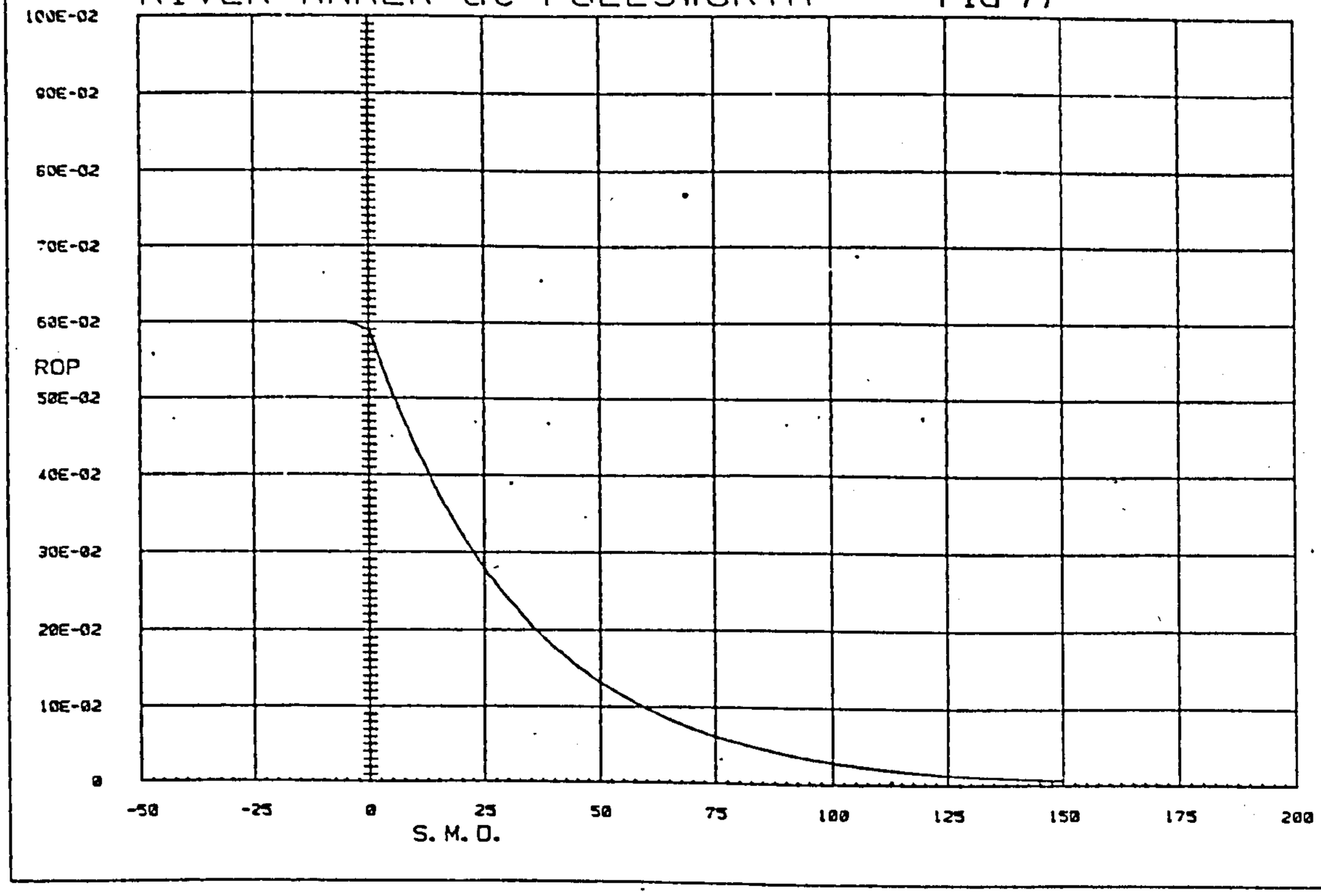
RIVER SOW at GREAT BRIDGFORD FIG 75



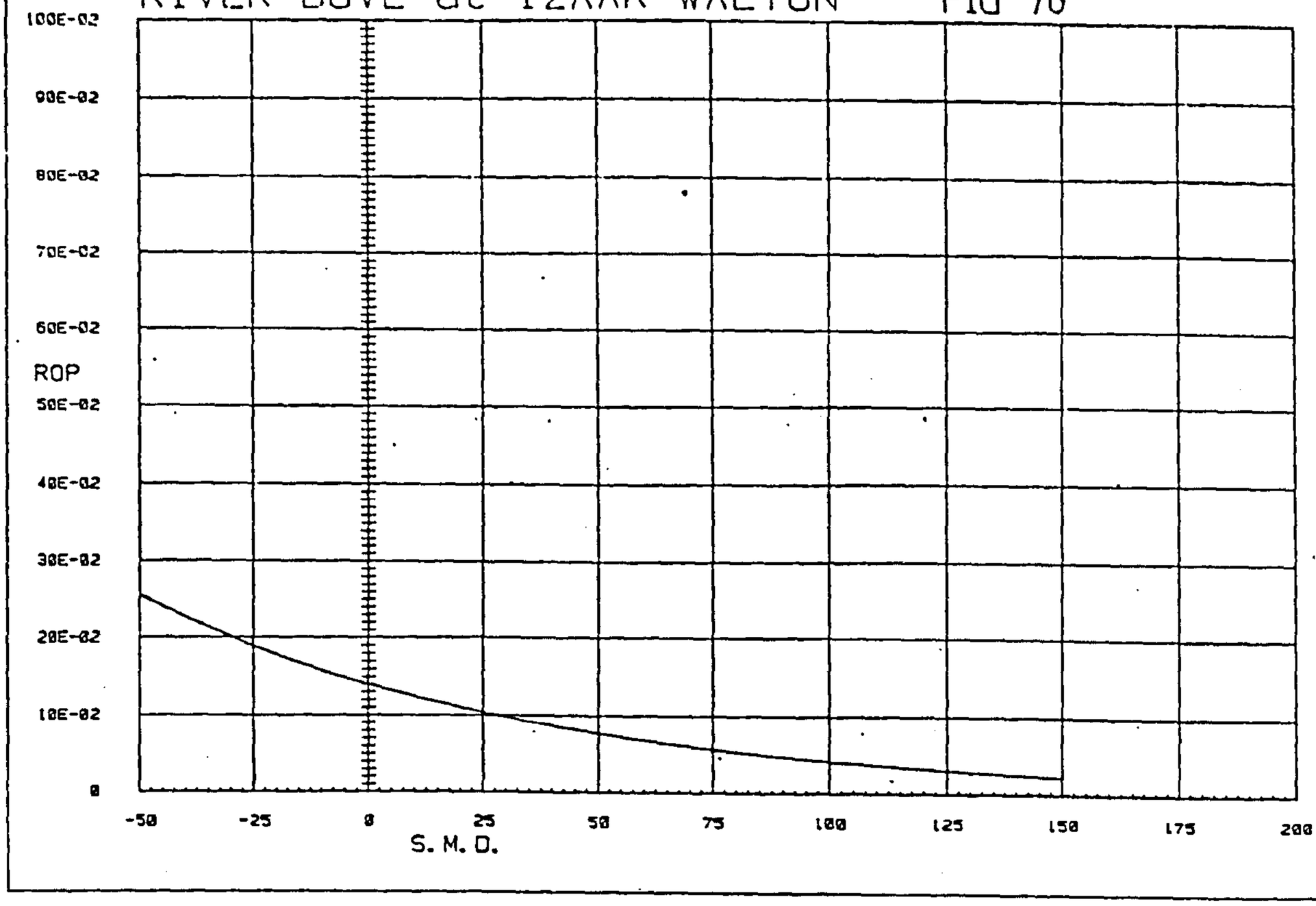
RIVER PENK at PENKRIDGE FIG 76



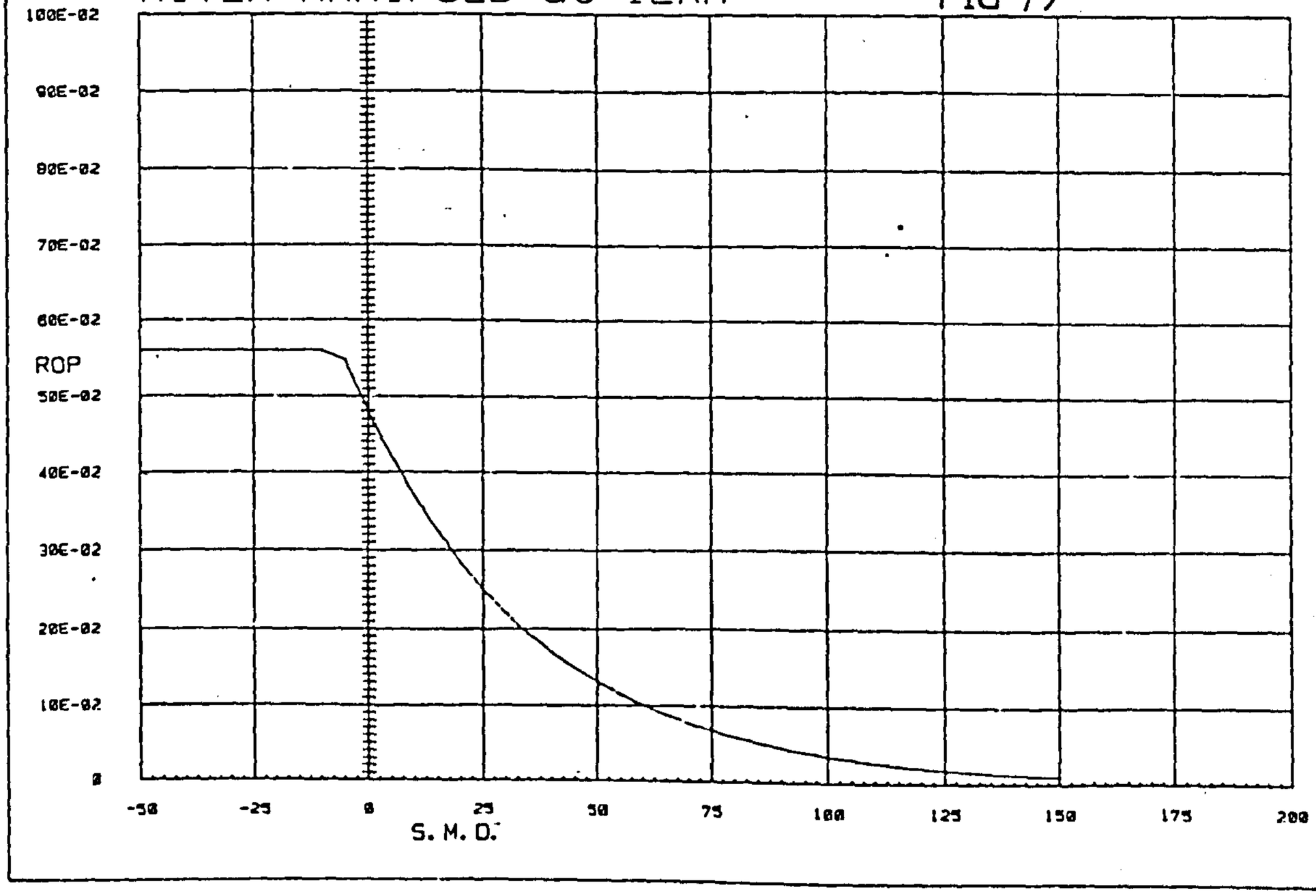
RIVER ANKER at POLESWORTH FIG 77

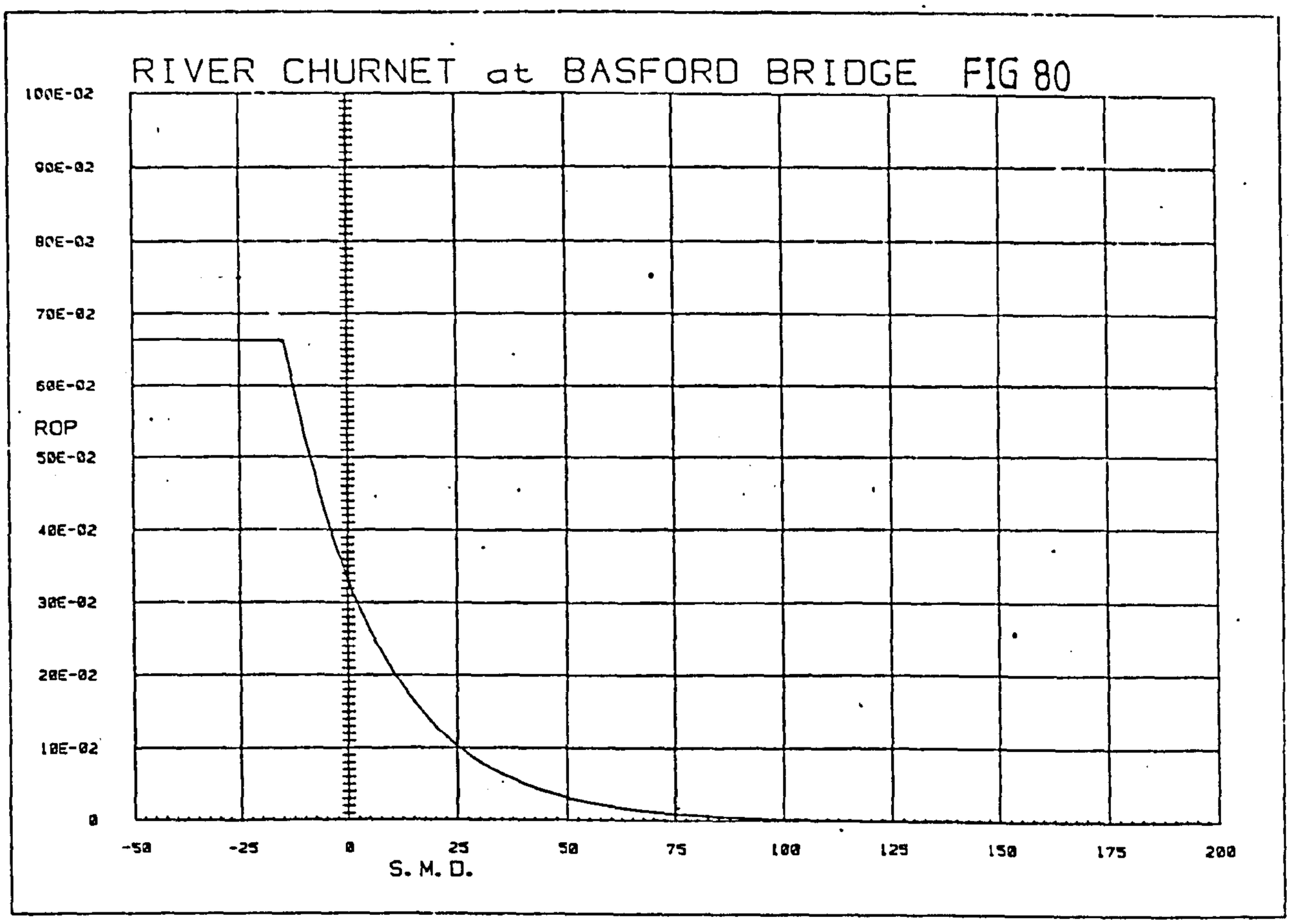


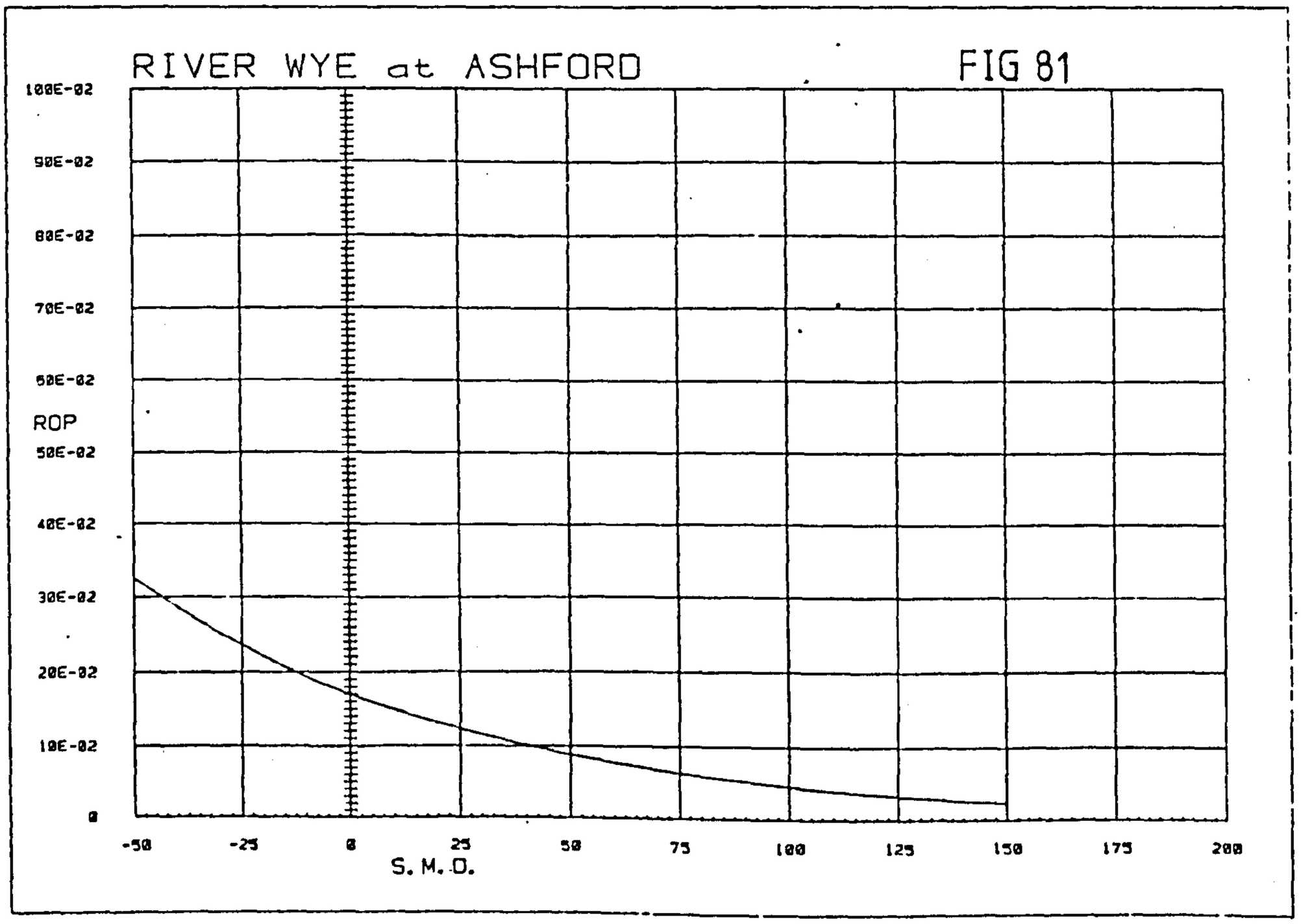
RIVER DOVE at IZAAK WALTON FIG 78



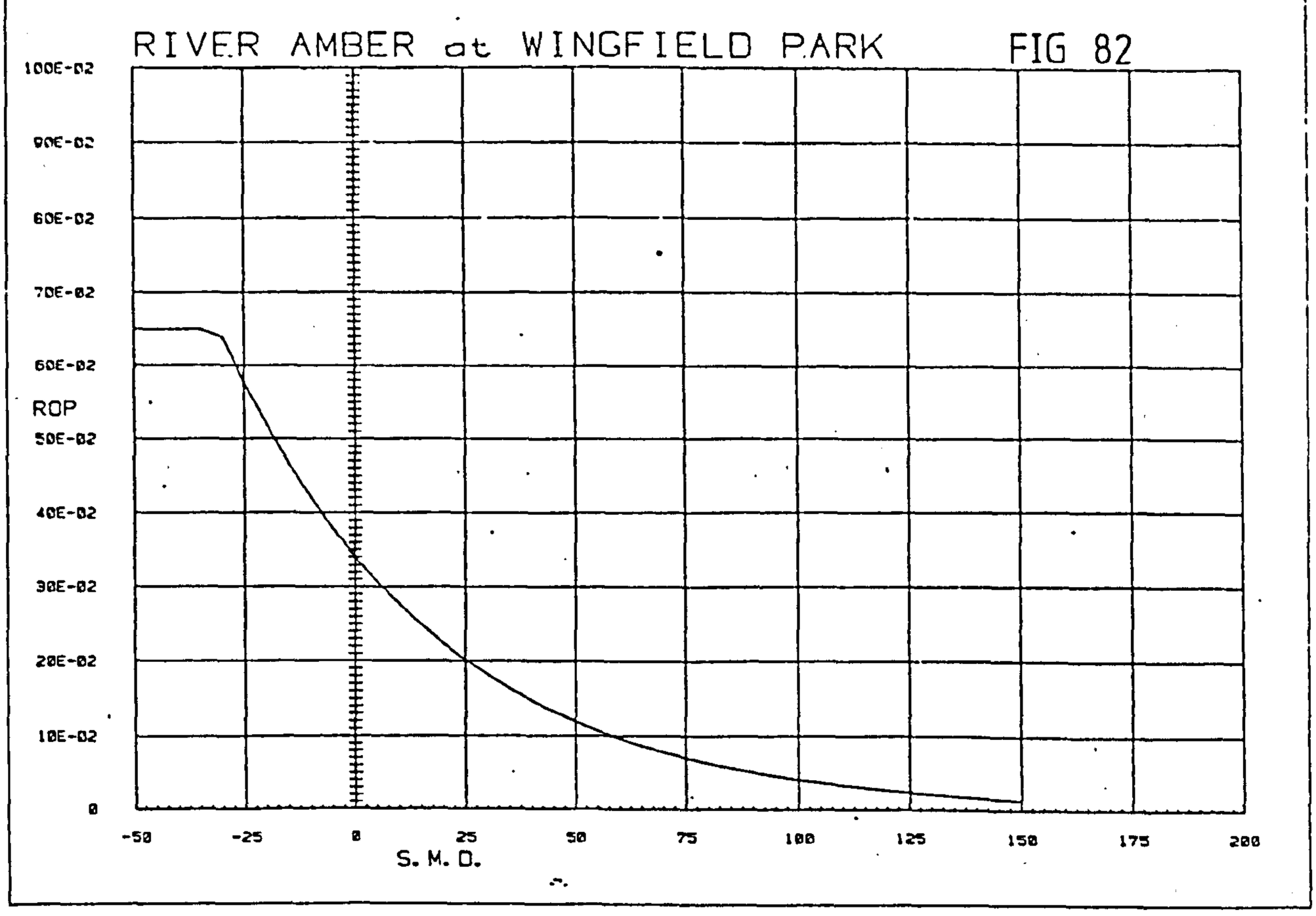
RIVER MANIFOLD at ILAM FIG 79



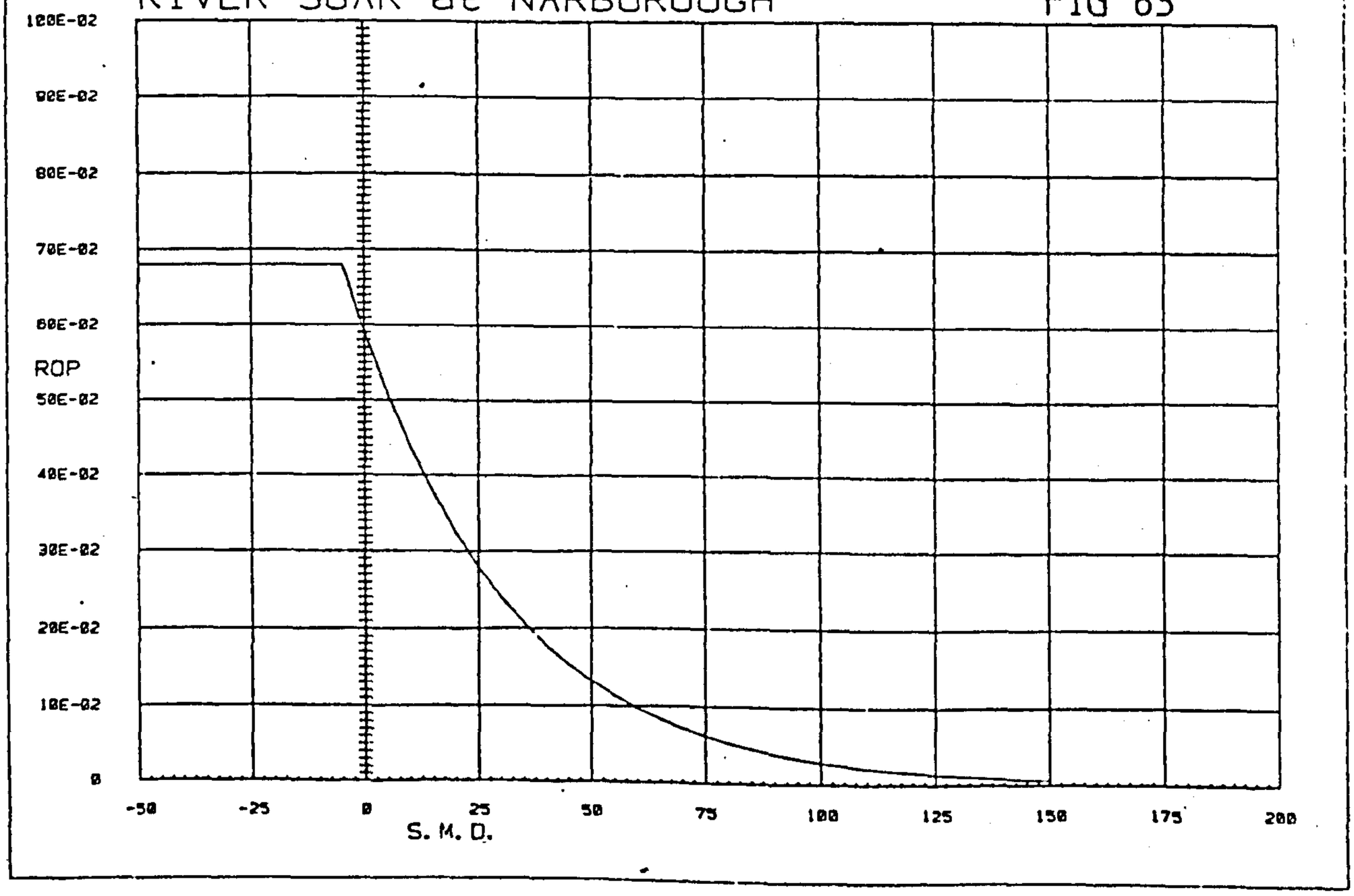

RIVER CHURNET at BASFORD BRIDGE FIG 80
100E-02
90E-02
80E-02
70E-02
60E-02
ROP
50E-02
40E-02
30E-02
20E-02
10E-02
0
-50
-25
0
25
50
75
100
125
150
175
200
S. M. D.


RIVER WYE at ASHFORD FIG 81
100E-02
90E-02
80E-02
70E-02
60E-02
ROP
50E-02
40E-02
30E-02
20E-02
10E-02
0
-50
-25
0
25
50
75
100
125
150
175
200
S. M. D.

RIVER AMBER at WINGFIELD PARK FIG 82

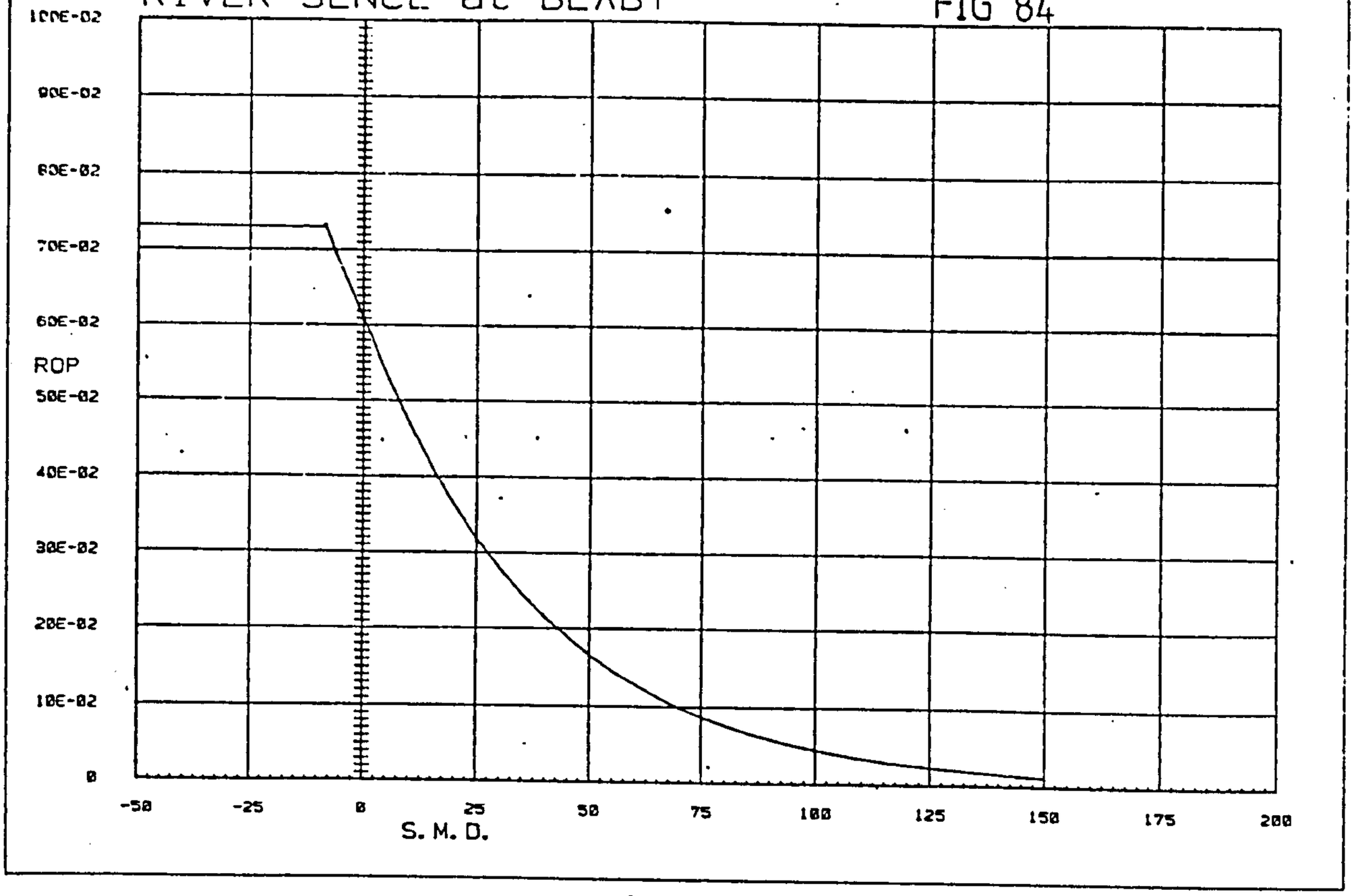


RIVER SOAR at NARBOROUGH FIG 83



RIVER SENCE at BLABY

FIG 84



RIVER WREAKE at SYSTON

FIG 85

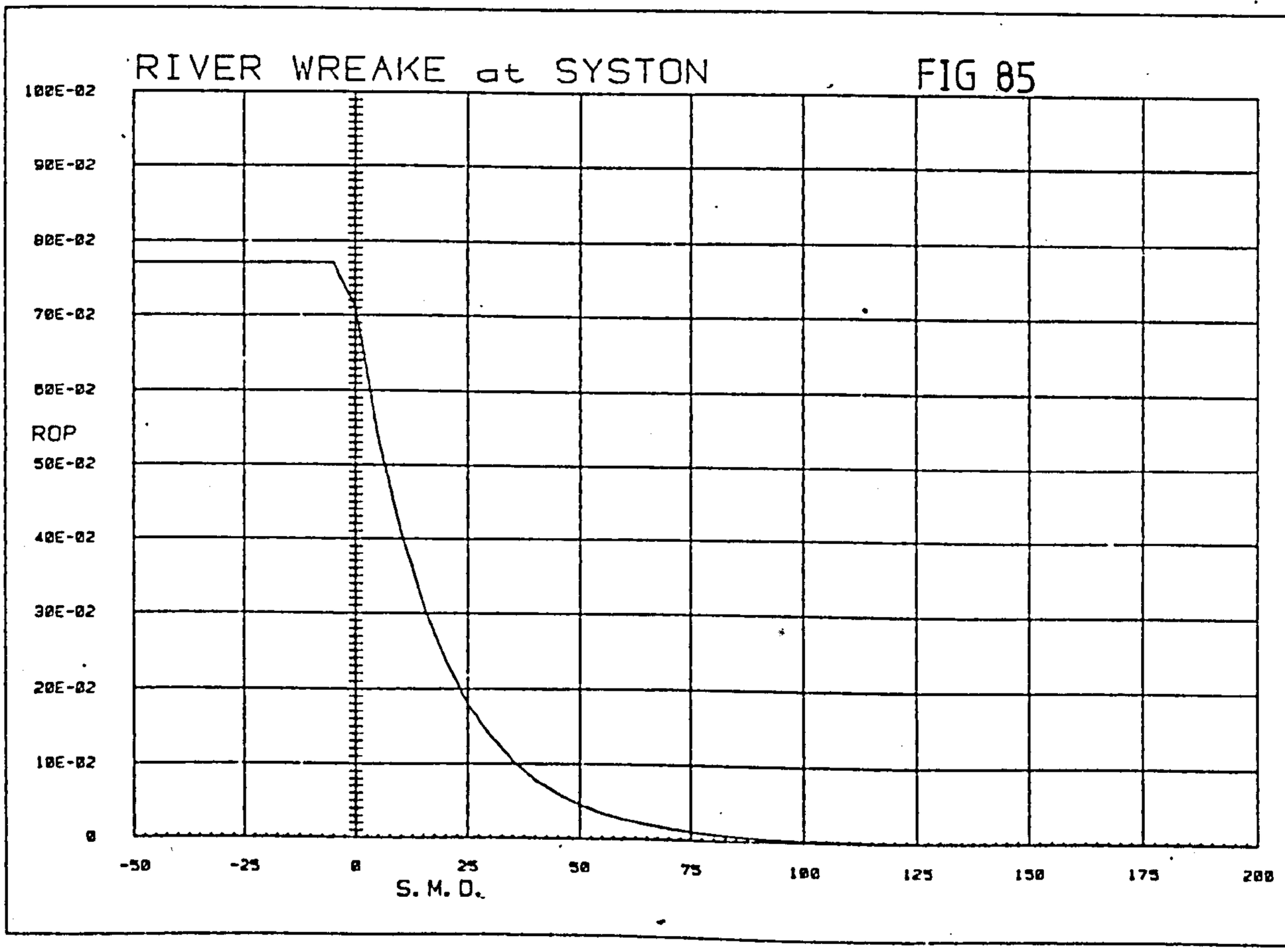
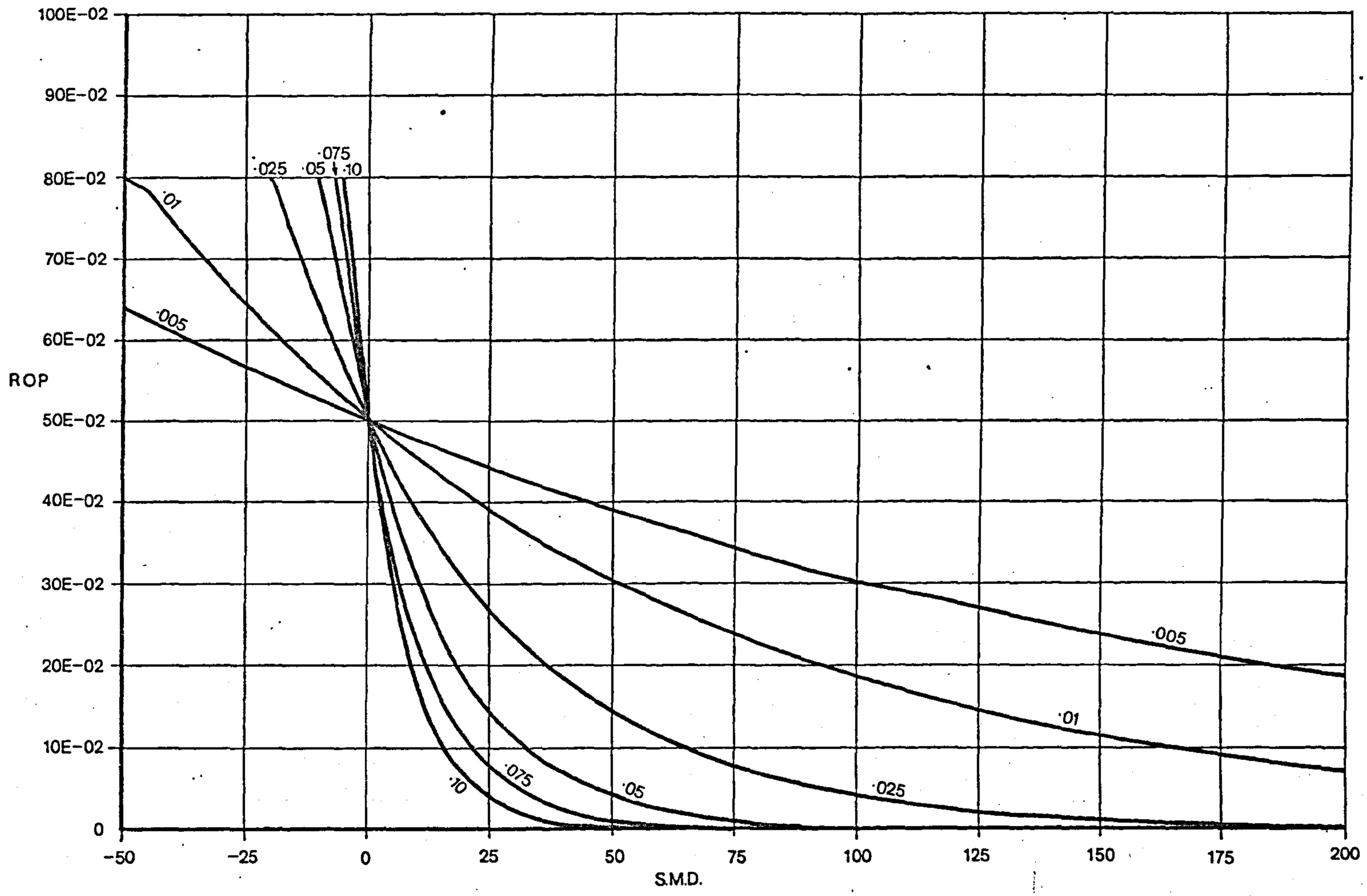


FIG 86
ROP TYPE CURVE



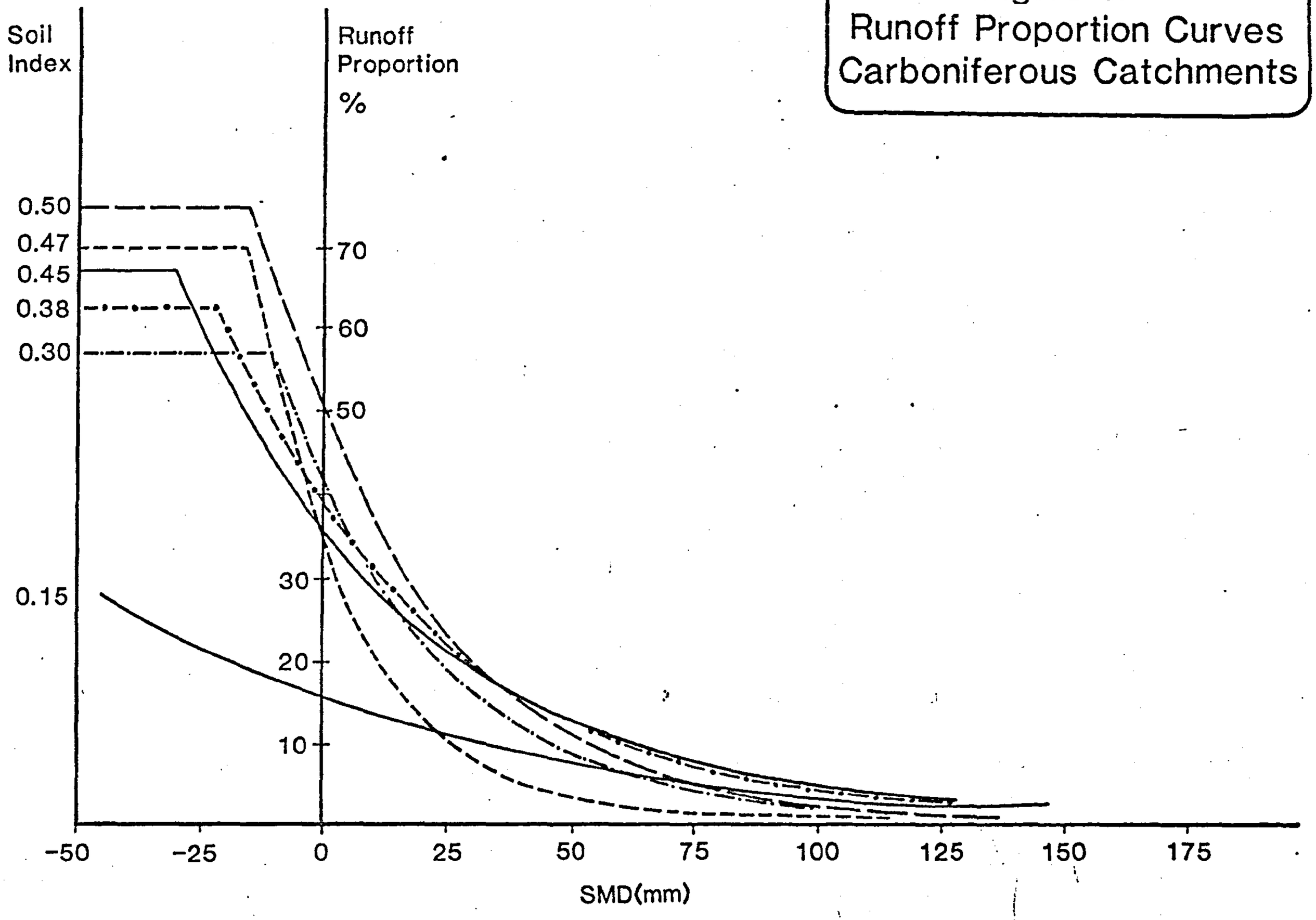


Figure 87
Runoff Proportion Curves
Carboniferous Catchments

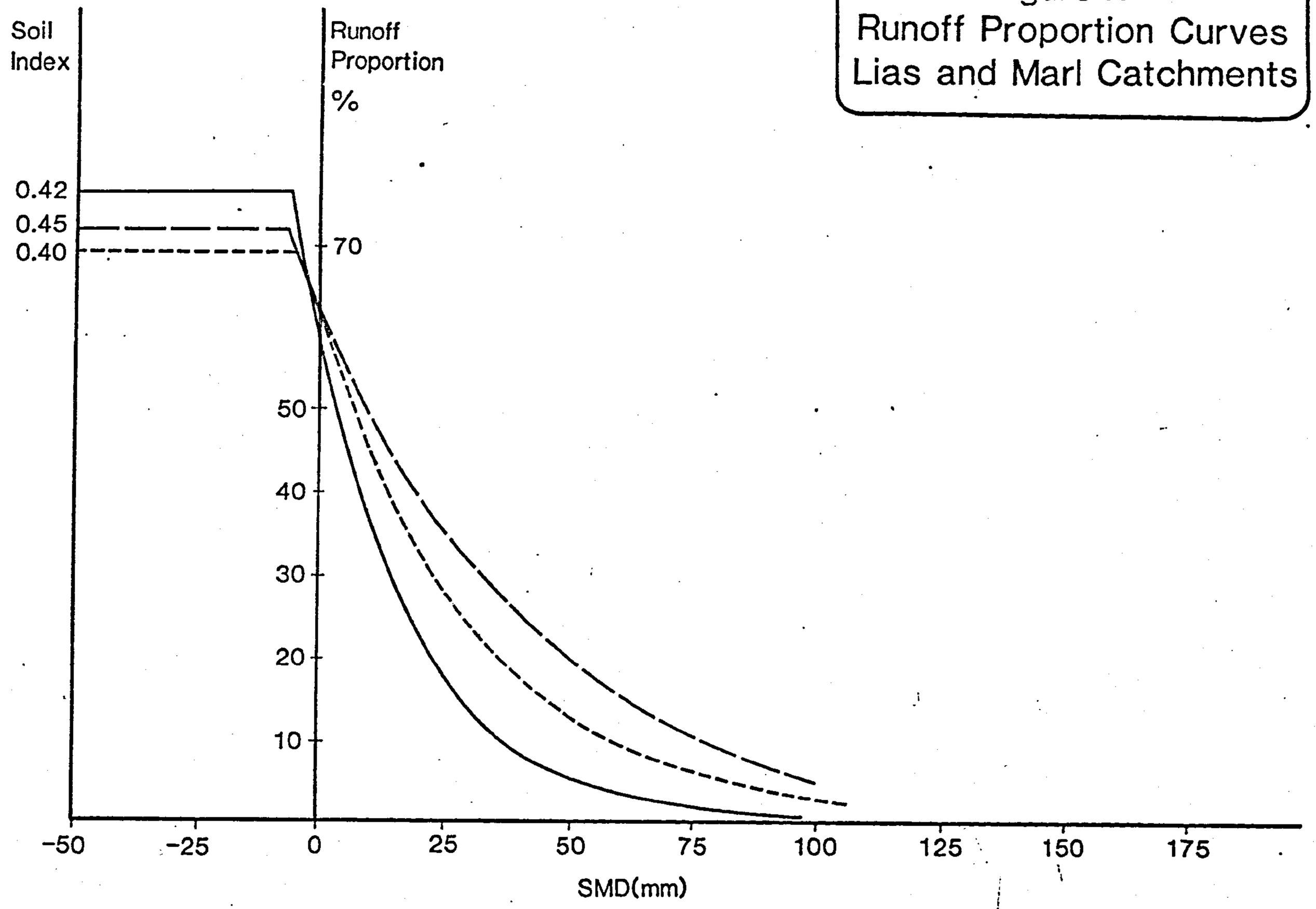


Figure 88
Runoff Proportion Curves
Lias and Marl Catchments

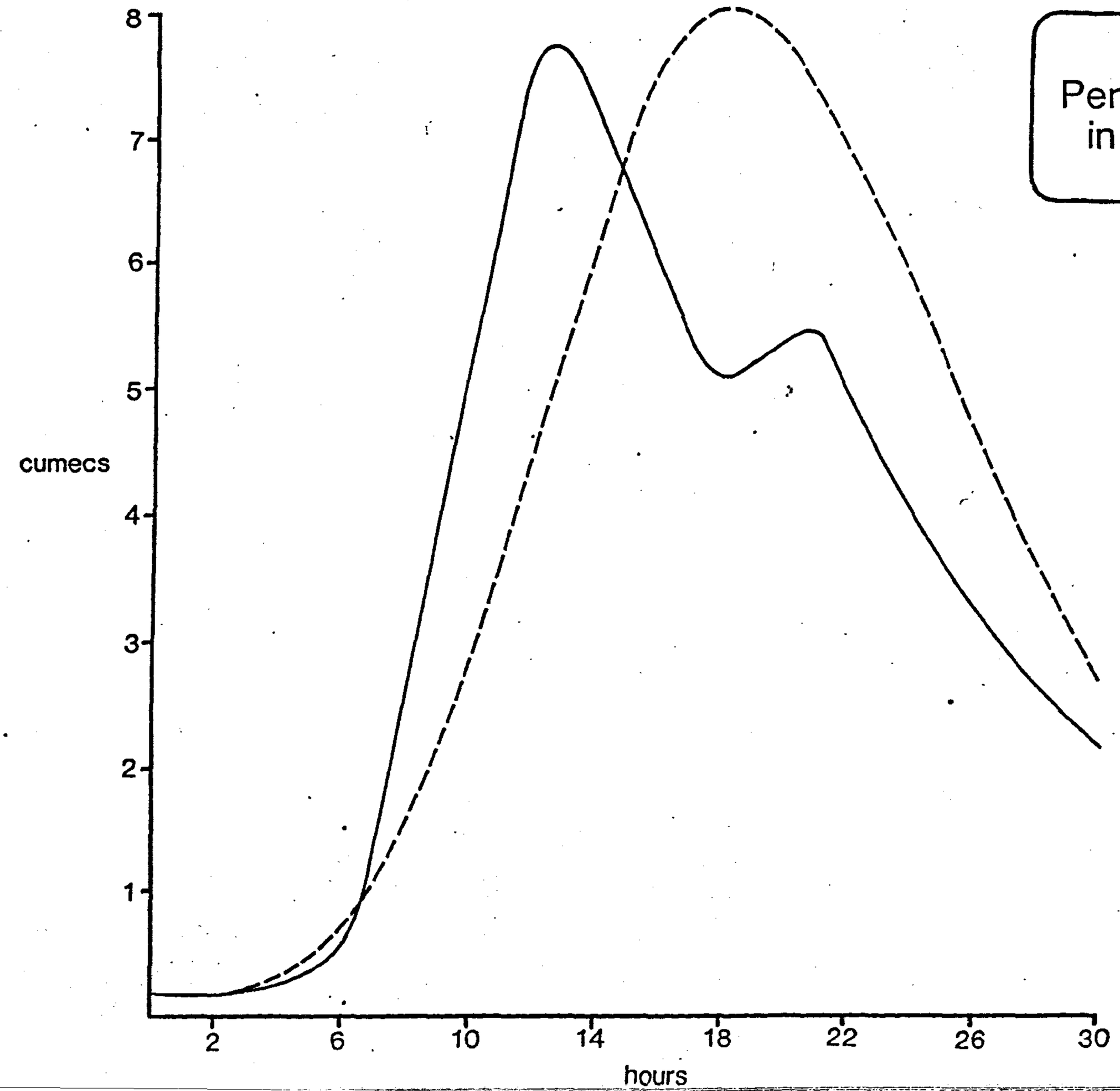


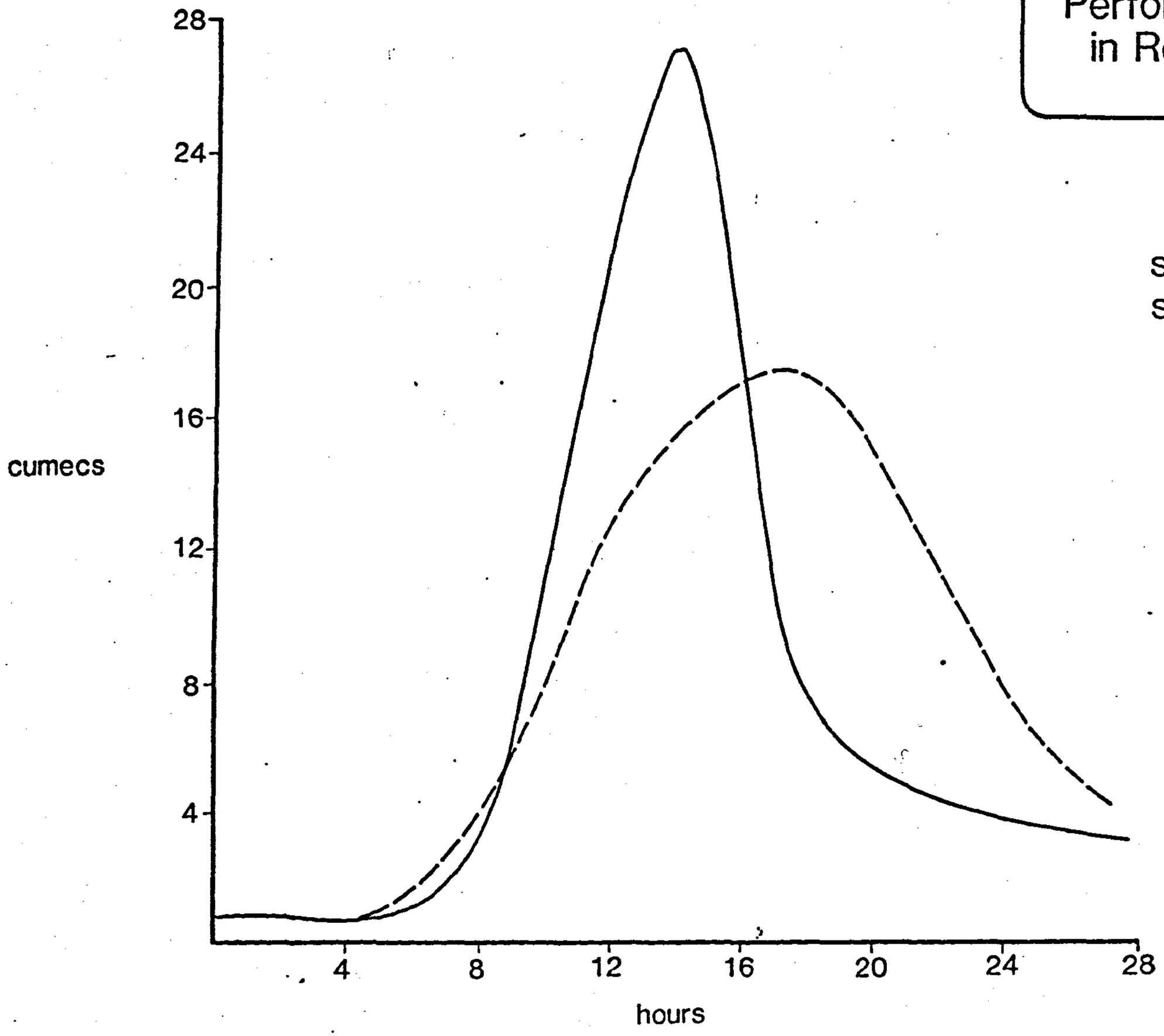
Figure 89
Performance of UCM in Real Time Mode – Duffield

—— Recorded Flow

--- Simulated Flow

Start – 00.01 26 Sept 1981
SMD = 10.0mm

Figure 90
Performance of UCM in Real Time Mode – Duffield



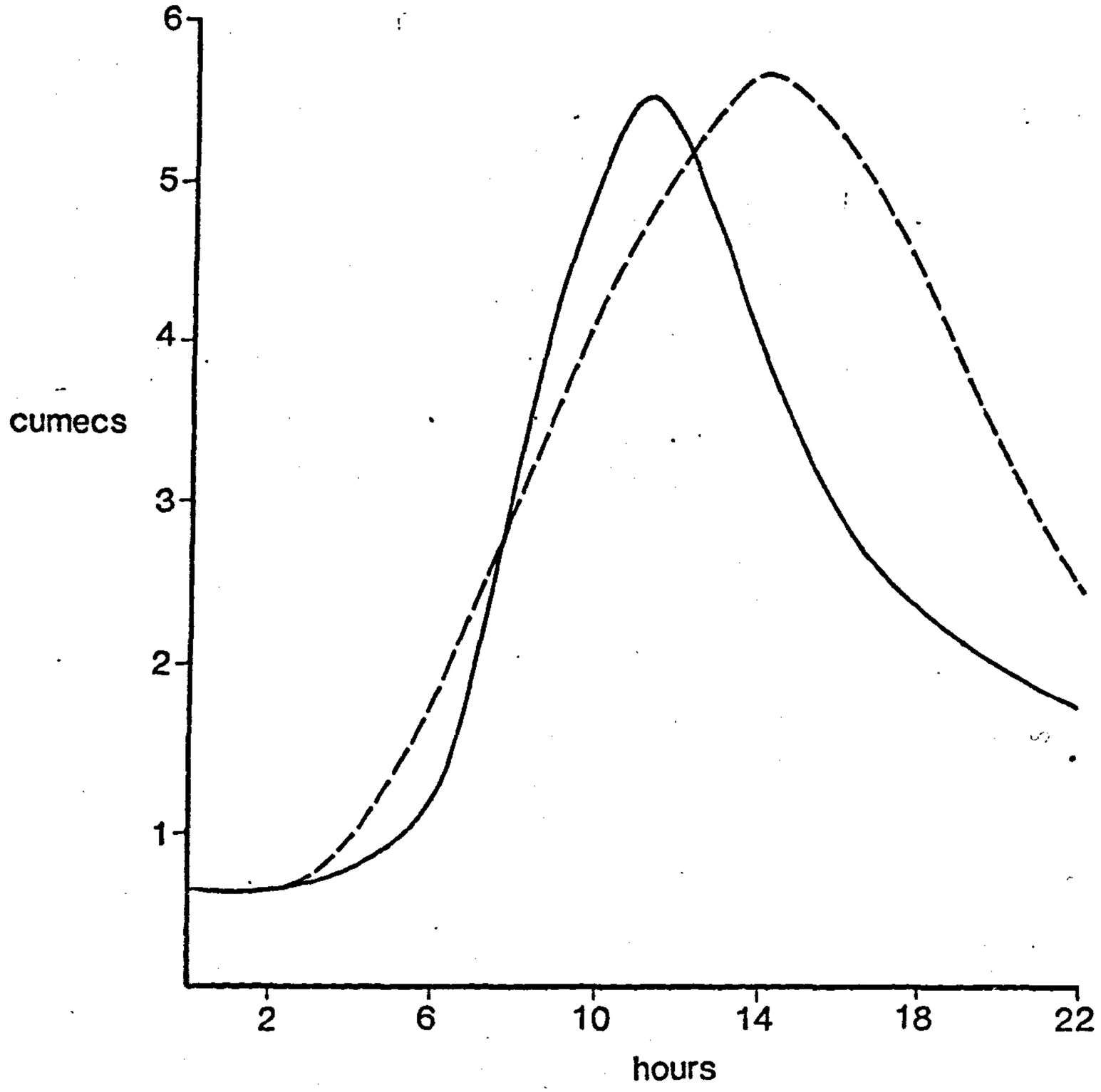
—— Recorded Flow

– – – Simulated Flow

Start – 09.00 30 May 1979

SMD = 0.0mm

Figure 91
Performance of UCM in Real Time Mode – Duffield



—— Recorded Flow

--- Simulated Flow

Start – 21.00 19 Oct 1981
SMD = 0.0

Figure 92
Performance of UCM in Real Time Mode – Kingston

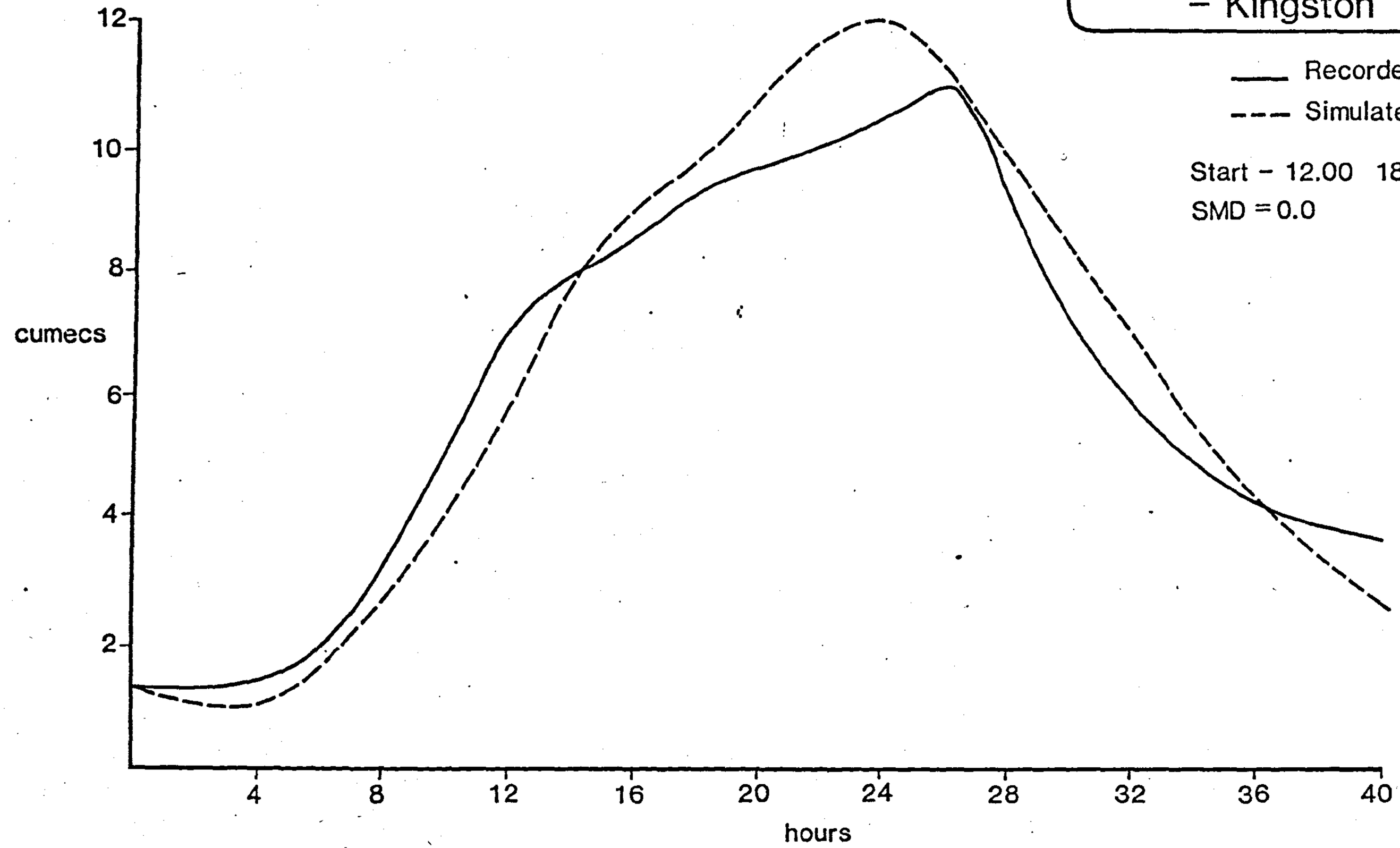


Figure 93
Performance of UCM
in Real Time Mode
– Kingston

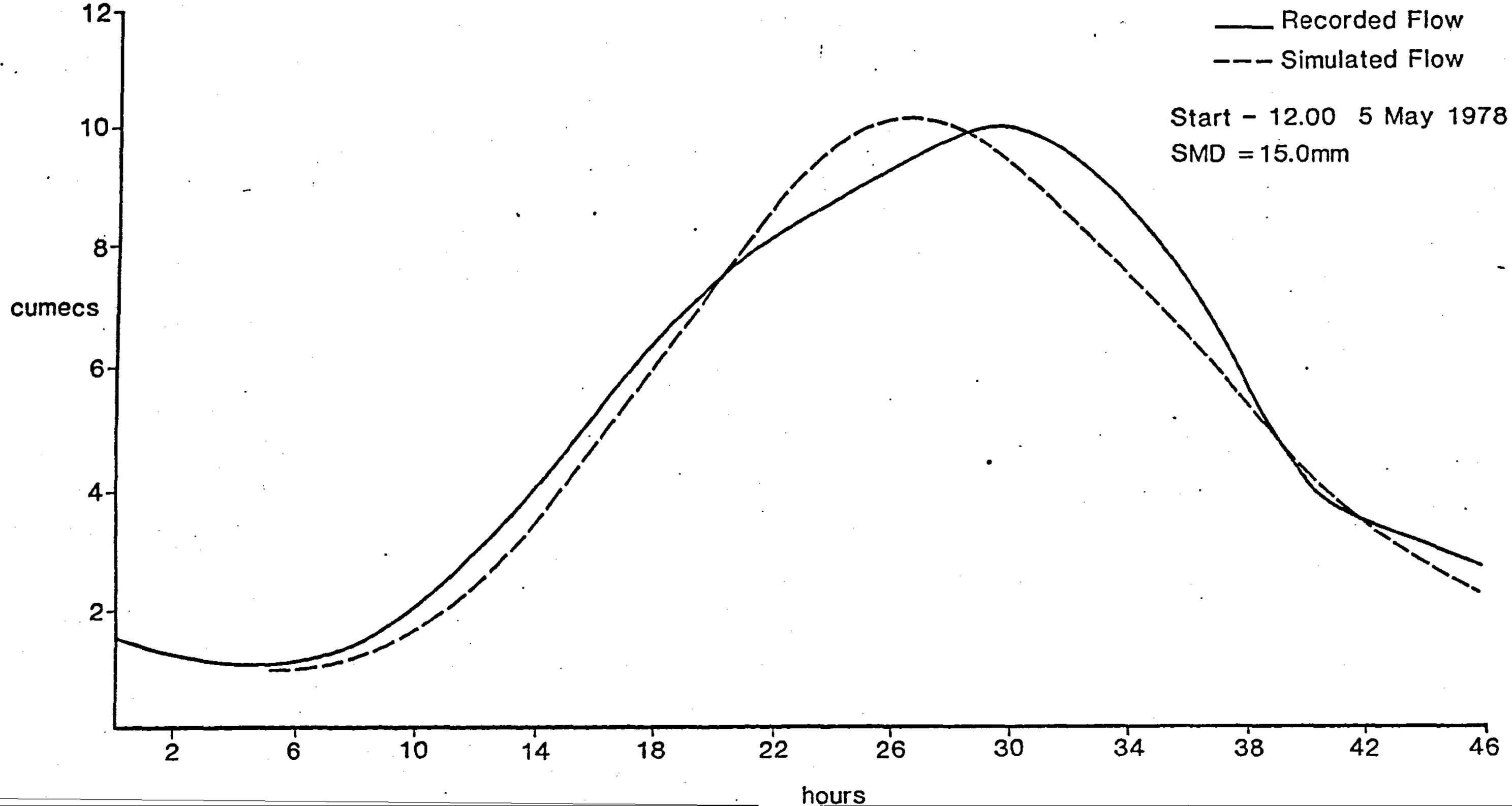


Figure 94
Performance of UCM in Real Time Mode – Kingston

—— Recorded Flow

---- Simulated Flow

Start – 09.00 7 May 1980
SMD = 70mm

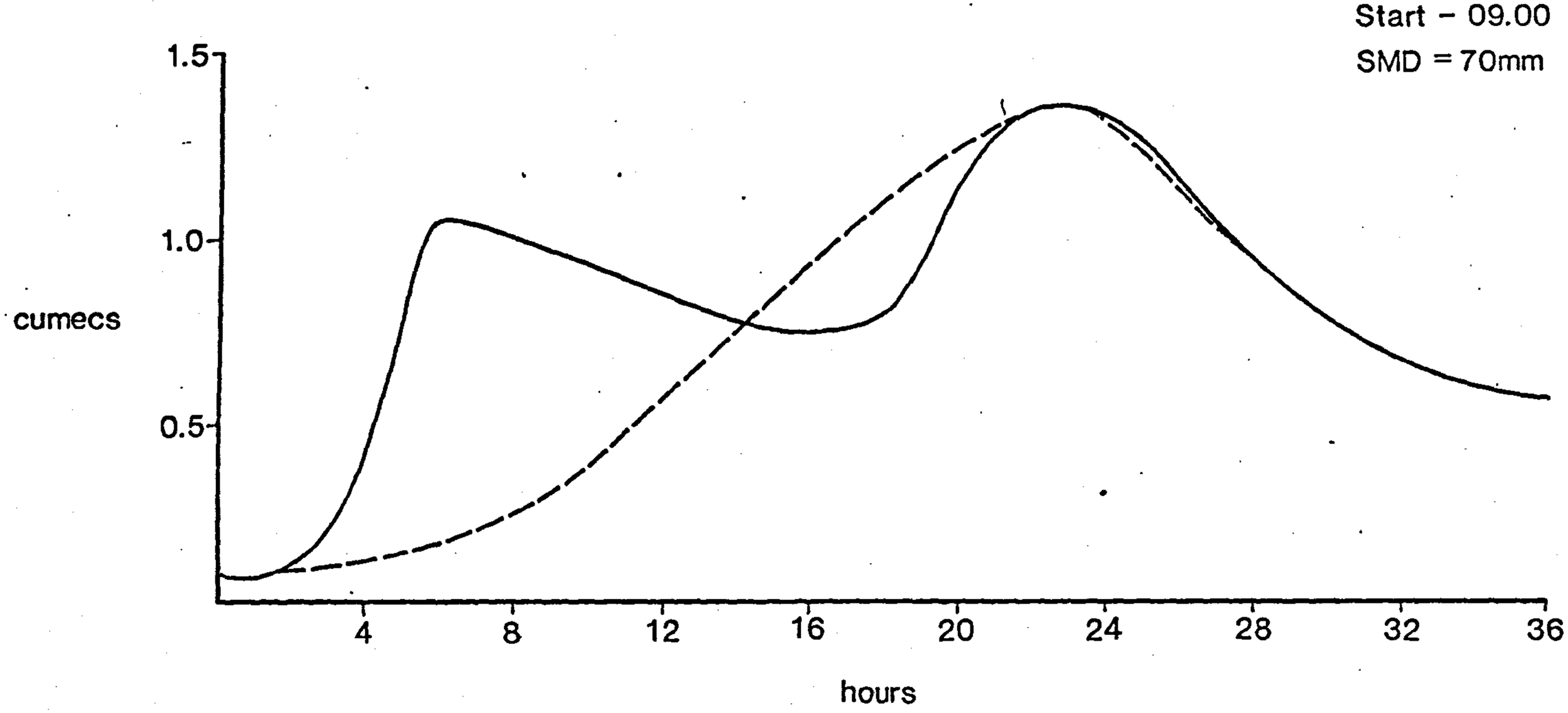


Figure 95
Comparison of UCM and Unit Hydrograph – Duffield

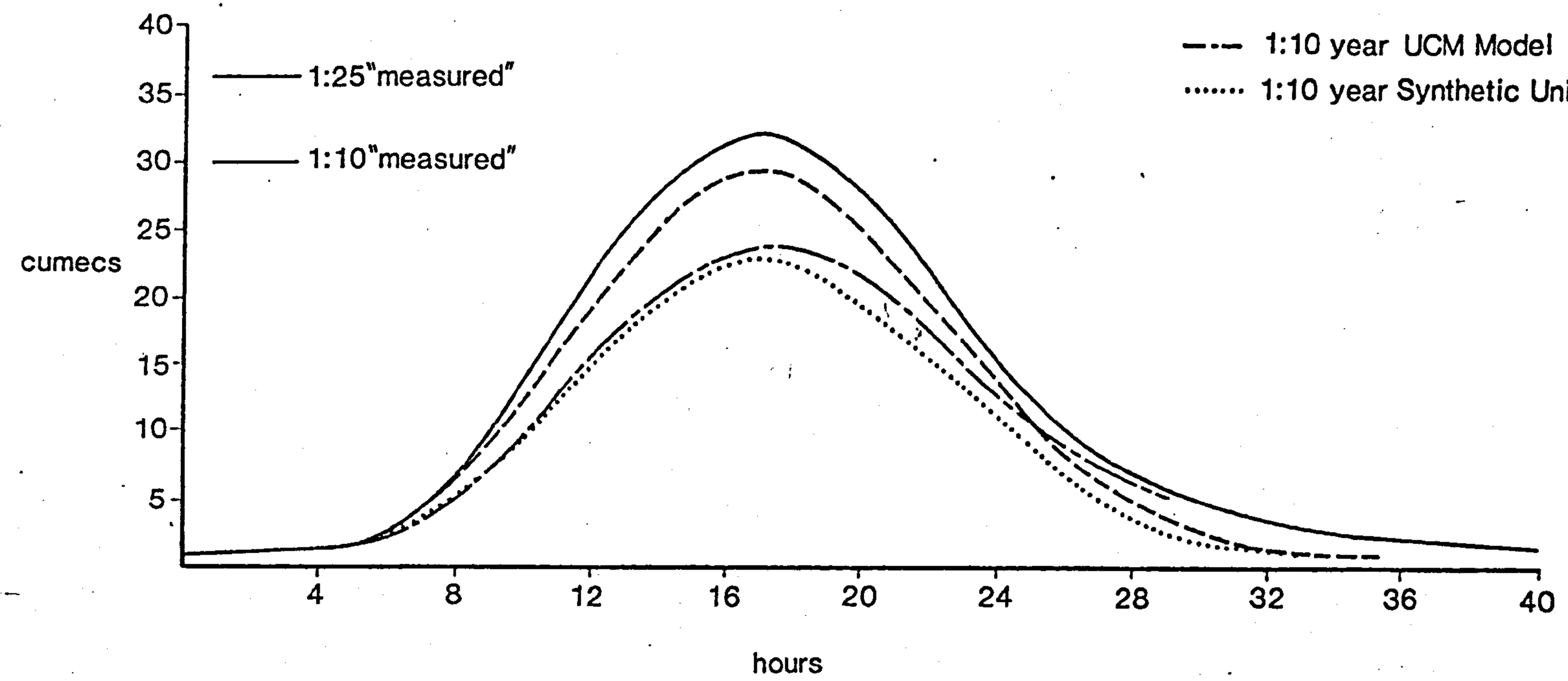


Figure 96
Comparison of UCM and Unit Hydrograph – Kingston

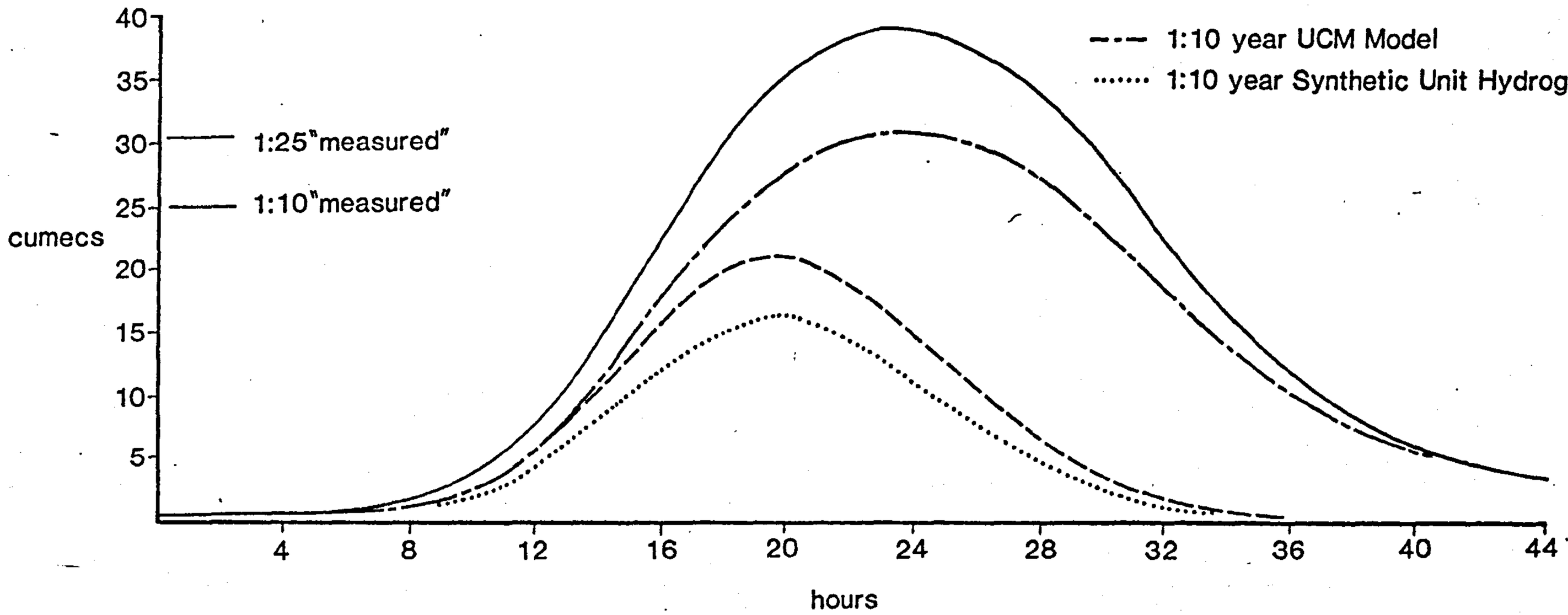


FIGURE 97

MAXIMUM FLOW PROBABILITY DISTRIBUTION - DUFFIELD

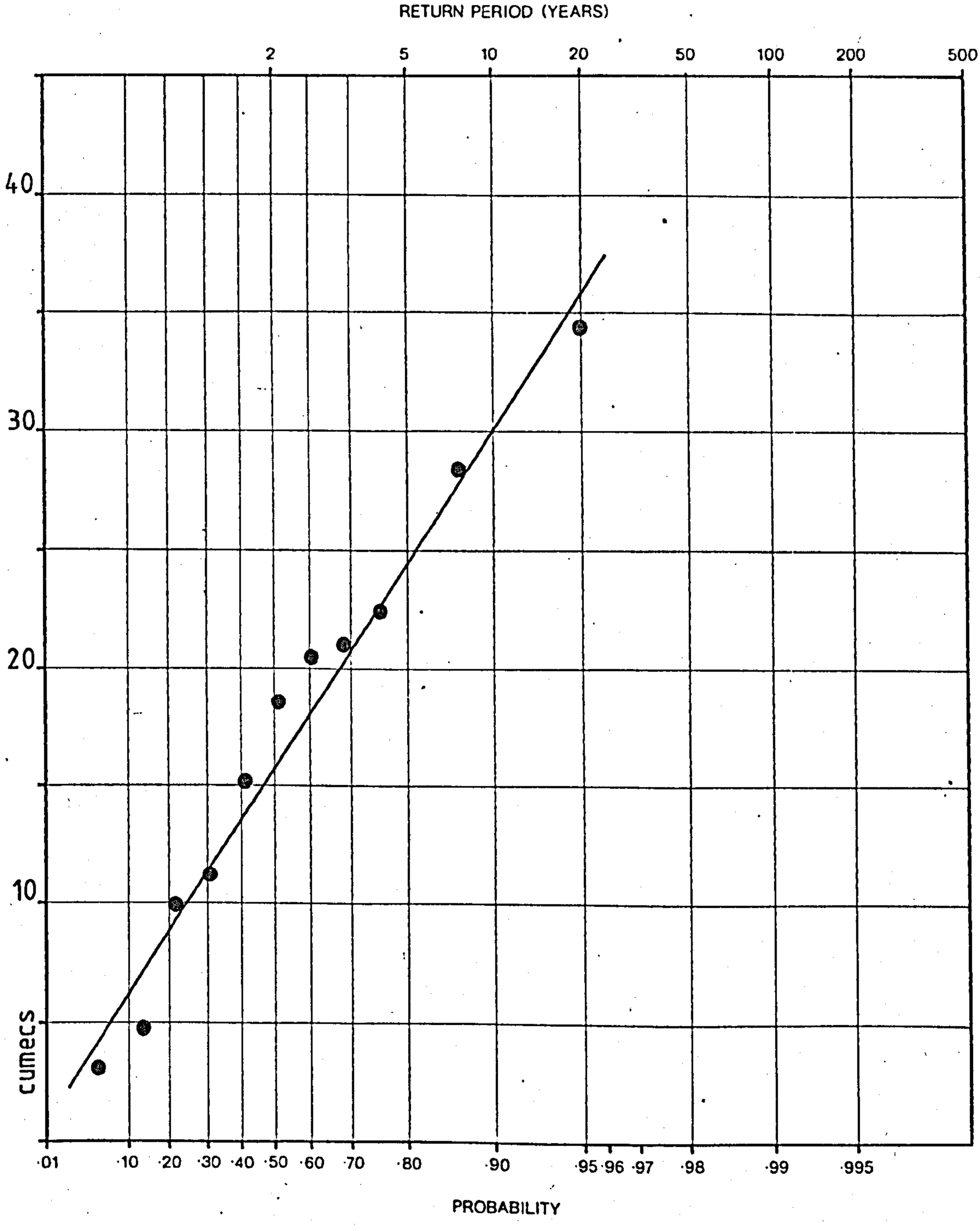


FIGURE 98

MAXIMUM FLOW PROBABILITY DISTRIBUTION - KINGSTON

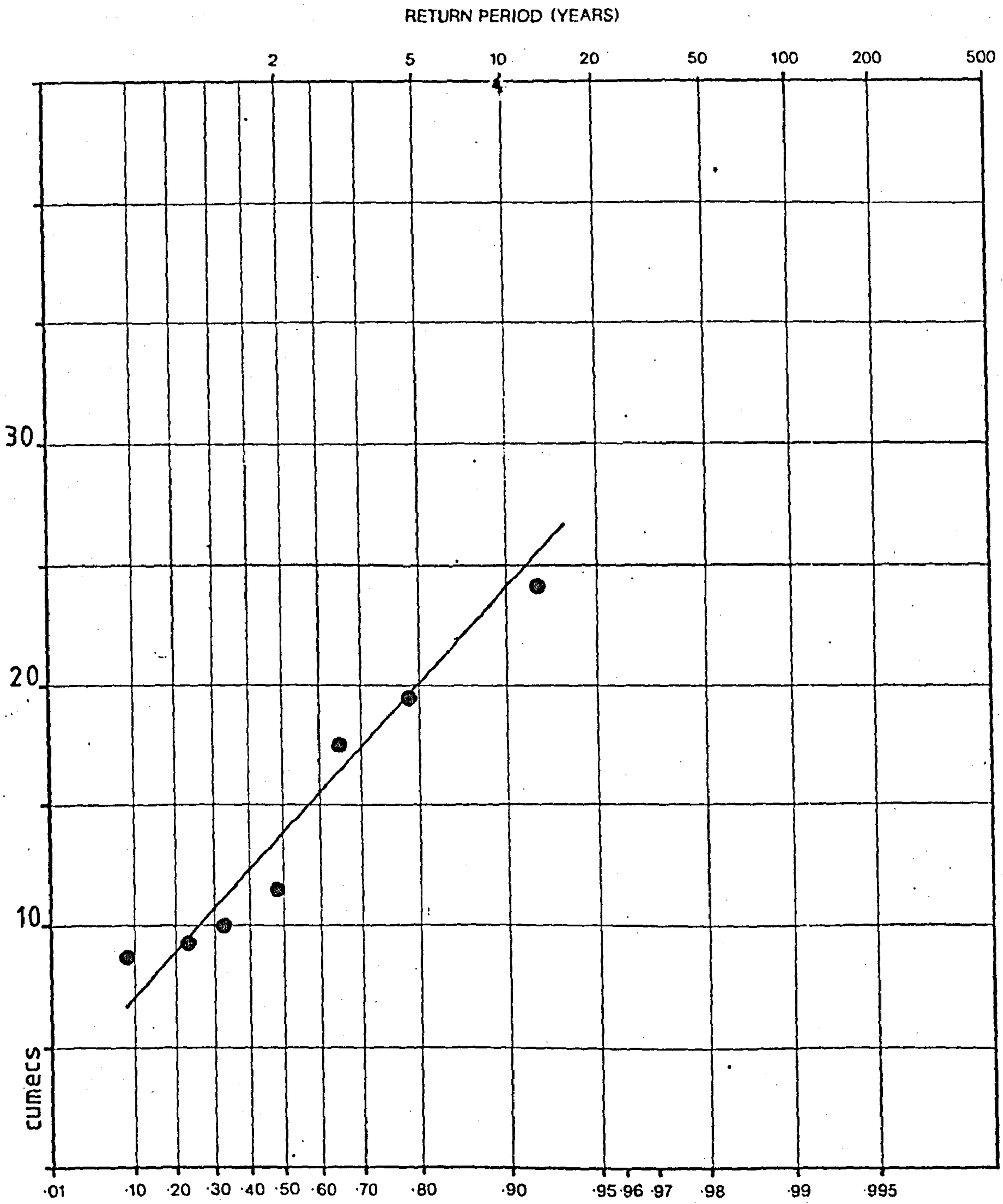


FIGURE 99 IN APPENDIX

APPENDIX 1

DETAILS OF THE PERMANENT RIVER FLOW MEASURING STATIONS USED IN THE ANALYSES (SECTIONS 3, 5 AND 6)

(i) TRENT BASIN

Station	River	N.G.R.	Area	Type of Measurement	Range of Reliability
Stoke	Trent	SJ 892 467	53	'Crump' Weir	L-M-H
Drakelow	Trent	SK 239 204	3027	Rated open channel	L-M
Colwick	Trent	SK 620 399	7486	Rated open channel	L-M
Gt. Bridgford	Sow	SJ 885 270	144	Flat 'V' weir	L-M
Penkridge	Penk	SJ 922 145	266	Rated open channel	M
Calthorpe Pk	Rea	SP 071 847	73	Model rated weir/concrete channel	L-M-H
Coleshill	Cole	SP 183 880	124	Flat 'V' weir	L-M
Ratcliffe Culey	Sence	SP 321 997	171	'Crump' weir	L-M
Polesworth	Anker	SK 263 034	374	'Crump' weir	L-M
Hollinsclough	Dove	SK 063 668	8	Compound 'Crump' weir	L-M-H
Izaak Walton	Dove	SK 146 509	83	Flat 'V' weir	L-M-H
Rocester	Dove	SK 112 397	391	Rated mill weir	M
Hulme End	Manifold	SK 106 595	44	Sharp edge weir with fish pass, C.M.G. rated	M
Ilam	Manifold	SK 140 507	145	'Crump' weir	L-M-H
Waterhouses	Hamps	SK 082 502	35	Flat 'v' weir both u/s, d/s slopes 1:2	L-M
Basford Br	Churnet	SJ 982 522	139	Flat 'V' weir, sloping wing walls	M
Rocester	Churnet	SK 103 389	232	Rated open channel	L-M

APPENDIX 1 (continued)

Yorkshire	Derwent	SK 198 851	125	Twin stainless steel flumes	L-M-H
Ashford	Wye	SK 181 696	151	Rated open channel	M
Wingfield Pk	Amber	SK 376 520	114	Flat 'V' weir, sloping wing walls	L-M
Narborough	Soar	SP 551 985	211	Flat 'V' weir	L-M
Blaby	Sence	SP 566 985	132	Flat 'V' weir	L-M
Syston	Wreake	SK 615 124	401	'Crump' weir	L-M
One Barrow	Blackbrook	SK 486 208	40	Trapezoidal flume	L-M-H
Kingston	Kingston	SK 503 277	58	Compound 'Crump' weir	L-M
Lowdham	Dover Beck	SK 653 479	64	Flat 'V' weir, sloping wing walls	M

(ii) SEVERN BASIN

Rhos-y-Petref	Dulas	SN 950 824	53	Flat 'V' weir	L-M-H
Llanyblodwell	Tanat	SJ 252 225	229	Rated open channel	L-M-H
Yeaton	Perry	SJ 434 192	181	'Crump' weir	L-M-H
Hookagate	Rea Brook	SJ 466 092	178	Compound trapezoidal weir	L-M-H
Ternhill	Tern	SJ 629 316	93	Rated structure	L-M
Roddington	Roden	SJ 589 141	259	Compound trapezoidal weir	L-M-H
Walcot	Tern	SJ 592 123	852	Flat 'V' weir	L-M
Burcote	Worfe	SO 747 952	258	'Crump' weir	L-M-H
Tenbury	Tame	SO 597 686	1135	Rated open channel	M
Stareton	Avon	SP 373 716	347	'Crump' weir	L-M
Besford Br	Bow Brook	SO 927 463	156	'Crump' weir	M
Hartford Min	Salwarpe	SO 868 618	184	Rated open channel	M
Alscot Park	Stour	SP 208 506	316	Compound broad crest weir	L-M

APPENDIX 2

VALUES FOR THE COMPUTATION OF THE ROUGHNESS INDEX (AFTER COWAN (1956))

	Channel conditions		Values
Material involved	Earth	n_0	0.020
	Rock out		0.025
	Fine Gravel		0.024
	Coarse Gravel		0.028
Degree of irregularity	Smooth	n_1	0.000
	Minor		0.005
	Moderate		0.010
	Severe		0.020
Variations of channel cross section	Gradual	n_2	0.000
	Variations causing occasional shifting of flow from side to side		0.005
	Variations causing frequent shifting of flow from side to side		0.010-0.015
Relative effect of obstructions	Negligible	n_3	0.000
	Minor		0.010-0.015
	Appreciable		0.020-0.030
	Severe		0.040-0.060
Vegetation	Low	n_4	0.005-0.010
	Medium		0.010-0.025
	High		0.025-0.050
	Very high		0.050-0.100
Degree of meandering	Minor - Ratio of meander length to straight length 1.0 - 1.2	n_5	1.000
	Appreciable 1.2 - 1.5		1.150
	Severe 1.5		1.300

APPENDIX 3

DRY WEATHER FLOW RESIDUAL

FLOW DIAGRAMS - TABULATED DATA

(Symbols and abreviations given in Appendix 4)
(units - all flows in Mld)

DRY WEATHER FLOW CONDITION - RIVER TRENT

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
0.0	Knypersley Res	SJ896548			1.0	+1.5	1.5		0.0	2.5		BWB
8.0	Norton Green WRW	SJ901518			2.0	+0.7	2.2	0.7	0.7	4.2		
8.0	Norton Green (1)	SJ900522	11.5		2.0		2.2	0.7	0.7	4.2		CMG N/R
9.0	Baddeley Green WRW	SJ904507			2.1	+0.7	2.9	1.4	1.4	5.0		
10.0	Smallthorne Bk (2)	SJ893507*	+13.5*	3.6							(0.27)	CMG
	-NCB Victoria	SJ879551				+2.8						CD
	-NCB Chatterley	SJ880536				+1.4						CD
	-NCB Norton	SJ890507			5.8	+1.1	8.2	6.7	6.7	14.0		CD
12.0	Causley Bk (3)	SJ900468*	+10.4*	2.4							(0.23)	CMG
	-Ashbank WRW	SJ917471			8.3	+0.9	9.1	7.6	7.6	17.4		
12.5	Stoke on Trent (4)	SJ892467	53.2		8.5		9.1	7.6	7.6	17.6	0.16	PF
15.0	Fowlea Bk (6)	SJ861491*	+12.5*	3.7							(0.3)	CMG
	-Tunstall WRW	SJ854506				+2.5						
	-H & R Johnson	SJ857497				+0.8						IW:max=1.3
	-Stoke WRW d/s	SJ863485				+4.1						
	-British Steel d/s	SJ863476				)-0.6						CW:max=10.9
					13.0	)+0.1	16.0	14.5	14.5	29.0		
16.0	Michelin	SJ875435			16.0	+5.0	21.0	15.5	19.5	34.5		
16.5	Chittings Bk (7)	SJ891428*	+13.7*	3.5	17.0		21.0	15.5	19.5	38.0	(0.26)	CMG
17.5	Lyme Bk (8)	SJ864428*	+28.6*	8.9							(0.31)	CMG
	-NCB Silverdale	SJ815467				+3.0						CD
	-NCB Holditch	SJ836476			28.3	+1.7	25.7	20.2	24.2	54.0		CD
19.5	Park Bk (9)	SJ825436*	+2.7*	0.9	32.0		25.7	20.2	24.2	57.7	(0.33)	CMG
22.2	Strongford (10)	SJ873392	161		34.0		25.7	20.2	24.2	59.7	0.21	cmg's
23.1	Strongford WRW	SJ878393			35.8	+83.5	109.2	103.7	107.7	145.0		
27.0	CEGB Meaford	SJ887364				)-13.5		94.5	98.1			CW:max=51.1
					42.3	)+ 8.0	103.7	102.5	106.1	146.0		
28.5	Washdale Bk (11)	SJ891356	+7.1	1.6	44.3		103.7	102.5	106.1	148.0	(0.23)	CMG
30.0	Scotch Bk (13 & 14)	SJ912350*	+17.3*	5.4							(0.31)	CMG
	-BWB d/s	SJ900338			50.7	- 5.0	98.7	102.5	106.1	149.4		
30.5	Stone (15)	SJ903337	207		53.6		98.7	102.5	106.1	152.3	0.26	CMG
33.0	Pirehill WRW	SJ902323			57.8	+ 2.5	101.2	105.0	108.6	159.0		
43.0	Gayton Bk	SJ974276*	+25.8*	6.2	67.9		101.2	105.0	108.6	169.1	(0.23)	CMG
46.5	Hixon WRW	SK001248			68.9	+ 0.9	102.1	105.9	109.5	171.0		
47.0	Great Haywood (19)	SJ993231	297		70.4		102.1	105.9	109.5	172.5	0.24	cmg's
48.0	River Sow	SJ993231	+587	118.9	190.6	43.3	145.4	148.1	160.0	336.0	(0.20)	See R.Sow
51.0	Rugeley WRW	SK031197			197.0	4.6	150.0	152.7	164.6	347.0		
56.1	Bourne Bk (44)	SK046205	+13.6	3.9	201.0		150.0	152.7	164.6	351.0	(0.29)	CMG
57.0	Slittingmill Bk (45)	SK035174*	+19.6*	3.5							(0.18)	CMG
	-BWB d/s	SK047182			205.0	-2.0	148.0	152.7	164.6	353.0		CF
58.0	CEGB Rugeley	SK064177				)-65.5		124.5	134.2			CW:max=141.3
					206.6	)+38.9	121.4	163.4	173.1	328.0		
61.0	Armitage WRW	SK088164			208.6	+1.1	122.5	164.5	174.2	331.1		
61.0	Shropshire Bk (46)	SK088161	+9.9	1.9	210.5		122.5	164.5	174.2	333.0	(0.19)	CMG
63.0	Blithbury Bk (48)	SK087177*										CMG N/R
65.0	River Blithe (54)	SK109191*	+160*	44.4							(0.28)	cmg's
	-Blithfield Res	SK070225			256.7	-16.2	106.3	164.5	174.2	363.0		
66.0	Yoxall (55)	SK131177	1167		257.4		106.3	164.5	174.2	363.7	0.22	CMG:PF N/R
68.0	Bourne Bk (56 & 57)	SK102135										CMG N/R
	-Hanch Res d/s	SK102138			261.2	-4.5	101.8	164.5	174.2	363.0		
70.5	Swarbourne Bk (60)	SK144190*	+35.6*	6.3	268.2		101.8	164.5	174.2	370.0	(0.18)	CMG
72.0	Pyford Bk (62)	SK129132*	+17.7*	4.2							(0.24)	CMG
	-Curborough WRW	SK126127			273.3	+3.9	105.7	168.4	178.1	379.0		
72.1	Alrewas (63)	SK169156										CMG N/R
72.2	BWB Alrewas	SK173156			274.0	+5.3	111.0	173.7	183.4	385.0		CF (return)
72.5	BWB Wychnor	SK175156			275.0	-22.0	89.0	163.5	173.0	364.0		CF
74.0	River Tame	SK192148	+1516	231.7	506.7	+605.7	694.7	808.4	836.4	1225.0	(0.16)	See R Tame
74.5	River Mease	SK195148	+168	21.6	528.3	+5.5	700.2	813.9	841.9	1228.5	(0.12)	See R Mease
81.0	Barton-u-N WRW	SK198181			530.6	+1.0	701.2	814.9	842.9	1231.8		
83.0	Branston BCA	SK214205			530.6	+1.5	702.5	816.4	844.4	1233.1		

DRY WEATHER FLOW CONDITION - RIVER TRENT

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
84.5	CEGB Drakelow	SK224201				)-362.3		577.3	597.1			CW:max=872.8
					530.6	)+349.4	689.6	858.8	946.5	1220.2		
85.0	Drakelow (139)	SK239204	3027		531.0		689.6	858.8	946.5	1220.6	0.17	PF: cmg's
85.5	Darklands Bk (138)	SK246202	+35.3	5.3							(0.15)	CMG
	-NCB Stanton	SK285195				+1.4						CD
	-NCB Bretby	SK274202				+1.1						CD
	-Stanton WRW	SK269193			536.3	+4.6	696.7	865.9	953.6	1233.0		
90.0	Pirelli	SK252256			536.8	+3.0	699.7	865.9	956.6	1236.5		ID
91.5	BTR Silvertown	SK246250			537.0	+0.9	701.6	865.9	957.5	1238.6		ID
92.0	Claymills WRW	SK264257			537.5	+28.4	730.0	894.3	985.9	1267.0		
93.0	River Dove	SK280261	+1255	302.9	839.9	-57.2	672.8	920.9	1025.3	1512.7	(0.27)	See R Dove
96.0	BCA Ltd.	SK295278			840.0	0.0	672.8	920.9	1025.3	1512.8		ID,IW:max=1.4
96.5	Egginton Bk (183)	SK269286*	+47.3*	5.7							(0.12)	CMG
	-Etwall WRW	SK263297				+0.7						
	-Hilton WRW	SK265313			845.7	+0.8	674.3	922.4	1026.8	1520.0		
97.5	CEGB Willington	SK308284				)-398.4		679.7	756.1			CW:max=1826.0
					846.0	)+395.1	671.0	922.8	1151.2	1517.0		
98.5	Repton Bk (184)	SK303273	+23.5	4.3							(0.16)	CMG N/R
	-Woodville WRW	SK317202			850.3	+0.6	671.6	922.9	1151.8	1521.9		
100.5	Hall Bk (185)	SK326288	+19.2	2.0							(010)	CMG
	-Mickleover WRW	SK315337			852.5	+1.7	673.3	924.6	1169.6	1525.8		
101.5	Milton WRW	SK322267			853.5	+0.9	674.2	925.5	1170.5	1526.7		
109.0	Internat.Combustion	SK353325			854.0	+0.7	674.9	925.5	1171.2	1527.9		ID
112.0	Ramsley Bk (186,7,8)	SK398258*	+30.6*	3.3							(0.11)	CMG
	-Worthington WRW	SK407191				)						
	-Melbourne WRW	SK393254			857.5	) +0.8	675.7	926.3	1172.0	1533.2		
114.0	CEGB Castle Donington	SK427282				) -75.0		881.0	1114.7			CW:max=2749.0
					859.0	) +74.2	674.9	926.3	1188.9	1533.9		
120.0	Shardlow	SK445300			861.0		674.9	926.3	1188.9	1535.9		Data N/A
120.5	Castle Donington WRW	SK445282			861.0	+1.3	676.2	927.6	1190.2	1537.2		
121.0	BWB Shardlow	SK459307			861.0	+6.1	682.3	933.7	1196.3	1543.3		CF
121.0	River Derwent	SK458308	+1189	452.4	1314.0	+35.2	717.5	1078.5	1383.0	2031.5	(0.38)	See R Derwent
124.0	River Soar	SK494308	+1388	108.7	1423.0	+169.9	887.4	1258.8	1563.3	2310.4	(0.06)	See R Soar
124.5	CEGB Ratcliffe	SK496308				)-130.9		1187.5	1474.7			CW:max=217.3
					1423.0	) +71.7	828.2	1259.2	1546.4	2251.2		
129.0	River Erewash	SK513331	+201	49.7	1474.0	+64.1	892.3	1329.8	1617.6	2366.3	(0.24)	See R Erewash
134.0	Fairham Bk (288)	SK562338*	+63.8*	6.0								CMG
	-Keyworth WRW	SK605306				+1.3						
	-Gotham WRW	SK541301			1481.0	+0.4	894.0	1331.5	1619.3	2375.0		
136.0	CEGB Wilford	SK565375				)-147.0		1249.1	1519.1			CW:max=1691.0
					1483.0	)+147.0	894.0	1344.4	1666.1	2377.0		
137.6	River Leen	SK568382	+135	22.6	1509.0	+0.1	894.9	1362.0	1670.4	2405.9	(0.28)	See R Leen
141.0	Colwick	SK620399	7486		1512.0		894.9	1362.0	1660.5	2406.9	0.20	PF
149	Polser Beck	SK642398										No CMG site
	-Cotgrave WRW	SK640356				+2.3						
	-Radcliffe WRW	SK641375			1520.0	+2.0	899.2	1366.3	1664.8	2419.2		
151.0	Stoke Bardolph WRW	SK647442			1523.0	+146.2	1045.4	1512.5	1811.0	2568.4		
156.0	East Bridgford WRW	SK685434			1529.0	+0.5	1045.9	1513.0	1811.5	2574.9		
158.0	Dover Beck (292)	SK653479*	+63.9*	9.4							(0.15)	CMG
	-Calverton WRW	SK630490			1540.0	+0.5	1086.4	1513.5	1812.0	2586.4		
167.0	River Greet (301)	SK715539*	+46.2*	8.9							(0.19)	CMG
	-Southwell & Farnsfield WRW	SK726526			1560.0	+2.6	1049.0	1516.1	1814.6	2609.0		
170.0	CEGB Staythorpe	SK765532				)-1119.0		865.8	1036.3			CW:max=3210.0
					1562.0	)+1119.0	1049.0	1516.1	2155.3	2611.0		
172.0	Pingley Dyke (302)	SK759540	+5.1	0.8	1564.0						(0.16)	CMG
177.0	River Devon (299)	SK788477*	+299*	19.4							(0.06)	PF
	-BWB Grantham Canal	SK837366				-3.6						
	-Bottesford WRW	SK807402				+1.3						
	-Aslockton WRW	SK726405				+2.4						
	-Balderton WRW d/s	SK813509			1585.0	+1.9	1051.0	1518.1	2157.3	2636.0		
178.0	Hoveringham Gravels	SK792559				) -2.6		1516.6	2155.1			IW:max=3.6
					1586.0	) +2.5	1050.9	1519.1	2156.6	2636.9		
180.0	Newark WRW	SK803563			1590.0	+6.5	1057.4	1525.6	2163.1	2647.4		
186.0	North Muskham (303)	SK801601	8231		1595.0		1057.4	1525.6	2163.1	2652.4	0.19	PF: cmg's

DRY WEATHER FLOW CONDITION - RIVER SOW

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
12.4	Eccleshall (21)	SJ831296	39.2		13.6					13.6	(0.11)	
12.7	Eccleshall WRW	SJ857296			13.6	+0.4	0.4	0.4	0.4	14.0		
17.4	Meece Bk (24)	SJ869307	+77.0	8.4							(0.11)	CMG
	-Swinnerton WRW	SJ843381			24.8	+0.9	1.3	1.3	1.3	26.1		
19.0	Gt Bridgford (25)	SJ885270	144		27.7		1.3	1.3	1.3	29.0	0.19	PF:CMG
23.0	Doxey Bk (27)	SJ899237										CMG N/R
	-Boons	SJ894221			35.2	+0.5	1.8	1.3	1.8	37.0		ID,CW:max=0.3
25.5	GEC Power Eng	SJ918235				)-2.4						
					40.0	)+2.4	1.8	1.3	4.1	41.8		IW:max=7.8
29.5	GEC Nelson	SJ932222			46.5	+0.7	2.5	1.4	4.8	49.0		ID
29.6	River Penk	SJ935159	306	63.5	109.3	24.2	26.7	25.6	33.9	136.0	(0.21)	See R.Penk
32.0	Stafford WRW	SJ957224			113.6	+16.6	43.3	42.2	50.5	156.9		
34.0	Milford (41)	SJ976217	581		117.7		43.3	42.2	50.5	161.0	0.20	PF N/R cmg's
36.5	Trent Confluence	SJ993231	587		118.9		43.3	42.2	50.5	162.2	0.20	

DRY WEATHER FLOW CONDITION - RIVER PENK

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
5.0	Codsall (28) (Penk or Moat Bk)	SJ875041	19.7		3.4					3.4	0.17	CMG
6.0	Codsall WRW	SJ882037			5.0	+ 3.6	3.6	3.6	3.6	8.6		
6.5	Wrottesley Bk (29)	SJ890037	+20.0	3.7	9.5		3.6	3.6	3.6	13.1	(0.18)	CMG
10.5	Coven WRW	SJ905075			12.8	+ 0.9	4.5	4.5	4.5	17.3		
11.0	Saredon Bk (30)	SJ927083*	+65.6*	10.0							(0.15)	CMG
	-Norton Canes WRW	SK020071				+ 2.7						
	-NCB Mid Cannock	SJ986090				+ 3.0						CD
	-Cannock Main WRW	SJ975089				+16.0						
	-BWB	SJ935085			23.2	- 6.9	19.3	19.3	19.3	42.5		CF
13.0	Somerford Bk (31)	SJ895093	+145		25.8		19.3	19.3	19.3	45.1	(0.18)	CMG
13.0	Brewood Bk (32)	SJ888087*	+6.7*	1.4							(0.20)	CMG
	-Brewood WRW d/s	SJ891090			27.2	+ 0.5	19.8	19.8	19.8	47.0		
19.0	Church Eaton Bk (34)	SJ886153*	+45.4*	5.5							(0.12)	CMG
	-Woodeaton WRW	SJ840189				+ 0.8	20.6	20.6	20.6			
	Whiston Bk (36)	SJ888147*	+30.5*	2.3	51.0		20.6	20.6	20.6	71.6	(0.08)	CMG
19.5	Penkridge (37)	SJ922145	266		53.0		20.6	20.6	20.6	73.6	0.19	CMG:PF
19.6	Boscomoor Bk (38)	SJ923141	+14.6									CMG N/R
21.0	Penkridge (39)	SJ935159	306		61.8		20.6	20.6	20.6	82.4	0.20	CMG
21.2	Penkridge WRW	SJ937163			62.0	+ 3.6	24.2	24.2	24.2	86.2		
30.0	Sow Confluence	SJ943229	332		63.5		24.2	24.2	24.2	87.7		

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DRY WEATHER FLOW CONDITION - RIVER TAME

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
1.0	Wednesfield WRW	SO952992			0.4	+5.6	5.6	5.6	5.6	6.0		
1.2	T I Weldless	SO953997			0.4	+1.0	6.6	5.6	6.6	7.0		ID,IW:max=0.27
5.5	Willenhall WRW	SO976987			7.7	+10.7	17.3	16.3	17.3	25.0		
6.0	Darleston Bk (65)	SO962968*	+9.2*	1.6							(0.17)	CMG
	-BS Bilston	SO944957				+1.4						
	-Bilston WRW d/s	SO963967			8.5	+11.7	30.4	28.0	30.4	38.9		ID
6.1	Darleston WRW	SO982981			8.5	+2.1	32.5	30.1	32.5	41.0		
7.5	F H Lloyd	SO990972				)-2.2		28.5	30.8			
					9.7	)+1.0	31.3	29.5	31.8	41.0		IW&CW:max=1.8
8.8	Albright & Wilson	SO994883			15.6	-0.7	30.6	29.1	31.3	46.0		CW:max=8.2
9.0	)Ford Bk (67)											CMG N/A
	) -Brownhills WRW	SK036041				+3.1						
	) -Barns Lane WRW	SK037015				+3.4						
	) -Goscote WRW d/s	SK021016				+14.0						
	) -Tube Fabs d/s	SP014991				+1.0	52.1	50.6	52.8			ID
	)Oldbury Tame	SP004962	+65.0	13.5		+38.3	90.4	88.9	91.1		(0.21)	See Oldbury Tame
	)Bescot WRW	SO999966				+7.8	98.2	96.7	98.9			
	)Brockhurst WRW	SP007968			30.5	+31.1	129.3	127.8	130.0	160.4		
11.5	Rayhall (72)	SP024947										CMG N/R diurnal fluct'n
12.0	W T Avery	SP024951				)-1.0		127.1	129.2			IW:max=0.55
						)+1.0	129.3	127.9	130.2			
12.0	Rayhall WRW	SP025941			31.5	+20.0	149.3	147.9	150.2	181.4		
17.5	Great Barr (73)	SP048925										CMG N/R diurnal fluct'n
23.0	IMI	SP081905				)-63.5		96.1	97.6			
					39.5	)+60.0	146.3	143.3	157.6	185.9		CW:max=137.7
24.0	GEC Witton	SP088901			43.0	+0.5	146.3	143.3	158.1	189.9		IW:max=3.3
25.5	CEGB Nechells	SP099898				)-6.2		138.6	152.9			CW:max=84.1
					43.7	)+3.5	143.6	142.1	156.4	187.9		
26.5	River Rea	SP105895	+108	15.1	58.8	+13.0	156.6	153.4	168.4	219.9	(0.14)	See R Rea
29.5	Dunlop	SP132902			67.9	+9.0	165.6	162.4	177.4	233.5		ID
34.5	Water Orton (80)	SP169915	404		78.0		165.6	162.4	177.4	243.6	0.19	PF:CMG
34.7	Minworth A/S WRW	SP160924			78.5	+211.8	377.4	374.3	389.3	455.9		
37.3	Coleshill WRW	SP188913			80.2	+47.3	424.7	421.6	436.6	504.9		
37.8	Minworth P/F WRW	SP160924			82.2	+158.0	582.7	579.6	594.6	664.9		
40.0	River Cole/Blyth	SP211915	+321	47.8	130.8	+4.4	587.1	594.4	609.4	717.9	(0.15)	See R Cole/Blyth
40.5	River Bourne	SP216916										No CMG site
	-Arley WRW	SP279896				+1.0						
	-Shustoke Reservoir	SP237914			131.6	-11.8	576.3	595.4	610.4	707.9		PWS
43.0	CEGB Hamshall	SP206926				)-23.7		575.5	590.0			CW:max=114.6
					135.3	)+14.0	566.6	589.5	604.0	701.9		
44.0	Lea Marston (96)	SP205935	799		139.1		566.6	589.5	604.0	705.7	0.17	CMG
48.0	Kingsbury Bk (95)	SP239965*										CMG N/A
	-Hurley WRW d/s	SP235966			140.1	+0.4	567.0	589.9	604.0	707.1		
49.0	Thistlewood Bk	SP210972										No CMG site
	-Kingsbury WRW	SP213972			142.1	+0.8	567.8	590.7	605.2	709.9		
53.0	Langley Bk (98)	SP176981*	+16.6*	3.3							(0.2)	CMG
	-Langley Mill WRW	SP154967			156.5	+1.6	569.4	592.3	606.8	725.9		
55.5	Black Bk (100)	SK105046	99.0	19.5	176.0	-0.8	568.6	598.6	613.1	744.6	(0.19)	See Black Bk
57.5	River Anker	SK205037	+415	31.1	207.1	24.7	593.3	632.0	646.5	800.4	(0.07)	See R Anker
59.5	Alders	SK191045				-3.1		629.5	644.0			IW&CW:max=20.9
					211.1	+0.1	590.3	629.5	644.1	801.4		
62.0	Tamworth WRW	SK191053			215.1	+13.9	604.2	643.4	658.0	819.3		
70.0	Whittington WRW	SK164084			223.1	+0.5	604.7	643.9	658.5	827.8		
70.5	Elford (122)	SK188104	1475		225.1		604.7	643.9	658.5	829.8	0.15(E)	
76.0	Alrewas WRW	SK182152			229.5	+1.0	605.7	644.9	663.4	835.2		
76.3	Trent Confluence	SK193148	1516		231.7		605.7	644.9	663.4	837.4	0.15	

DRY WEATHER FLOW CONDITION - RIVER OLDBURY TAME

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
2.0	Tubes Equipment	SO993900			2.7	+0.5	0.5	0.5	0.5	3.2		ID
2.3	Tividale (70)	SO989904										CMG N/R
3.6	Oldbury WRW	SO986903			5.0	+14.5	15.0	15.0	15.0	20.0		
4.6	Tividale WRW	SO972910			6.1	+3.8	18.8	18.8	18.8	24.9		
6.0	Tipton WRW	SO977932			8.6	+13.6	32.4	32.4	32.4	41.0		
6.2	Tipton Bk (69)	SO975932* SO927924										CMG N/R
	-Sedgley G/R WRW	SO926939				+1.4						
	-Coseley WRW	SO946928				+2.2						
	-Dudley WRW	SO951917			11.6	+1.3	37.3	37.3	37.3	48.9		
7.4	Patent Shaft Steel	SO980947			12.6	+1.0	38.3	38.3	38.3	50.9		ID
9.6	Bescot (71)	SJ000952	63.6		13.2		38.3	38.3	38.3	51.5	0.21	CMG
10.6	Confluence with Tame	SJ004962	65.0		13.5		38.3	38.3	38.3	51.8	0.21	

DRY WEATHER FLOW CONDITION - RIVER REA

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.0	British Leyland	SP012776			1.5	0.7	0.7	0.0	0.7	2.2		IW:max=1.3
7.0	Triplex	SP039792			2.3	0.3	1.0	0.3	1.0	3.3		ID
8.0	Kings Norton (74)	SP045793	18.6		2.6		1.0	0.3	1.0	3.6	0.14	CMG N/R
9.5	J & E Sturge	SP057797			3.7	0.6	1.8	0.9	1.6	5.5		IW:max=1.1
11.5	Griffins Bk (76)	SP040912*				)+8.1						CMG N/R
	-Frankley WW	SP005802				)-1.2						
	-Cadbury Schweppes	SP046813			5.0	)+1.5	10.2	10.5	11.2	16.2		IW:max=78.6
13.2	Bourne Bk (77)	SP056833*	22.0	3.0							(0.13)	CMG
	-Bartley Reservoir	SP008814				+2.0						Leakage
	-G Morgan	SP046833			9.0	+0.8	13.0	11.3	12.0	21.0		CW:max=0.9
14.7	Calthorpe Park (75)	SP071847	72.6		10.0		13.0	11.3	12.0	23.0	0.14	PF:CMG
21.0	Nechells (78) & Tame confluence	SP105896	108		15.1		13.0	11.3	12.0	28.1	0.14	CMG

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DRY WEATHER FLOW CONDITION - RIVER BLACK BROOK

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
7.0	Chesterfield	SK100050	21.0		4.2		-4.2	0.0	0.0	0.0		BWB:SI&chase water
7.5	Trib	SK102051	+15.0	3.0							0.20	CMG
	-Litchfield WRW	SK080080				+4.1						
	General Spray				7.3	-1.0	-1.1	3.1	3.1	6.2		SI's
8.0	Footherley Bk	SK106046	+3.3	7.3								
	-Little Aston WRW	SK093019				+2.1					(0.22)	CMG
	-L.Stronhall WRW	SK086047			14.6	+0.3	+1.3	5.4	5.4	15.9		
9.0	Shenstone WRW	SK120043			15.0	+0.4	+1.7	5.8	5.8	16.7		
11.0	BCA	SK133036				) -2.2		5.1	5.1			
					17.2	) +2.2	+1.7	7.3	7.3	16.9		
	-General Spray to Weeford					-2.0	-0.3	6.4	6.4			
15.0	Fairclough (Lower Bagley)	SK175017			19.2	-0.5	-0.8	6.3	6.3	18.6*		IW prescribed flow = 17.3
17.0	Tame Conf.	SK210015	99.0		19.5		-0.8	6.3	6.3	18.7		

DRY WEATHER FLOW CONDITION - RIVER BLYTHE (INC. COLE)

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
3.5	Spring Bank WRW	SP106726			0.1	+0.4	0.4	0.4	0.4	0.5		
6.5	Cheswick (81)	SP127754	13.0		1.5		0.4	0.4	0.4	1.9	0.11	CMG
20.5	Cuttle Bk -Norton Green WRW	SP182749			16.2	+2.2	2.6	2.6	2.6	18.8		No CMG site
23.0	Balsall Bk (86) -Balsall Common WRW	SP215771 SP219776	+11.1	1.3	18.7	+0.7	3.3	3.3	3.3	22.0	(0.12)	CMG
25.0	Eastcote Bk (87) -Barston WRW	SP201803 SP192795			20.2	+12.5	15.8	15.8	15.8	36.0		CMG N/R
27.0	Patrick Bridge (88)	SP215814	138		21.8		15.8	15.8	15.8	37.6	0.16	CMG
27.5	(Trib)Meriden WRW	SP237822			21.9	+0.4	16.2	16.2	16.2	38.1		
36.0	Castle Farm (89)	SP212887	184		32.2		16.2	16.2	16.2	48.4	0.17	CMG
38.5	Shustoke Reservoir	SP206704			30.7	-11.8	4.4	12.3	12.3	35.1		PWS
39.5	River Cole (93) -Webster & Horsfall	SP183880* SP108847	+124*	16.5	47.2	-2.5 +2.5	4.4	14.8	14.8	51.6	(0.13)	CMG IW&CW:max=8.3
40.0	Blythe End and Tame confluence	SP211915	321		47.8		4.4	14.8	14.8	52.2	0.15	

DRY WEATHER FLOW CONDITION - RIVER ANKER

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
1.0	Bramcote (101)	SP414888	13.5		2.7					2.7	0.20	CMG
4.0	Pauls Ford (102)	SP389910	29.2		4.5					4.7	0.16	
5.0	Sketchley Bk (104)	SP390917*										
	-Hinckley WRW	SP418925			6.7	+7.9	7.9	7.9	7.9	14.6		CMG N/A
7.0	Trib	SP372895										
	-Sketchleys				7.2	0.0	7.9	7.9	7.9	15.1		IW:max=10.3
13.0	Trib											
	-BWB	SP354849				-0.6						CF
	-BWB	SP362906			10.5	-2.6	4.7	7.9	7.9	15.2		CF
14.0	NCB Haunchwood	SP315917			11.4	+0.7	5.4	8.6	8.6	16.8		CD
21.5	Leather Mill Farm (107)	SP339955	127		16.6		5.4	8.6	8.6	22.0	0.13	CMG
22.0	Nuneaton WRW	SP338956			17.0	15.1	20.5	23.7	23.7	39.5		
23.5	Atherstone (108)	SP324970			17.7		20.5	23.7	23.7	38.2		CMG
24.0	Trib											
	-BWB	SP312966			18.5	-0.8	19.9	23.7	23.7			CF
25.0	Atherstone WRW	SP318980			18.5	+3.2	23.1	26.9	26.9			
26.5	River Sence (116)	SP321997*	+171*	16.3							(0.10)	PF:cmg's
	-NCB S Leicester	SK425124				+0.4						CD
	-Coalville WRW	SK413121				+2.5						
	-NCB Snibston	SK416139				+1.0						CD
	-Ibstock WRW	SK401092				+0.9						
	-NCB Bagworth	SK439089				+0.4						CD
					34.5		28.3	30.3	30.3	62.8		)
30.0	Penmire Bk (118)	SK275997*	+9.0*									)
	-NCB Birch Coppice	SK259996				+0.5						CD)water loss
	-Grendon WRW	SK277987				+0.4						)to
	-BWB d/s	SK283002				-3.7	22.5	31.2	31.2	61.5		CF)aquifer
												CMG
34.0	Polesworth WRW	SK271021			28.6	+2.2	24.7	33.4	33.4	53.3		
35.5	Polesworth (120)	SK263034	374		27.4		24.7	33.4	33.4	52.1	0.07	PF:CMG
37.0	Warton Bk (121)	SK272041*	+21.5*	2.0	29.4		24.7	33.4	33.4	54.1	(0.09)	CMG
44.0	Tame confluence	SK205037	415		31.1		24.7	33.4	33.4	54.8	0.07	

DRY WEATHER FLOW CONDITION - RIVER MEASE

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.0	Packington WRW	SK360144			3.8	+3.2	3.2	3.2	3.2	7.0		
7.8	NCB Measham	SK352113			4.9	+1.3	4.5	4.5	4.5	9.4		CD
9.0	Snareston (126)	SK339103	40.0		5.7		4.5	4.5	4.5	10.2	0.14	CMG
13.5	Saltersford Bk (127)	SK312124	+13.8	1.6							(0.11)	CMG
	-NCB Oakthorpe	SK331140			8.4	+0.5	5.0	5.0	5.0	14.8		CD
15.5	Hooborough Bk (128)	SK299131	+16.0	2.1							(0.13)	CMG
	-Donisthorpe WRW	SK305143				+0.5						
	-NCB Donisthorpe	SK312145			10.6	+0.9	6.4	6.4	6.4	17.0		CD
16.0	Trib											
	-Overseal WRW	SK291149			11.1	+0.6	7.0	7.0	7.0	18.1		
16.5	Netherseal (130)	SK287128	111		14.8		6.2	6.2	6.2	20.9	(0.13)	CMG water loss to aquifer
19.5	Bunter/Keuper sst. boundary with Keuper Marl											
20.5	Stones Br (131)	SK262115			14.2		5.5	5.5	5.5	19.7(e)		CMG N/R
25.0	Harlaston (134)	SK215112	152		20.0		5.5	5.5	5.5	25.5	0.12	CMG
30.0	Confluence with Trent	SK195148	168		21.6		5.5	5.5	5.5	27.1	0.12	

DRY WEATHER FLOW CONDITION - RIVER DOVE

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
3.0	Hollinsclough (141)	SK063668	8.0		3.2					4.3	0.40	PF
32.0	Izaak Walton (142)	SK146509	83.0		56.0					56.0	0.67	CMG:PF
32.5	River Manifold	SK140507	+145	60.5	119.0	-1.5	-1.5		1.6	117.5	(0.42)	See R.Manifold
39.0	Bentley Bk (150)	SK173469*	+61.4*	10.0							(0.16)	CMG
	-Ashbourne WRW d/s	SK163462			136.5	+1.3	-0.2	1.3	2.9	136.3		
41.0	Henmore Bk (152)	SK175462*	+37.7*	5.7							(0.15)	CMG:PF
	-Nestles d/s	SK174461			144.2	+5.7	5.5	1.6	8.6	149.7		ID,CW:max=19.1
46.0	Tit Bk (153)	SK120424										CMG N/R
52.0	Rocester (154)	SK112397	391		167.5		5.5	1.6	8.6	173.0	0.43	PF
56.0	River Churnet (164)	SK103389	+232	81.5	249.0	+7.5	13.0	16.1	23.1	262.0	(0.3)	See R Churnet
56.5	Alders Bk (165)	SK096373	+23.0	1.3	250.5		13.0	16.1	23.1	263.5	(0.06)	CMG
61.0	River Tean (169)	SK092348	+62.2	7.5							(0.12)	CMG
	-BCA	SK006412				) -1.0						IW:max=5.9
						) +1.0						
	-Checkley WRW	SK032372				+12.3						
	-Univ.Birmingham	SK033375				0.0						IW:max=2.3
	-Fole Dairy	SK044372			263.0	+0.9	26.2	29.3	36.3	289.2		IW:max=1.6
62.0	Uttoxeter WRW	SK095345			264.0	+4.6	30.8	33.9	40.9	294.8		
65.0	Unigate Foods	SK096333			267.5	) -5.6		33.2	40.0			IW&CW:max=10.8
						) +5.6	30.8	34.2	45.6	298.3		
66.5	Marston Bk (170)	SK129334*	+13.8*	1.7	270.2		30.8	34.2	45.6	301.0	(0.12)	CMG
67.5	Marchington Bk (171)	SK136307*	+15.2*	3.4	273.8		30.8	34.2	45.6	304.6	(0.22)	CMG
72.0	Draycott Bk (172)	SK157303	+4.1	0.9	274.8		30.8	34.2	45.6	305.2	(0.22)	CMG
75.0	Foston Bk (173)	SK195298	+25.9	2.7	279.0		30.8	34.2	45.6	309.8	(0.11)	CMG
78.0	Hatton WRW	SK219299			279.2	+2.0	32.8	36.2	47.6	312.0		
81.0	Marston on Dove (174)	SK238288	877		279.5		32.8	36.2	47.6	312.3	0.32	CMG:PF
83.5	Nestles	SK217293				)-8.7		35.2	46.3			
						)+8.3	32.4	36.5	54.6	312.4		CW:max=10.9
84.5	Rolleston Bk (175)	SK238278*	+19.4*	3.0								
	-Rolleston WRW	SK243281			282.5	+1.1	33.5	37.6	55.7	316.5	(0.15)	CMG
87.0	Hilton Bk (181)	SK242305	+92.6	18.0	301.0		33.5	37.6	55.7	334.5	(0.19)	CMG
87.5	STWA Egginton	SK267273			301.0	-90.7	-57.2	26.6	39.4	243.8		PWS:max=295.5
90.0	Trent Confluence	SK279261	1013		302.9		-57.2	26.6	39.4	245.7	0.30	

DRY WEATHER FLOW CONDITION - RIVER MANIFOLD

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
12.0	STW Hulme End	SK106595				-0.8	-0.8	0.0	0.0			PWS: max=1.4
12.0	Hulme End (145)	SK106595	44.0		17.6		-0.8	0.0	0.0	16.8	0.4	cmg's
20.0	River Ramps (146) -BCA	SK082502* SK076503	+35.0*	5.2		-2.3 +1.6	-1.5	0.0	1.6	40.0	(0.15)	PF IW&CW: max=2.5
28.0	Ilam (148)	SK140507	145		60.5		-1.5	0.0	1.6	59.0	0.42	CMG: PF

DRY WEATHER FLOW CONDITION - RIVER CHURNET

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.9	STWA Upper Hulme	SK013615			7.1	-2.0	-2.0	0.0	0.0	5.1		PWS:max=2.55
9.6	Tittesworth Reservoir	SJ993587			13.9	+1.1	-0.9	0.0	1.1	13.0		PWS reservoir
9.8	Tittesworth Compensation & Solomon's Hollow	SJ992581										N/R
12.0	T I Wardle	SJ976570			16.6	-2.2	-3.1	0.0	0.9	13.5		IW:max=8.2
13.0	BWB Rudyard	SJ951583			17.6	-0.9	-4.0	0.0	0.8	13.6		CF
18.0	Leek WRW	SJ980540			25.2	+9.6	5.6	9.6	10.4	30.8		
18.2	J Wardle	SJ982535				)-1.6		9.1	9.9			CW:max=10.0
					25.3	)+2.3	6.3	11.4	12.2	31.6		
20.2	Endon Bk (158)	SJ933537*										CMG N/A
	-BWB Stanley Pool	SJ929519				-2.0						
	-Endon WRW	SJ938541*				+0.6						
	-Deep Hayes Res.d/s	SJ961534			28.8	+2.1	7.0	12.1	12.9	35.8		
23.0	Basford Bridge (161)	SJ 982522	139		32.4		7.0	12.1	12.1	39.4	0.23	PF : CMG
23.5	Cheddleton WRW	SJ982513				+0.8	7.8	12.9	12.9	54.5		
39.8	B.I. Sands	SK045450				)-2.5		12.3	12.3			
						)+2.2	7.5	14.5	14.5	83.5		IW : Max = 2.5
40.3	Alton (162)	SK071426	201.0		74.0		7.5	14.5	14.5	84.5	0.36	CMG
52.0	Rocester (164)	SK103389	232.0		81.5		7.5	14.5	14.5	88.0	0.35	CMG : PF

DRY WEATHER FLOW CONDITION - RIVER DERWENT

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
7.0	Slippery Stones	SK169952	17.2		6.3					6.3	0.36	
10.0	Howden Dam	SK170924			13.8	-13.8	-13.8					
12.5	Ashop Diversion (In)	SK171898				+26.7	+12.9					
12.6	Derwent Dam	SK171899			18.7	-31.6	-18.7					Based on
13.0	Locker Bk	SK165897				-0.4	-19.1					1978
16.0	Ashop Diversion from Ashop	SK139895				-26.3	-45.4					survey
17.0	Noe Diversion(Inflow)	SK165875				+7.5	-37.9					
18.5	Ladybower Dam	SK200853			52.7	-14.8	-52.7					
19.0	Yorkshire Bridge(190)	SK198851	125		52.7	+73.7	+21.0	0.0	0.0	73.7	0.42	Compensation water
22.0	Hope WRW	SK176832				+1.3	22.3	1.3	1.3			
22.0	River Noe	SK204825	+70.2	33.0							(0.47)	CMG based on 1978
	-Noe Diversion	SK145858	)									
	-Jaggers Clough	SK161864	)		89.2	-4.5	17.8	1.3	1.3	107.0		
29.5	Burbage Bk	SK251788*	+12.0*	3.7	102.2		17.8	1.3	1.3	120.0	(0.3)	
33.0	Stoke Bk (191)	SK238753	+14.6	4.5	112.2		17.8	1.3	1.3	130.0	(0.3)	CMG
38.0	Bar Bk (192)	SK260721	+13.2	5.1							(0.38)	CMG
	-STWA	SK281768			123.5	-1.3	16.5	1.3		140.0		PWS:max=4.4
41.0	Chatsworth (193)	SK261683	349		128.4		16.5	1.3	1.3	144.9	0.36	CMG
44.0	River Wye	SK260654	+273	83.8	213.1	+8.4	24.9	12.3	12.8	238.0	(0.3)(S)	See R Wye
45.5	Hillcarr Sough	SK260643		28.0	241.6		24.9	12.3	12.8	266.5		
46.0	Firth Derihon	SK260638				)-1.0		12.2	12.7			
					241.8	)+6.2	30.1	12.3	18.9	271.9		CW:max=5.2
47.0	Yatestoop Sough	SK265626		9.0	250.9		30.1		18.9	281.0		
49.5	STWA Hilldale	SK285652			251.2	-0.8	29.3	12.3	18.8	280.5		PWS:max=7.46
53.5	Bentley Bk (201)	SK301598	+14.0	6.1							(0.43)	CMG
	-F & H Drabble	SK317599				)-0.8						
					258.7	)+0.8	29.3	13.1	19.6	288.0		IW:max=1.25
55.0	Matlock (200)	SK297586	691		263.3		29.3	13.1	19.6	292.6	0.37(S)	cmg's
56.5	Cromford Sough	SK298571		22.0	287.7		29.3	13.1	19.6	317.0		
60.0	Matlock (Lea Rd)WRW	SK314559			291.5	+6.2	35.5	19.3	25.8	327.0		
61.4	Meerbrook Sough	SK328558		46.7								PF
	-STWA Meerbrook	SK328558			340.5	-33.0	1.5	19.3	25.8	342.0		PWS:max=48.5
64.5	STWA Ambergate	SK338528			346.1	-13.6	-12.1	18.6	24.8	334.0		PWS:max=91.0
65.0	Johnson & Nephew	SK340524				-2.6		18.5	24.6			
					346.1	+2.6	-12.1	18.8	27.2	334.0		CW:max=87.4
66.5	River Amber	SK347515	+139	18.7	369.6	+26.5	14.4	48.8	57.2	384.0	(0.13)	See R Amber
72.5	Belper WRW	SK345467			377.1	+3.5	17.9	52.3	60.7	395.0		
73.5	ESC Milford	SK349453			377.9	-0.8	17.1	52.2	60.6	395.0		IW:max=123.6
77.0	R.Ecclesbourne (215)	SK320447*	+50.4*	10.2							(0.2)	PF
	-STWA	SK297537				-1.0						PWS:max=0.9
	-Wirksworth WRW	SK284523			396.8	+1.1	17.2	53.3	61.6	414.0		
79.0	Duffield WRW	SK356415			398.1	+0.7	17.9	54.0	62.3	416.0		
80.4	STWA Little Eaton	SK360405			399.5	-34.4	-16.5	49.6	57.2	383.0		PWS:max=43.2
80.5	Bottle Bk (217)	SK364415*	+36.6*	5.9							(0.16)	CMG
	-Ripley WRW	SK398482				+0.9						
	-Kilburn WRW	SK373448				+1.1						
	-Little Eaton WRW d/s	SK361409			405.8	+0.7	-13.8	52.3	59.9	392.0		
86.6	Longbridge Weir (218)	SK356363	1054		417.4		-13.8	52.3	59.9	403.6	0.39 (S)	CMG
86.7	Markeaton Bk (220,222)	SK332379*	+49.5*	13.3							(0.27)	cmg's
	-Trent Fish Culture	SK280426				-0.6						
					428.8	+0.6	-13.8	52.8	59.5	415.0		IW:max=4.2
91.0	Spondon WRW	SK393344			433.0	+105.8	92.0	158.6	166.3	525.0		
92.0	British Celanese	SK398344			435.4	-41.6	50.4	146.1	153.2	486.0		IW&CW:max=386.4
93.0	CEGB Spondon	SK406345				)-55.1		129.6	135.9			CW:max=1021.5
					436.0	)+53.7	49.0	146.1	189:6	485.0		
100.0	Nooning Lane WRW	SK423338			446.3	+0.7	49.7	146.8	190.3	496.0		
103.5	Draycott WRW	SK452315			449.6	+3.4	53.0	150.2	193.7	503.0		
104.0	STWA Church Wilne	SK445327			449.8	-17.8	35.2	144.8	186.7	485.0		PWS:max=91.2
105.0	Church Wilne (224)	SK441316			449.9		35.2	144.8	186.7	485.1	0.38(S)	PF
106.0	Trent Confluence	SK458308	1189		452.4		35.2	144.8	186.7	487.6	0.38(S)	

DRY WEATHER FLOW CONDITION - RIVER WYE

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
1.5	STWA Stanley Moor	SK033721			3.1	-1.4	-1.4			1.7		FWS:max=6.4
5.0	STWA Lightwood	SK055751			9.1	-1.2	-2.6			6.5		FWS:max=2.3
8.0	Buxton WRW	SK080725			14.6	+8.0	5.4	8.0	8.0	20.0		
8.1	Ashwood Dale (194)	SK081725	27.2		15.0		5.4	8.0	8.0	20.4	0.55	CMG
23.3	Magpie Sough	SK179696		30.2	73.0		5.4	8.0	8.0	78.4		
23.5	Ashford (195)	SK181696	151		73.2		5.4	8.0	8.0	78.6	0.48(S)	CMG
27.0	W L T Fearnehough	SK212691			76.6	-0.6 +0.6	5.4	7.9 8.0	7.9 8.5	82.0		
35.0	River Lathkill (198)	SK239655	+90.0	3.4	82.1		5.4		8.5	87.5	(0.04)	CMG
36.5	Picory Corner WRW	SK248660			82.6	+3.0	8.4	11.0	11.5	91.0		
37.5	Rowsley (199)	SK251656	274		83.8		8.4	11.0	11.5	92.2	0.3(S)	CMG

DRY WEATHER FLOW CONDITION - RIVER AMBER

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
8.0	Ogston Reservoir	SK381598			5.8	-3.3	-3.3	0.0	0.0	2.5		INS reservoir
9.0	Smith Bk (205)	SK389629*	+8.0*	1.0							(0.12)	CMG
	-Clay Cross WRW d/s	SK388624			7.3	+1.0	-2.3	1.0	1.0	5.0		
10.0	Hallfield Gate (206)	SK386582	48.6		7.6		-2.3	1.0	1.0	5.3	0.15	CMG
14.0	Alfreton Bk (210)	SK390567	+37.0	6.4							(0.17)	CMG
	-NCB New Hucknall	SK473582				+1.1						CD
	-Huthwaite WRW	SK468582				+0.6						
	-S.Normanton WRW	SK448577				+1.8						
	-NCB Blackwell	SK438577				+6.2						CD
	-NCB Morton	SK416605				+3.0						CD
	-Stonebroom WRW	SK420606				+0.8						
	-Alfreton WRW	SK413569			14.2	+3.6	14.8	18.1	18.1	29.0		
16.0	Wingfield Park (211)	SK376520	114		15.9		14.8	18.1	18.1	30.7	0.13	CMG:PF
17.0	Hartshay Bk (212)	SK375518	+6.0	1.2							(0.2)	CMG
	-Blackwell WRW	SK429536				+1.5						
	-Swanwick WRW	SK403523				+2.5						
	-Ripley WRW	SK393517			16.8	+2.1	20.9	24.2	24.2	37.7		
18.0	Fritchley Bk (213)	SK360530*	+8.1*	0.5							(0.06)	CMG
	-Fritchley WRW	SK361526			17.8	+0.1	21.0	24.3	24.3	38.8		
18.5	Stevensons Dyers	SK358522				-0.5		24.0	24.0			ID,IW:max=3.5
					17.9	+5.5	26.0	29.5	29.5	43.9		
19.0	Heage WRW	SK365504			18.1	+0.5	26.5	30.0	30.0	44.6		
20.5	Derwent confluence	SK347515	134.0		18.7		26.5	30.0	30.0	45.2	0.13	

DRY WEATHER FLOW CONDITION - RIVER SOAR

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
3.6	Burbage WRW	SP451921				+0.5	0.5	0.5	0.5			
7.0	Clay Bk (227)	SP498892*	26.6*	1.9							(0.07)	CMG
9.0	Stoney Bridge (228)	SP504930	71.7		6.6		0.5	0.5	0.5	7.1	0.09	CMG
12.0	Stoney Stanton WRW	SP501952			7.6	+1.9	2.4	2.4	2.4	10.0		
13.5	ECC Quarry Rigs	SP516960				)-2.3		2.0	2.0			
					9.6	)+2.3	2.4	4.3	4.3	12.0		IW:max=2.3
14.0	)Astley Bk (229)	SP525926*	+16.1*	2.0							(0.12)	CMG
	) -Broughton Astley	SP523946				+0.7	3.1	5.0	5.0			
	) WRW d/s											
	)											
	)Thurlaston Bk (231)	SP515976	+61.9	5.9							(0.09)	CMG
	) -Newbold Vernon WRW	SK442032				+0.5						
	) -Earlshilton WRW	SP476975			18.0	+2.4	6.0	7.9	7.9	24.0		
15.0	Enderby WRW	SP529987			18.1	+0.5	6.5	8.4	8.4	24.6		
16.0	Narborough WRW	SP549966			18.2	+1.8	8.3	10.2	10.2	26.5		
17.0	Whetstone Bk (232)	SP556971										CMG N/R
18.5	Narborough (233)	SP551985	211		19.3		8.3	10.2	10.2	27.6	0.09	CMG
19.0	River Sence	SP550985	+132	6.1	25.5	+8.1	16.4	18.3	18.3	41.9	(0.05)	See R Sence (Soar)
22.0	Braunstone WRW	SK552020			29.3	+3.0	19.4	21.3	21.3	48.7		
24.0	Wash Bk (242)	SP618999*	+5.5*	0.6							(0.1)	CMG
	-Oadby WRW d/s	SK615001			31.4	+2.9	22.3	24.2	24.2	53.7		
30.5	Humberstone Bk (243)	SK621052*	+18.9*	2.0	36.4		22.3	24.2	24.2	57.7	(0.1)	CMG
32.5	Keyham Bk (245)	SK600075										CMG N/R
36.0	Wanlip WRW	SK597115				+96.6	118.9	120.8	120.8			
37.0	River Wreake	SK628132	+402	18.3	59.0	+9.5	128.4	136.7	136.7	187.4	(0.07)	See R Wreake
37.5	Rothley Bk	SK592133	+96.0	7.6	66.6	+6.9	135.3	144.1	144.1	201.9	(0.12)	See Rothley Bk
38.0	Rothley WRW	SK544136			67.0	+6.5	141.8	150.6	150.6	208.5		
45.0	Quorndon Bk (270)	SK516100*	+12.3*	3.2							(0.26)	CMG
	-Cropston & Swithland Res.d/s	SK556149			76.0	-1.4	140.4	150.6	150.6	216.4		PWS reservoirs
48.0	Barrow & Quorn WRW	SK562180			77.0	+4.9	145.3	155.5	155.5	222.3		
52.5	Kingsbrook (273)	SK545218	+12.8	1.4	77.0		145.3	155.5	155.5	224.3	(0.11)	CMG
54.0	Wood Bk (274)	SK531213*	+22.0*	4.7							(0.21)	CMG
	-Loughborough WRW d/s	SK530210			84.0	+11.6	156.9	167.1	167.1	240.9		
55.0	Black Bk (277)	SK486208*	+40.5*	4.3							(0.11)	CMG
	-NCB Whitwick	SK429150				+0.7						CD
	-Coalville WRW	SK431185				+1.8						
	-Shepshed WRW d/s	SK490206			89.0	+4.7	164.1	174.3	174.3	253.1		
58.0	Longwhatton Bk (279)	SK488238	+34.6	7.3							(0.21)	CMG
	-NCB Churchill	SK418173				+2.0						CD
	-NCB Swannington	SK420171				+1.5						CD
	-Longwhatton WRW d/s	SK491223				+0.5						
	-Hathern WRW d/s	SK502233			99.0	+0.3	168.4	178.6	178.6	267.4		
60.0	Zouch (280)	SK498240										
63.5	N. Beeby	SK493278			101.0	-0.6	167.8	178.2	178.2	268.8		SI
64.0	Kingston Bk (282)	SK503277	+58.3	5.9							(0.1)	CMG
	-East Leake WRW	SK539264				+1.0						
	-Sutton Bonnington WRW d/s	SK499276			108.0	+0.6	169.4	179.8	179.8	277.4		
64.5	Kegworth WRW	SK486274				+0.5	169.9	180.3	180.3	278.4		
64.8	Ratcliffe on Soar(283)	SK496292	1370				169.9	180.3	180.3		0.08	CMG
67.0	Trent Confluence	SK494308	1388		108.7		169.9	180.3	180.3	278.6	0.08(E)	

DRY WEATHER FLOW CONDITION - RIVER SENCE (SOAR)

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
3.5	Little Stretton (234)	SK663002	16.6		1.4					1.4	0.08	CMG
8.5	Fleckney WRW	SP657947			3.2	+0.9	0.9	0.9	0.9	4.1		
13.0	Trib -Great Glen WRW	SP633976			4.1	+0.4	1.3	1.3	1.3	5.4		
15.0	Kilby Bridge (239)	SP610968	81.7		4.7		1.3	1.3	1.3	6.0	0.06	CMG
15.1	Wigston WRW	SP596968				+5.0	6.3	6.3	6.3			
15.3	Countesthorpe WRW	SP591961				+0.6	6.9	6.9	6.9			
19.0	Blaby (241)	SP566985	129		5.9		6.9	6.9	6.9	12.8	0.05	PF&CMG
20.0	Whetstone WRW	SP555982			6.0	+1.2	8.1	8.1	8.1	14.1		
20.5	Soar confluence	SP550985	132		6.1		8.1	8.1	8.1	14.2	0.05	

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DRY WEATHER FLOW CONDITION - RIVER WREAKE

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
10.5	Saxby (248)	SK822194	28.1		1.7					1.7	0.06	CMG
17.8	U/s Melton Mowbray	SK763188	167		10.0					10.0	0.06	
18.0	Thorpe Bk (251)	SK762201	14.7	0.5	10.5					10.5	(0.03)	cmg's
18.5	Scalford Bk (250)	SK760216	19.8	0.6	11.1					11.1	(0.03)	cmg's
19.5	Pedigree Petfoods	SK758188				-5.1						
					11.5	+0.4	-4.7	0.4	0.4	6.8		
22.7	Melton WRW	SK736185			12.3	+7.0	2.3	7.4	7.4	14.6		
24.0	B.S. Holwell	SK718189				-3.0						
					13.0	+2.5	1.8	8.2	8.2	14.8		
26.0	Asfordby WRW	SK706183			13.5	+1.0	2.8	9.2	9.2	16.3		
29.0	Saxelby Bk (253)	SK682180	12.8	0.3	14.5		2.8	9.2	9.2	17.3	(0.02)	CMG
33.5	Ox Bk (254)	SK653162	4.2	0.1	15.5		2.8	9.2	9.2	18.3	(0.02)	CMG
35.5	Rearsby Bk (255)	SK658148	13.5	0.3	17.3		2.8	9.2	9.2	20.1	(0.02)	CMG
38.0	Queniborough Bk (260 & 258)	SK642130	63.0	0.9			2.8	9.2	9.2		(0.01)	CMG
	-Queniborough WRW	SK634131			17.9	+6.7	9.5	15.9	15.9	27.4		
40.0	Syston (261) and Soar Confluence	SK615124	401		18.3		9.5	15.9	15.9	27.8	0.05	PF

DRY WEATHER FLOW CONDITION - ROTHLEY BROOK

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
1.0	Thornton (264)	SK460078	5.1		0.7					0.7	0.14	CMG
1.5	Markfield WRW	SK473094			0.8	+0.6	0.6	0.6	0.6	1.4		
4.0	Thornton Reservoir	SK414072			2.1	-0.7	-0.1	0.4	0.4	2.0		PWS reservoir
5.0	Trib											No CMG site
	-Thornton Bagworth WRW	SK466065				+0.5						
	-NCB Desford	SK478041				+0.5						CD
	-NCB Merrylees Sump	SK470061			2.6	+0.6	1.5	2.0	2.0	4.1		CD
5.2	Merrylees (265)	SK472056	22.0		2.8		1.5	2.0	2.0	4.3	0.13	CMG
7.0	Desford WRW	SK478041			3.8	+0.8	2.3	2.8	2.8	6.1		
12.0	Kirby Muxloe (266)	SK520051	51.4		5.0					7.3	0.10	CMG
13.0	Glenfield WRW	SK531057			5.2	+2.4	4.7	5.2	5.2	9.9		
17.5	Trib											
	-Groby WRW	SK537075			6.4	+0.8	5.5	6.0	6.0	11.9		
18.0	Anstey (268)	SK562099			6.5		5.5	6.0	6.0	12.0		CMG N/A
18.5	Anstey WRW	SK561079			6.6	+1.4	6.9	7.4	7.4	13.5		
22.0	Rothley (269)	SK594136	95.3		7.5		6.9	7.4	7.4	14.4		CMG : PF
24.0	Soar confluence	SK592133	96.0		7.6		6.9	7.4	7.4	14.5	(0.08)	

DRY WEATHER FLOW CONDITION - RIVER EREWASH

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
2.0	NCB Bentinck	SK485548			1.5	+0.8	0.8	0.8	0.8	2.3		CD,IW:max=1.3
3.0	Kirkby WRW	SK481549			3.0	+3.8	4.6	4.6	4.6	7.6		
4.0	NCB Langton	SK475549			4.2	+2.0	6.6	6.6	6.6	10.8		CD
6.0	Pinxton WRW	SK450541			7.0	+2.0	8.6	8.6	8.6	15.6		
7.5	Pye Bridge (284)	SK441522			8.8		8.6	8.6	8.6	17.4	0.25	CMG
8.0	Alfreton WRW	SK441525			9.8	+2.0	10.6	10.6	10.6	20.4		
12.0	BWB Langley Mill	SK452473			15.2	-15.0	-4.6	2.9	2.9	10.6		CF
13.0	Heanor WRW	SK456464			16.8	+11.0	6.4	13.9	13.9	23.2		
15.5	Gilt Bk -NCB Moorgreen	SK476479			20.0	+0.5	6.9	14.4	14.4	26.9		CMG N/A CD,IW:max=0.9
16.0	Newthorpe WRW	SK477448			20.8	+11.0	17.9	25.4	25.4	38.7		
21.0	Ilkeston WRW	SK484393			29:0	+9.5	27.4	34.9	34.9	56.4		
22.0	Nut Bk (285) -NCB Shipley -British Steel	SK453414* SK448414 SK466393			31.2	+17.5 -0.8 +0.8	45.3	52.4	52.4	76.5		CMG N/R IW:max=1.3
25.0	Stapleford (286)	SK482364	178		38.2		45.3	52.4	52.4	83.5	0.21	cmg's,FF N/R
25.5	Stapleford WRW	SK487358			39.5	+3.8	49.1	56.2	56.2	88.6		
29.0	Toton WRW	SK507336			47.5	+15.0	64.1	71.2	71.2	111.6		
30.0	Trent confluence	SK513331	201.0		49.7		64.1	71.2	71.2	113.8	0.24	

DRY WEATHER FLOW CONDITION - RIVER LEEN

DISTANCE	EVENT	N G R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.0	Tributary -NCB Newstead	SK528538			5.1	+0.9	0.9	0.9	0.9	6.0		CD
5.2	NCB Linby	SK546507			5.9	)-1.4)+1.2	0.7	0.7 1.9	0.7 1.9	6.6		CD,IW:max=2.2
6.0	Hucknall (289)	SK549500	19.1		7.3		0.7	1.9	1.9	8.0	0.38	CMG
13.0	Tributary -NCB Babbington	SK532437			14.7	+3.0	3.7	4.9	4.9	18.4		CD,IW:max=1.9
15.1	Gerrard Bros.	SK555419			16.9	-2.6	1.1	4.5	4.5	18.0		CW:max=4.1
15.7	Wade & Co.	SK552415			17.5	-1.0	0.1	4.3	4.3	17.6		IW:max=1.0
18.0	Triumph Road (290)	SK549392	108		19.9		0.1	4.3	4.3	20.0(e)	0.18	PF N/R
20.5	Trent confluence	SK568382	135		22.6		0.1	4.3	4.3	22.7(e)	0.17	

A3.24

DRY WEATHER FLOW CONDITION - RIVER MAUN/IDLE

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.0	Sutton Ashfield WRW	SK513595			5.0	+6.1	6.1	6.1	6.1	11.1		
8.5	Bunter W. Boundary											
9.0	Mansfield WRW u/s					+7.3	13.4	13.4	13.4	24.0		
	Mansfield (307)	SK547625	28.6				13.4	13.4	13.4	24.0	0.37	PF:CMG
	Mansfield WRW d/s				10.6	+7.3	20.7	20.7	20.7	31.3		
13.0	J Bealby	SK573647										SI:max=1.1
13.5	A Shaw Browne	SK583652										SI:max=1.0
15.5	Clipstone (308)	SK600650	41.8		18.1		20.7	20.7	20.7	38.8	0.43	CMG
16.0	Vicar Water (309)	SK605649	+31.1	0.3	18.0		20.7	20.7	20.7	38.7	(0.01)	CMG
18.0	Edwinstowe (310)	SK626644	84.4		17.9		20.7	20.7	20.7	38.6	0.21	CMG
19.0	Edwinstowe WRW	SK641670			17.9	+2.1	22.8	22.8	22.8	40.7		Area of loss to Aquifer
21.5	Rainworth Water (312)	SK641609*	+60.0*	1.2								
	-Rainworth WRW	SK589592				+3.3					(0.02)	CMG
	-Bilsthorpe WRW	SK643614			19.0	+1.2	25.9	25.9	25.9	44.9		
25.0	Whitewater (313)	SK662701	166		19.1		25.9	25.9	25.9	45.0	0.12	cmg's
27.0	River Meden	SK659720	+106	35.7	51.7	+12.4	36.4	39.2	39.2	88.1	(0.34)	See R.Meden
28.0	G Woodcock	SK660725										SI:max=1.7
29.5	E Boundary Bunter											
30.0	Haughton (319) & Bothamsall (320)	SK681728) SK681733)	277		45.3		32.3	35.8	35.8	77.6	0.18	PF:CMG
32.0	NCB Bevercotes	SK696735										CD,IW:max=1.7
33.0	River Poulter	SK701754	+127	24.6	69.9	+5.8	38.1	41.6	41.6	108.0	(0.19)	See Poulter
34.5	Gamston (327)	SK707762	445		69.9		38.1	41.6	41.6	108.0	0.15	CMG
35.5	E J Howard	SK709769										SI:max=2.3
38.5	Flow on to Bunter, E. Boundary											
38.5	Northern Rubber	SK707804										CW:max=0.8
39.0	BWB Retford	SK702808			75.5	+1.0	37.1	41.2	41.2	112.6		CF
39.5	T Waterfield	SK706813										IW&CW:max=1.4
41.0	Retford WRW	SK697828			87.0	+4.4	41.5	45.6	45.6	128.5		
45.0	Lound	SK713857	528		113.5		41.5	45.6	45.6	155.0	0.21	CMG
47.0	Lound WRW	SK694867			114.0	+0.2	41.7	45.8	45.8	155.7		
50.0	Mattersey (328)	SK690895	538		115.5		41.5	45.8	45.8	157.0	0.21	CMG
52.0	Mattersey Thorpe WRW	SK675902			116.0	+1.3	43.0	47.1	47.1	159.0		
53.0	Ranskill WRW	SK668879			116.2	+0.2	43.2	47.3	47.3	159.4		
55.5	River Ryton	SK659921	+263	70.0	187.0	+11.3	54.5	65.0	65.0	241.5	(0.27)	See R.Ryton
57.0	Bawtry WRW	SK655933			226.0	+0.4	54.9	65.4	65.4	280.9		
58.0	Newington	SK673937	825		230.1		54.9	65.4	65.4	285.0	0.28	cmg
61.0	E Boundary Bunter											
73.0	Trent Confluence	SK790947	894		262.1		54.9	65.4	65.4	317.0(e)	0.29(e)	Subject to inflow from aquifer d/s Ryton confluence

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DRY WEATHER FLOW CONDITION - RIVER MEDEN

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.0	Skegby WRW	SK496617			3.5	+2.5	2.5	2.5	2.5	6.0		
5.5	Pleasley (314)	SK496632	19.2		5.5		2.5	2.5	2.5	8.0	0.28	CMG
6.3	NCB Pleasley	SK500635										CD:IW:max=1.6
7.0	Pleasley WRW 1 & 2	SK507646			6.7	+0.6	3.1	3.1	3.1	9.8		
8.5	W H Hollins	SK515650										IW:max=0.4
10.5	Cast Development	SK532652			8.5	+2.0	5.1	5.1	5.1	13.6		
12.5	Sookholme (315)	SK550662	43.6		11.0		5.1	5.1	5.1	16.1	0.25	cmg's
13.5	Mansfield W'house WRW	SK547643			13.6	+4.2	9.3	9.3	9.3	22.9		
13.6	NCB Warsop	SK555678			13.7	-0.7	8.6	9.0	9.0	22.3		IW:max=2.2
14.0	Shirebrook WRW	SK533674				+2.2		11.2	11.2			
	NCB Shirebrook	SK541665			15.0	-0.9	9.9	10.8	10.8	24.9		IW:max=1.7
14.1	Bunter W Boundary											
14.2	Church Warsop (316)	SK558680	62.8		15.1		9.9	10.8	10.8	25.0	0.24	CMG
16.5	Warsop WRW	SK583689			19.6	+2.5	12.4	13.3	13.3	32.0		Gain of water d/s of Warsop
17.0	NCB Welbeck	SK583697										IW:max=3.3
19.5	Gleadthorpe (317)	SK593700	78.5		24.2		12.4	13.3	13.3	36.6	0.31	CMG
26.5	Thoresby (318)	SK656718	104		35.5		12.4	13.3	13.3	47.9	0.34	CMG
27.0	Maun confluence	SK659720	106		35.7		12.4	13.3	13.3	48.1	0.34	River divides again before becoming R.Idle The divided section is considered to be all Maun.

DRY WEATHER FLOW CONDITION - RIVER POULTER

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
1.5	Scarcliffe WRW	SK499686			1.0	+0.4	0.4	0.4	0.4	1.4		
3.5	Langwith (321)	SK520695	11.4		2.1		0.4	0.4	0.4	2.5	0.18	CMG
7.0	Langwith WRW	SK545702			5.6	+0.6	1.0	1.0	1.0	6.6		
9.0	Bunter W. Boundary											
10.0	Cuckney (322)	SK571718	29.5		14.7		1.0	1.0	1.0	15.7	0.50	cmg's
11.5	Millwood Bk (324)	SK558753*	37.6*	4.1							(0.11)	
	-Clowne WRW	SK503755	-			+1.2						
	-NCB Cresswell	SK524736				+1.6						
	-Cresswell WRW	SK538743				+0.7						cmg's
	-Whitwell WRW	SK534760				+1.2						
	-Hodthorpe WRW	SK549766				+0.1						
11.5	Great Lake				19.3		5.8	5.8	5.8	25.1		MILLWOOD BROOK JOINS POULTER AT GREAT LAKE ON BUNTER SST.
14.0	Worksop Road (325)	SK606728	88.0		20.1		5.8	5.8	5.8	25.9	0.23	CMG
21.0	Clumber Lake											Losses or abstraction
24.5	Elkesley (326)	SK684749	127		24.4		5.8	5.8	5.8	30.2	0.19	CMG
25.0	E. Boundary Bunter											
25.5	Idle Confluence	SK701754	128		24.6		5.8	5.8	5.8	30.4	0.19	

DRY WEATHER FLOW CONDITION - RIVER RYTON

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
1.0	Kiverton Park WRW	SK492822			1.0	+1.3	1.3	1.3	1.3	2.3		
4.0	KivertonWire & Steel	SK511822			3.5	+0.3	1.6	1.6	1.6	5.1		ID
6.0	Hawkeswood (329)	SK530817	20.2		5.1		1.6	1.6	1.6	6.7	0.25	CMG
7.0	Anston Bk (330)	SK538827*	+22.7*	1.9							(0.08)	cmg's
	-Dinnington WRW	SK516860				+1.3						
	-NCB Dinnington	SK519856				0.0						CD
	-Anston 1 & 2 WRW	SK526839			7.0	+0.6	3.5	3.5	3.5	10.5		
8.5	BWB Brancliffe	SK544821			7.3	-1.6	1.9	3.0	3.0	9.2		CF
10.5	Worksop Rhodesia WRW	SK568797			7.6	+0.5	2.4	3.5	3.5	10.0		
13.0	Bunter W Boundary											
13.1	Worksop (331)	SK575594	82.4		7.9		2.4	3.5	3.5	10.3	0.09	PF
14.5	BWB Kilton	SK589790			11.3	-7.0	-4.6	1.7	1.7	6.7		CF
16.0	NCB Manton	SK608762			14.5	+5.2	0.6	6.9	6.9	15.1		CD
17.0	Worksop WRW	SK614793			16.6	+1.4	2.0	8.3	8.3	18.6		
21.0	Checker House	SK648816	132		25.0		2.0	8.3	8.3	27.0	0.19	cmg
35.5	Blyth (332)	SK610870	153		32.5		2.0	8.3	8.3	34.5	0.21	CMG
37.5	Oldcotes Dyke	SK623876	+82.0	13.5	46.5	+9.2	11.2	17.5	17.5	57.7	(0.16)	See Oldcotes Dyke
38.0	Blyth WRW	SK634872			47.0	+0.2	11.3	17.7	17.7	58.3		
42.0	Serlby Park (337)	SK641987	259		57.0		11.3	17.7	17.7	68.3	0.23	CMG
46.5	Idle confluence	SK659921	263		70.0		11.3	17.7	17.7	81.3	0.27(e)	

DRY WEATHER FLOW CONDITION - OLDCOTES DYKE

DISTANCE	EVENT	NGR	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
4.5	Maltby (333)	SK521919			2.6					2.6(e)		CMG N/R
7.5	Maltby WRW	SK542904			3.5	+3.9	3.9	3.9	3.9			
7.7	)NCB Thurcroft	SK498895				+0.9						
	)& Slade Hooton WRW	SK525888			3.6	+2.7	7.5	7.5	7.5	11.1		
8.7	Stone (334)	SK551899	29.0		3.9		7.5	7.5	7.5	11.4	0.14	CMG
	Bunter W Boundary											
14.5	Hodsock Bk (335)	SK611871*	+31.3*	6.0							(0.19)	CMG
	-Hodsock WRW	SK596862			13.3	+1.7	9.2	9.2	9.2	22.5		
15.0	Blyth (336)	SK615876	81.3		13.4		9.2	9.2	9.2	22.6	0.16	CMG
16.0	Ryton Confluence	SK623876	82.0		13.5		9.2	9.2	9.2	22.7	0.16	

DRY WEATHER FLOW CONDITION - RIVER TORNE

DISTANCE	EVENT	N.G.R.	AREA	NATURAL		ARTIFICIAL		EFFLUENT		TOTAL FLOW	NATURAL YIELD	COMMENTS
				INPUT	TOTAL	INPUT	TOTAL	sewage industrial	sewage industrial thermal			
0.5	Maltby NCB	SK551925			0.8	+0.4	0.4	0.4	0.4	1.2		CD
7.0	Harworth WRW	SK611921			7.1	+1.4	1.8	1.8	1.8	8.9		
8.0	Spital Hill (341)	SK607932	45.2		8.0		1.8	1.8	1.8	9.8	0.18	CMG
11.0	Tickhill WRW	SK605936			10.2	+0.7	2.5	2.5	2.5	12.7		
14.0	Loversall Dyke (342)	SK573985										CMG N/R
	-Yorkshire Main NCB	SK545994				+1.0	6.2	6.2	6.2	18.7		
	-Warmsworth WRW	SK550998			12.5	+2.7						
14.5	Rossington NCB	SK599983				-1.0	5.6	5.9	5.9	18.0		
15.0		SK604903				+0.4		6.3	6.3	18.4		CD
18.0	Rossington (343)	SK628997	126		15.3		5.6	6.3	6.3	20.9	0.12	CMG
19.0	Trib -Balby WRW (YWA)	SE570010			15.4	+6.8	12.4	13.1	13.1	27.8		
19.5	Branton WRW	SE637007			15.9	+1.2	13.6	14.3	14.3	29.5		
26.0	Auckley (344)	SE616012	143		17.2		13.6	14.3	14.3	30.8	0.12	PF:cmg's
42.0	Trent confluence	SE830094	382		19.5		13.6	14.3	14.3	33.1(e)		

A3,30

APPENDIX 4

LIST OF SYMBOLS AND ABBREVIATIONS APPEARING IN APPENDIX 3

BWB	British Waterways Board
cmg's	Flow based on a number of current meter gaugings
CD	Colliery Discharge
CEGB	Central Electricity Generating Board
CF	Canal Feeder
CMG	A specific current meter gauging
CW	Cooling Water
DWF	Dry Weather Flow
D/s	Downstream. Suffix d/s indicates that the event is downstream of the flow measuring station.
ID	Industrial Discharge
IW	Industrial (not cooling) Water
Ml/d	Megalitres per day
N/A	Not available
NGR	National Grid Reference
N/R	Not Reliable
PF	Processed Flow
PWS	Public Water Supply
SI	Spray Irrigation
WRW	Water Reclamation Works
STWA	Severn-Trent Water Authority
Column 2 (n)	Refers to a STWA low flow survey gauging site
Column 2 *	NGR of gauging site, not NGR of river/tributary confluence
Column 3 *	Area to gauging site, not area of full subcatchment
Column 12 ()	Brackets indicate yield of subcatchment
Column 12 e	Estimated using yield maps
Column 13 max	Licensed daily maximum take
Column 13 s	Influenced by flow from a sough or soughs
Column 13 e	Estimated value
Column 13 pf	Prescribed flow
Column 13 MF	Mean flow from WRW

APPENDIX 5

RIVERFLOW MEASURING STATIONS USED IN THE FLOW FREQUENCY AND DURATION ANALYSES

FREQUENCY	DURATION
Syston	Syston
Ratcliffe Culey	Ratcliffe Culey
Polesworth	Ilam
Ilam	Izaak Walton
Calthorpe Park	Hollinsclough
Yorkshire Bridge	Hulme End
Izaak Walton	Waterhouses
Hollinsclough	Rocester (Dove)
One Barrow	Rocester (Churnet)
Waterhouses	Kingston
Rocester (Dove)	Drakelow
Rocester (Churnet)	Colwick
Burcote	Burcote
Stareton	Stareton
Roddington	Roddington
Walcot	Walcot
Tenbury	Tenbury
Rhos-y-Pentref	Rhos-y-Pentref
	Llanyblodwell
	Hookagate
	Besford Bridge
	Hartford Mill
	Alscot Park
	Yeaton

APPENDIX 6

ESTIMATION OF FLOW FREQUENCY CURVE USING THE 'LOW FLOW STUDY' (IOH, 1980)

Catchment - R. Ecclesbourne to SK 320 447
- 50 km^2

(i) Calculate 'external relationship'

Ten day mean annual minimum flow = MAM(10)

$$MAM(10) = 11.2\sqrt{BFI} + 0.0982\sqrt{SAAR} - 6.81$$

BFI = Baseflow Index = 0.50 (100% Millstone Grit)
SAAR = Average Annual Rainfall = 790 mm

MAM (10) = 15% ADF (Average flow, cumecs).

(ii) Calculate 'internal relationship (duration)'

GRADMAM = Rate of change of MAM(D) ÷ MAM(10) with D.

$$\log_{10}(GRADMAM) = 0.00842\sqrt{SAAR} - 0.137\sqrt{MAM(10)} - 1.61$$

$$= 0.0125$$

MAM (7) = (1 + (7-10) GRADMAM) MAM 10

= 14.44% ADF

(iii) Calculate 'internal relationship (frequency)'

Using curve 4, Figure 3.3., Low Flow Study, p.29

2.33 year 7 day flow = 0.91 x MAM(7) = 13.65% ADF
5.0 " " " " = 0.69 x " = 10.35% ADF
10.0 " " " " = 0.58 x " = 8.70% ADF
25.0 " " " " = 0.47 x " = 7.05% ADF
50.0 " " " " = 0.40 x " = 6.00% ADF

(iv) Converting to absolute units.

Average flow (ADF) = SAAR - Actual Evaporation
= 340 mm
= 0.54 cumecs (46.9 Mld)

2.33	year	7	day	flow	=	6.4 Mld
5.0	"	"	"	"	=	4.8 Mld
10.0	"	"	"	"	=	4.1 Mld
25.0	"	"	"	"	=	3.3 Mld
50.0	"	"	"	"	=	2.8 Mld.

APPENDIX 7

GENERAL CATCHMENT MODEL

COMPUTER LISTING

(Calculation procedure only, no input/output routines)

```
      SUBROUTINE RRMODL(MSC,MHRS,NHRS)
      COMMON/DFAV/NXT4,NXT5,NXT6,NXT7,NXT8,NXT11
      COMMON/ARAY/PREC(140),TEMP(140),EVAP(140),PRFL(210),ROFF(210),
     1            SIMR(110),DUMMY(210)
      COMMON/PARM/NPA,NPP,Y(10),YI(50),IQUIV(50,10)
      DIMENSION P(30),S(12)
      EQUIVALENCE (P(1),PTSN),(P(2),PDSN),(P(3),PTML),(P(4),PCML),
     1 (P(5),PXML),(P(6),PMIN),(P(7),PCIN),(P(8),PSRC),(P(9),PSRS)
     2,(P(10),PRPM),(P(11),PSST),(P(12),PMPC),(P(13),PDRF),(P(14),PDRX
     3,(P(15),PGWF),(P(16),PLAG),(P(17),PDUR),(P(18),PIEF),(P(19),PETF
     4,(P(20),PSET),(P(21),PDET),(P(22),PETM),(P(23),PCIF),(P(24),PCIX
     5,(P(25),PCOF),(P(26),PCOX),(P(27),PCBF)
      EQUIVALENCE (S(1),SSNW),(S(2),SDNS),(S(3),SDPT),(S(4),SINT),
     1 (S(5),SSMD),(S(6),SGRW),(S(7),SCIB),(S(8),SCOB)
      NREC=(MSC-1)*12+1
      READ (5'NREC,5010) AREA,ALT
      DO 10 J=1,NPP
      DO 10 K=1,NPA
      IF (IQUIV(J,K).GT.0) YI(J)=Y(K)
   10 CONTINUE
      DO 20 J=1,27
      P(J)=YI(J)
   20 CONTINUE
      DO 30 J=1,8
      JJ=J+30
      S(J)=YI(JJ)
   30 CONTINUE
      PCBR=PCBF*3.6/AREA
      PCXI=1.0/PCIX
      PCBR=(PCBR/PCIF)**PCXI
      NREC=(MSC-1)*75+2
      READ (6'NREC,6000)(PREC(J),J=1,110)
      READ (6'NXT6,6000)(TEMP(J),J=1,110)
      READ (6'NXT6,6000)(EVAP(J),J=1,110)
      NREC=(MSC-1)*75+57
      READ (6'NREC,6000)(PREC(J),J=111,140)
      READ (6'NXT6,6000)(TEMP(J),J=111,140)
      READ (6'NXT6,6000)(EVAP(J),J=111,140)
      DO 50 I=1,210
      PRFL(I)=0.0
   50 CONTINUE
      KHRS=111-MHRS
      LHRS=110+NHRS
      KLAG=IFIX(PLAG)
      KDUR=IFIX(PDUR)
      XLAG=PLAG-FLOAT(KLAG)
      KREM=INT(PDUR+XLAG)
      KRAP=INT(PDUR+PLAG)
      XLST=PDUR+PLAG-FLOAT(KRAP)
      KKHRS=KHRS-KLAG-KDUR
      LLHRS=LHRS-KLAG
      DO 900 I=KKHRS,LLHRS
      IF (I.LT.1) GO TO 900
      IF (I.GT.140) GO TO 80
      PRECI=PREC(I)
      TEMPI=TEMP(I)
      EVAPI=EVAP(I)
      GO TO 90
   80 PRECI=0.0
      TEMPI=TEMP(140)
      EVAPI=EVAP(140)
   90 CONTINUE
```

```
      TEMPI=5.0
      VROF=0.0
      VMLT=0.0
      VRAN=0.0
      VDRN=0.0
      VPRC=0.0
      IF (PRECI.LE.0.0) GO TO 210
      IF (TEMPI.LE.PTSN) GO TO 100
      VRAN=PRECI
      GO TO 200
  100 SSNW=SSNW+PRECI
      VDNS=0.1+0.015*TEMPI
      IF (VDNS.LT.PDSN)VDNS=PDSN
      SDPT=SDPT+PRECI/VDNS
      SDNS=SSNW/SDPT
      GO TO 210
  200 IF (SSNW.LE.0.005) GO TO 300
      SSNW=SSNW+VRAN
      SDPT=SDPT+VRAN
      SDNS=SSNW/SDPT
      VRAN=0.0
  210 IF (SSNW.LE.0.005) GO TO 300
      IF (TEMPI.LE.PTML) GO TO 300
      VMLT=PCML*(TEMPI-PTML)**PXML
      SDPT=SDPT-VMLT/SDNS+VMLT
      SDNS=SSNW/SDPT
      IF (SDNS.LE.PMDN) GO TO 220
      VMLT=SSNW-SDPT*PMDN
      GO TO 300
  220 VMLT=0.0
  300 VTRM=VRAN+VMLT
      IF (VTRM.LE.0.005) GO TO 310
      SINT=SINT+VTRM
      IF (SINT.LE.PCIN) GO TO 310
      VTRU=SINT-PCIN
      SINT=PCIN
      GO TO 400
  310 VTRU=0.0
      GO TO 500
  400 LOOP=1+IFIX(VTRU)
      FLOP=FLOAT(LOOP)
      DO 450 KLOP=1,LOOP
      VROP=PSRC*EXP(PSRS*SSMD*(-1.0))
      IF (VROP.GT.PRPM) VROP=PRPM
      VROF=VROF+VROP*VTRU/FLOP
  450 SSMD=SSMD-(1.0-VROP)*(VTRU/FLOP)
  500 IF (SSMD.GE.-0.1) GO TO 700
      VPRC=PMPC*SSMD/(PSST*(-1.0))
      IF (VPRC.LE.PMPC) GO TO 690
  600 VPRC=PMPC
      SSMD=SSMD+VPRC
      VEXS=(PSST+SSMD)*(-1.0)
      IF (VEXS.LT.0.1) GO TO 700
      VDRN=(VEXS**PDRX)/PDRF
      SSMD=SSMD+VDRN
      GO TO 700
  690 SSMD=SSMD+VPRC
  700 SGRW=SGRW+VPRC
      VBSF=(SGRW**1.5)/PGWF
      SGRW=SGRW-VBSF
      VTOF=VROF+VDRN+VBSF
      IST=KLAG+I+1
      LAST=KLAG+I+KREM-1
```

```
      PRFL(IST-1)=PRFL(IST-1)+(1.0-XLAG)*VTOF/PIUR
      PRFL(LAST+1)=PRFL(LAST+1)+XLST*VTOF/PIUR
      DO 750 L=IST,LAST
      PRFL(L)=PRFL(L)+VTOF/PIUR
  750 CONTINUE
      IF (EVAPI.LT.0.002) GO TO 860
      VIEP=EVAPI*PIEF
      IF (SINT.LT.VIEP) GO TO 800
      SINT=SINT-VIEP
      VREP=0.0
      GO TO 860
  800 SINT=0.0
      VREP=EVAPI-SINT/PIEF
      IF (VREP.LT.0.002) GO TO 860
      IF (SSMD.GT.PSET) GO TO 820
      VTRP=VREP*PETF
      GO TO 850
  820 IF (SSMD.LT.PDET) GO TO 830
      VTRP=VREP*PETM
      GO TO 850

  830 VTRP=VREP*(PETF-(SSMD-PSET)*(PETF-PETM)/(PDET-PSET))
  850 SSMD=SSMD+VTRP
  860 ISTT=110-KLAG-KDUR
  900 CONTINUE
      DO 950 I=KHRS,LHRS
      SCIB=SCIB+PRFL(I)
      IF (SCIB.LE.PCBR) GO TO 920
      VCXS=SCIB-PCBR
      SCIB=PCBR
      SCOB=SCOB+VCXS
  920 VCIB=PCIF*(SCIB**PCIX)
      VLIM=SCIB*0.75
      IF (VCIB.GT.VLIM) VCIB=VLIM
      SCIB=SCIB-VCIB
      IF (SCOB.LT.0.001) GO TO 930
      VCOB=PCOF*(SCOB**PCOX)
      VLIM=SCOB*0.75
      IF (VCOB.GT.VLIM) VCOB=VLIM
      SCOB=SCOB-VCOB
      GO TO 940
  930 VCOB=0.0
  940 CONTINUE
  950 ROFF(I)=VCIB+VCOB
      NREC=(MSC-1)*75+46
      READ (6'NREC,6000)(SIMR(J),J=1,110)
      KKHRS=KHRS-1
      DO 970 I=KHRS,110
      SIMR(I)=ROFF(I)*AREA/3.6
  970 CONTINUE
      WRITE(6'NREC,6000)(SIMR(J),J=1,110)
      NREC=(MSC-1)*75+66
      DO 980 I=111,210
      IF (I.GT.LHRS) GO TO 975
      ROFF(I)=ROFF(I)*AREA/3.6
      GO TO 980
  975 ROFF(I)=(-9.9)
  980 CONTINUE
      WRITE(6'NREC,6000)(ROFF(J),J=111,210)
      RETURN
 5000 FORMAT(6F10.4)
 5010 FORMAT(20X,2F6.1)
 6000 FORMAT(10F6.2)
      END
```

APPENDIX 8

```
      PROGRAM UCM
      DIMENSION PPT(122),RO(122),Q(210),P(8),S(3),V(6)
      READ(1,*)AREA,(P(J),J=1,8)
      DO 10 J=1,122
   10 PPT(J)=0.0
      READ(1,*)IW1
      READ(1,*)(PPT(J),J=1,IW1)
      READ(1,*)S(3),SQ
      READ(1,*)PSST
      SQ=SQ/1000.0
      S(1)=(SQ*P(1))**0.6000
      S(2)=((SQ/P(2))**0.6000)-SQ
      DO 50 I=1,210
   50 Q(I)=0.0
      KLAG=IFIX(P(3))
      IW1=IFIX(P(4))
      XLAG=P(3)-FLOAT(KLAG)
      KREM=INT(P(4)+XLAG)
      IW2=INT(P(4)+P(3))
      XLST=P(4)+P(3)-FLOAT(IW2)
      IW3=122-KLAG
      DO 900 I=1,IW3
      V(1)=0.0
      V(2)=0.0
      IF(PPT(I).LE.0.005)GOTO 500
      V(3)=P(5)*EXP(P(6)*S(3)*(-1.0))
      IF(V(3).GT.P(7))V(3)=P(7)
      V(1)=V(1)+V(3)*PPT(I)
      S(3)=S(3)-(1.0-V(3))*PPT(I)
  500 IF(S(3).GE.-0.1)GOTO 700
      V(2)=P(8)*S(3)/(PSST*(-1.0))
      IF(V(2).GT.P(8))V(2)=P(8)
      S(3)=S(3)+V(2)
  700 S(1)=S(1)+V(2)
      V(4)=(S(1)**1.5)/P(1)
      S(1)=S(1)-V(4)
      V(5)=(V(1)+V(4))/P(4)
      IW1=KLAG+I+1
      IW2=KLAG+I+KREM-1
      Q(IW1-1)=Q(IW1-1)+(1.0-XLAG)*V(5)
      Q(IW2+1)=Q(IW2+1)+XLST*V(5)
      DO 900 J=IW1,IW2
      Q(J)=Q(J)+V(5)
  900 CONTINUE
      DO 950 I=1,122
      S(2)=S(2)+Q(I)
      V(6)=P(2)*(S(2)**1.6667)
      S(2)=S(2)-V(6)
  950 RO(I)=V(6)
      DO 970 I=1,122
  970 RO(I)=RO(I)*AREA/3.6
      WRITE(6,6000)(RO(J),J=1,122)
 6000 FORMAT(1H,10F9.3)
      STOP
      END
```

Explanation. UCM model.

AREA	Catchment Area
P (1)	PGWF
P (2)	PCIF
P (3)	PLAG
P (4)	PDUR
P (5)	PSRC
P (6)	PSRS
P (7)	PRPM
P (8)	PMPC
S (1)	Groundwater Store
S (2)	Channel Store
S (3)	SMD Store
PPT	Rainfall ordinates (total, IW1)
SQ	Initial discharge at outflow point
V (1) – V (6)	Variables

APPENDIX 9

GAUGED CATCHMENT DATA

River Trent to Stoke-on-Trent

(SJ 892 467)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

a = 9.83 b = +0.0203 c = 1.713 r = 1.6

Raingauges:	Name	weighting
Gauge 1 :	Stanley	4
Gauge 2 :	Whitmore	1

Catchment parameters :

Area (km^2)	53.2
Average altitude (m)	191.3
Annual average rainfall (mm)	825
Main stream length (km)	12.9
Leng (km)	27.1
Slope (m/km)	10.0
Relief (m)	211.8
Form	0.033
Steam frequency (j/km^2)	1.74
Channel cross sectional area (XSEC) (m^2)	4.43
Mean hydraulic radius (XSWP) (m)	0.686
Channel volume (Chan) ($m^3 \times 10^3$)	120.0
Manning roughness	0.044
Soil	0.49
Geology A (permeability)	0.20
Geology B (arbitrary index)	3.04
Dry weather flow ($Mld/km^2 \times 100$)	14.90

River Sow to Great Bridgford

(SJ 885 270)

Stage discharge relationship = $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	16.094	b	=	+0.00497	c	=	2.568	r = 0.46
Range 2	a	=	10.177	b	=	+0.0102	c	=	1.991	r = 0.74
Range 3	a	=	9.585	b	=	+0.0554	c	=	2.251	r = 1.6

Raingauges:	Name	Weighting
Gauge 1 :	Whitmore	4
Gauge 2 :	Hollies	4
Gauge 3 :	Stone	2

Catchment parameters :

Area (km^2)	144.0
Average altitude (m)	126.0
Annual average rainfall (mm)	750
Main stream length (km)	19.9
Leng (km)	61.1
Slope(m/km)	2.21
Relief (m)	136.8
Form	0.038
Stream frequency (j/km^2)	1.24
Channel cross sectional area (xSec) (m^2)	4.09
Mean hydraulic radius (XSWP) (m)	0.687
Channel volume (Chan) ($m^3 \times 10^3$)	120.0
Manning roughness	0.050
Soil	0.35
Geology A (permeability)	2.00
Geology B (arbitrary index)	2.64
Dry weather flow ($Mld/km^2 \times 100$)	27.50

River Penk to Penkridge

(SJ 922 145)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	= 8.465	b	= -0.08124	c	= 1.34	r	= 1.15
Range 2	a	=19.143	b	= -0.565	c	= 1.354	r	= 1.67
Range 3	a	= 3.778	b	= +0.313	c	= 2.554	r	= 2.5

Raingauges:	Name	Weighting
Gauge 1 :	Rodbaston	3
Gauge 2 :	Cosford	3
Gauge 3 :	Hollies	3
Gauge 4 :	Walsall Wood	2

Catchment parameters :

Area (km^2)	266.0
Average altitude (m)	119.7
Annual average rainfall (mm)	690
Main stream length (km)	19.8
Leng (km)	109.6
Slope (m/km)	2.13
Relief (m)	152.7
Form	0.027
Stream frequency (j/km^2)	0.89
Channel cross sectional area (XSec) (m^2)	6.49
Mean hydraulic radius (XSWP) (m)	0.738
Channel volume (Chan)	711.3
Manning roughness	0.041
Soil	0.45
Geology A (permeability)	1.00
Geology B (arbitrary index)	2.50
Dry weather flow (Mld/km^2 x 100)	19.92

River Rea to Calthorpe Park

(SP 071 847)

Stage discharge relationship : $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	8.47	b	=	+0.0079	c	=	1.6222	r = 0.6
Range 2	a	=	18.365	b	=	-0.096	c	=	2.297	r = 0.9
Range 3	a	=	34.884	b	=	-0.497	c	=	1.254	r = 2.0

Raingauges:	Name	Weighting
Gauge 1 :	Warley Park	4
Gauge 2 :	Elmdon	2
Gauge 3 :	Alvechurch	2

Catchment parameters :

Area (km^2)	72.6
Average altitude (m)	169.0
Annual average rainfall (mm)	730
Main stream length (km)	16.0
Leng (km)	34.8
Slope (m/km)	5.67
Relief (m)	183.0
Form	0.054
Stream frequency (j/km^2)	0.62
Channel cross sectional area (XSec) (m^2)	4.01
Mean hydraulic radius (XSWP) (m)	0.529
Channel volume (Chan) ($m^3 \times 10^3$)	174.2
Manning roughness	0.047
Soil	0.63
Geology A (permeability)	1.20
Geology B (arbitrary index)	2.70
Dry weather flow ($Mld/km^2 \times 100$)	13.08

River Cole to Coleshill

(SP 183 880)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	28.415	b	=	-0.0102	c	=	2.349	r = 0.55
Range 2	a	=	29.635	b	=	-0.042	c	=	2.237	r = 1.7

Raingauges:	Name	Weighting
Gauge 1 :	Elmdon	3
Gauge 2 :	Alvechurch	3
Gauge 3 :	Henley	1

Catchment parameters :

Area (km^2)	135.0
Average altitude (m)	126.5
Annual average rainfall (mm)	700
Main stream length (km)	22.2
Leng (km)	58.2
Slope (m/km)	3.12
Relief (m)	120.6
Form	0.049
Stream frequency (j/km^2)	0.57
Channel cross sectional area (XSec) (m^2)	8.77
Mean hydraulic radius (XSWP) (m)	0.945
Channel volume (Chan) ($m^3 \times 10^3$)	510.2
Manning roughness	0.045
Soil	0.61
Geology A (permeability)	0.00001
Geology B (arbitrary index)	1.50
Dry weather flow ($Mld/km^2 \times 100$)	16.50

River Anker to Polesworth

(SK 263 064)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	19.559	b	=	+0.0102	c	=	1.6074	r	=	1.75
Range 2	a	=	12.374	b	=	+0.0824	c	=	2.271	r	=	2.8

Raingauges:	Name	Weighting
Gauge 1 :	Atherstone	4
Gauge 2 :	Hinckley	4
Gauge 3 :	Mt. St. Bernards	2

Catchment parameters :

Area (km^2)	374.0
Average altitude (m)	107.6
Annual average rainfall (mm)	650
Main stream length (km)	31.2
Leng (km)	161.8
Slope (m/km)	1.54
Relief (m)	218.6
Form	0.032
Stream frequency (j/km^2)	0.49
Channel Cross Sectional Area (XSec) m^2	10.89
Mean hydraulic radius (XSWP) (m)	0.922
Channel volume (Chan) ($m^3 \times 10^3$)	1762.0
Manning roughness	0.027
Soil	0.46
Geology A (permeability)	0.0000215
Geology B (arbitrary index)	1.65
Dry weather flow ($Mld/km^2 \times 100$)	6.82

River Churnet to Basford Bridge

(SJ 982 522)

Stage discharge relationship : $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	16.934	b	= +0.0182	c	= 2.6731	r = 0.6
Range 2	a	=	9.6216	b	= +0.0266	c	= 1.5493	r = 2.8
Range 3	a	=	1.8943	b	= -0.0935	c	= 3.2464	r = 3.0

Raingauges:	Name	Weighting
Gauge 1 :	Stanley Reservoir	3
Gauge 2 :	Cauldon Lowe	2

Catchment parameters :

Area (km^2)	139.0
Average altitude (m)	234.3
Annual average rainfall (mm)	970
Main stream length (km)	18.6
Leng (km)	65.30
Slope (m/km)	9.89
Relief (m)	372
Form	0.041
Stream frequency (j/km^2)	1.47
Channel Cross Sectional Area (XSEC) (m^2)	15.86
Mean hydraulic radius (XSWP) (m)	0.622
Channel volume (Chan) ($m^3 \times 10^3$)	1035.7
Manning roughness	0.047
Soil	0.46
Geology A (permeability)	1.60
Geology B (arbitrary index)	4.03
Dry weather flow ($Mld/km^2 \times 100$)	23.31

River Manifold to Ilam

(SK 140507)

Stage discharge relationship : $Q = a\ (h+b)^c$ up to max h=r metres

a = 26.598 b = +0.0411 c = 1.7291 r = 3.0

Raingauges:	Name	Weighting
Gauge 1 :	Hollinsclough	3
Gauge 2 :	Cauldon Lowe	3
Gauge 3 :	Stanley Reservoir	2

Catchment parameters:

Area (km^2)	145.0
Average altitude (m)	305.8
Annual average rainfall (mm)	1100
Main stream length (km)	29.3
Leng (km)	80.6
Slope (m/km)	7.73
Relief (m)	382.0
Form	0.039
Stream frequency (j/km^2)	1.68
Channel cross sectional area (XSEC) (m^2)	31.25
Mean hydraulic radius (XSWP) (m)	1.54
Channel volume (Chan) ($m^3 \times 10^3$)	915.60
Manning roughness	0.056
Soil	0.43
Geology A (permeability)	5.50
Geology (arbitrary index)	4.50
Dry weather flow ($Mld/km^2 \times 100$)	41.03

River Dove to Izaak Walton

(SK 146 509)

Stage discharge relationship: $Q = a.(h+b)^c$ up to max h=r metres

Range 1 a = 16.058 b = +0.00781c = 2.5616 r = 0.38

Range 2 a = 14.07 b = -0.1196 c = 1.7113 r = 1.5

Raingauges	Name	Weighting
Gauge 1 :	Hollinsclough	4
Gauge 2 :	Longcliffe	1
Gauge 3 :	Stanley Reservoir	1

Catchment parameters :

Area (km^2)	83.0
Average altitude (m)	318.5
Annual average rainfall (mm)	1100
Main stream length (km)	30.4
Leng (km)	30.4
Slope (m/km)	6.05
Relief (m)	419.6
Form	0.022
Stream frequency (j/km^2)	0.6
Channel cross-sectional area (XSEC) (m^2)	13.01
Mean hydraulic radius (XSWP) (m)	0.891
Channel volume (Chan) ($m^3 \times 10^3$)	395.5
Manning roughness	0.052
Soil	0.18
Geology A (permeability)	9.10
Geology B (arbitrary index)	4.90
Dry weather flow ($Mld/km^2 \times 100$)	60.84

River Wye to Ashford

(SK 181 696)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1 a = 15.3268 b = -0.8404 c = 1.4339 r = 2.37

Range 2 a = 0.0334 b = 0.0 c = 7.8165 r = 2.8

Raingauges:	Name	Weighting
Gauge 1 :	Chapel Reservoir	4
Gauge 2 :	Tideswell	4
Gauge 3 :	Hollinsclough	2

Catchment parameters :

Area (km^2)	151.0
Average altitude (m)	341.4
Annual average rainfall (mm)	1100
Main stream length (km)	24.3
Leng (km)	31.7
Slope (m/km)	8.85
Relief (m)	412.0
Form	0.04
Stream frequency (j/km^2)	0.34
Channel cross sectional area (XSEC) (m^2)	8.46
Mean hydraulic radius (XSWP) (m)	0.622
Channel volume (Chan) ($m^3 \times 10^3$)	268.2
Manning roughness	0.060
Soil	0.16
Geology A (permeability)	9.00
Geology B (arbitrary index)	4.69
Dry weather flow ($Mld/km^2 \times 100$)	48.48

River Amber to Wingfield Park

(Sk 376 520)

Stage discharge relationship : $Q = a\ (h+b)^{c}$ up to max h=r metres

Range 1	a	=	16.0118b	=	-0.00032	c	=	2.5298	r = 0.31
Range 2	a	=	7.4938b	=	-0.2422	c	=	0.8274	r = 2.0
Range 3	a	=	6.2557b	=	-0.26	c	=	1.175	r = 2.45
Range 4	a	=	0.2347b	=	-0.6265	c	=	6.9644	r = 2.8

Raingauges:	Name	Weighting
Gauge 1 :	Ogston	4
Gauge 2 :	Sutton in Ashfield	2

Catchment parameters:

Area (km^2)	114.0
Average altitude (m)	161.3
Annual average rainfall (mm)	800
Main stream length (km)	18.8
Leng (km)	62.3
Slope (m/km)	8.58
Relief (m)	257.8
Form	0.033
Stream frequency (j/km^2)	1.21
Channel cross sectional area (XSEC) (m^2)	11.54
Mean hydraulic radius (XSWP) (m)	1.035
Channel volume (Chan) ($m^3 \times 10^3$)	781.2
Manning roughness	0.058
Soil	0.35
Geology A (permeability)	0.90
Geology B (arbitrary index)	3.12
Dry weather flow ($Mld/km^2 \times 100$)	16.00

River Soar to Narborough

(SP 551985)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	15.2862	b	=	-0.01516	c	=	2.3817	r = 0.59
Range 2	a	=	8.5063	b	=	-0.0886	c	=	1.0781	r = 1.1
Range 3	a	=	7.645	b	=	-0.374	c	=	2.0361	r = 1.8

Raingauges:	Name	Weighting
Gauge 1 :	Narborough	3
Gauge 2 :	Stanford Reservoir	1
Gauge 3 :	Hinckley	3

Catchment parameters :

Area (km^2)	211.0
Average altitude (m)	100.0
Annual average rainfall (mm)	600
Main stream length (km)	21.9
Leng (km)	96.8
Slope (m/km)	2.56
Relief (m)	92.2
Form	0.052
Stream frequency (j/km^2)	0.63
Channel cross sectional area (XSEC) (m^2)	8.64
Mean hydraulic radius (XSWP) (m)	1.019
Channel volume (Chan) ($m^3 \times 10^3$)	933.1
Manning roughness	0.044
Soil	0.40
Geology A (permeability)	0.0000145
Geology B (arbitrary index)	1.50
Dry weather flow ($Mld/km^2 \times 100$)	9.15

River Sence to Blaby

(SP 566 985)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	16.6833	b	= +0.00976	c	= 2.6067	r = 0.54
Range 2	a	=	8.1087	b	= +0.0187	c	= 1.4686	r = 1.6
Range 3	a	=	0.3769	b	= +0.7021	c	= 4.5273	r = 2.4

Raingauges:	Name	Weighting
Gauge 1:	Narborough	3
Gauge 2:	Wistow Hall	4
Gauge 3:	Stanford Reservoir	1

Catchment parameters :

Area (km^2)	129.0
Average altitude (m)	119.2
Annual average rainfall (mm)	620
Main stream length (km)	26.0
Leng (km)	59.8
Slope (m/km)	3.18
Relief (m)	147.5
Form	0.036
Stream frequency (j/km^2)	0.75
Channel cross sectional area (XSEC) (m^2)	7.71
Mean hydraulic radius (XSWP) (m)	0.841
Channel volume (Chan) ($m^3 \times 10^3$)	461.1
Manning roughness	0.051
Soil	0.45
Geology A (permeability)	0.0000965
Geology B (arbitrary index)	1.50
Dry weather flow ($Mld/km^2 \times 100$)	7.13

River Wreake at Syston

(SK 615124)

Stage discharge relationship: $Q = a\ (h+b)^c$ up to max h=r metres

Range 1	a	=	9.824	b	=	+0.01148	c	=	1.6119	r = 1.65
Range 2	a	=	0.7307	b	=	0.0	c	=	6.7191	r = 2.2

Raingauges:	Name	Weighting
Gauge 1 :	Wymondham	4
Gauge 2 :	Brooksby	3
Gauge 3 :	Wanlip	2
Gauge 4 :	Barnstone	2

Catchment parameters :

Area (km^2)	401.0
Average altitude (m)	117.7
Annual average rainfall (mm)	630
Main stream length (km)	42.2
Leng (km)	195.4
Slope (m/km)	1.71
Relief (m)	172.4
Form	0.044
Stream frequency (j/km^2)	0.77
Channel cross sectional area (XSEC) (m^2)	27.82
Mean hydraulic radius (XSWP)(m)	1.84
Channel volume (Chan) ($m^3 \times 10^3$)	5436.0
Manning roughness	0.057
Soil	0.42
Geology A (permeability)	0.40
Geology B (arbitrary index)	1.665
Dry weather flow ($Mld/km^2 \times 100$)	4.61

APPENDIX 10

BEST FIT PARAMETER VALUES - ALL EVENTS

RIVER TRENT @ STOKE

	01	02	03	04	05	06	08	09	10	11
FLOW	3.5	7.5	3.0	14.5	16.0	8.0	6.0	15.0	8.0	0.5
SMD	67	96	0	0	0	1	18	0	0	80
PSRC	0.360	0.430	0.27	0.295	0.570	0.412	0.450	0.430	0.320	0.376
PSRS	0.024	0.020	0.020	0.028	0.027	0.048	0.016	0.030	0.027	0.021
PRPM	-	-	0.89	0.53	0.71	0.76	0.69	0.45	0.90	-
PMPC	0.30	0.10	0.10	0.11	0.10	0.89	0.15	0.89	0.10	0.29
PGWF	11900	4770	19850	9540	11110	15400	21700	6750	32600	12070
PLAG	0.00	0.01	0.10	0.39	1.88	0.02	0.68	0.00	0.02	0.28
PDUR	5.44	1.99	2.01	9.10	8.85	18.33	1.33	11.50	12.50	1.78
PCIF	0.118	0.046	0.060	0.012	0.021	0.021	0.067	0.016	0.062	0.051
PCOF	-	-	-	-	-	-	-	-	-	-
PCOX	-	-	-	-	-	-	-	-	-	-
PCBF	-	-	-	-	-	-	-	-	-	-
%ER (F)	5	53	2	38	50	44	5	325	37	0
%EF (ℓ)	94	77	90	98	98	90	97	83	91	92

Bankfull discharge 35 m^3/s

RIVER SOW @ GREAT BRIDGFORD

	01	02	03	04	05	06	08	09	10	11
FLOW	11.0	2.2	7.5		12.0	10.5	5.0	13.0	12.0	0.5
SMD	52	100	0		0	1	18	0	0	80
PSRC	0.457	0.130	0.200		0.352	0.304	0.125	0.223	0.281	0.061
PSRS	0.031	0.016	0.036		0.026	0.022	0.022	0.022	0.047	0.026
PRPM	-	-	0.60		0.74	0.60	0.59	0.62	0.60	-
PMPC	0.12	0.10	0.11		0.10	0.81	0.15	0.55	0.10	0.11
PGWF	3814	26650	18440		27346	22770	14800	20000	30700	32600
PLAG	0.02	0.02	0.23		0.50	0.82	0.01	0.48	0.21	0.21
PDUR	19.70	14.70	10.00		27.80	25.4	22.60	22.30	24.80	30.30
PCIF	0.028	0.075	0.143		0.035	0.034	0.063	0.046	0.108	0.037
PCOF	0.029	-	-		-	-	-	-	-	-
PCOX	3.54	-	-		-	-	-	-	-	-
PCBF	10.60	-	-		-	-	-	-	-	-
%ER (F)	34	2	1		36	64	1	12	11	0
%EF (L)	98	95	99		98	93	99	99	99	99

Bankfull at Measuring Station 5.5 m^3/s
Bankfull upstream 7.5 m^3/s

RIVER PENK @ PENKRIDGE

	01	02	03	04	05	06	08	09	10	11
FLOW	10.5	17.5	28.0		17.0	25.0	31.0	32.0		4.0
SMD	68	100	0		0	1	18	0		80
PSRC	0.4	0.27	0.69		0.346	0.333	0.69	0.346		0.773
PSRS	0.029	0.013	0.04		0.027	0.066	0.029	0.028		0.028
PRPM	-	-	0.63		0.06	0.74	0.59	0.59		-
PMPC	0.81	0.88	-		0.69	0.79	0.8	0.9		0.8
PGWF	12670	8100	12600		13060	11400	10400	10600		4590
PLAG	3.76	0.034	0.033		2.87	3.32	2.21	2.89		0.004
PDUR	9.22	18.04	17.6		9.02	10.43	14.24	12.82		9.77
PCIF	0.032	0.034	0.022		0.014	0.018	0.034	0.036		0.057
PCOF	-	-	0.059		-	-	0.016	0.018		-
PCOX	-	-	0.62		-	-	1.44	1.0		-
PCBF	-	-	22.1		-	-	26.3	27.3		-
%ER (F)	6	45	38		114	54	33	78		17
%EF (E)	99	95	99		94	99	99	99		83

Bankfull 21 m^3/s

RIVER REA @ CALTHORPE PARK

	01	02	03	04	05	06	08	09	10	11
FLOW	18.0	39.0	19.0	12.0	24.0		30.0	29.0	18.0	15.0
SMD	50	90	0	0	0		18	3	2	90
PSRC	-	-	0.413	0.503	0.602		-	0.482	0.687	-
PSRS	-	-	0.011	0.019	0.009		-	0.01	0.017	-
PRPM	0.3	0.58	0.43	0.6	0.57		0.57	0.63	0.61	0.57
PMPC	0.3	0.4	0.1	0.39	0.38		0.64	0.1	0.10	0.3
PGWF	99971	49111	11640	34770	15695		27400	21700	13800	13500
PLAG	0.012	0.003	0.001	0.082	0.0		0.007	0.0	0.001	0.018
PDUR	2.06	2.0	2.93	1.94	2.56		1.99	2.02	2.21	2.02
PCIF	0.050	0.063	0.038	0.027	0.040		0.052	0.073	0.072	-
PCOF	-	-	-	-	-	-	-	-	-	-
PCOX	-	-	-	-	-	-	-	-	-	-
PCBF	-	-	-	-	-	-	-	-	-	-
%ER (F)	411	784	58	35	112		160	118	71	96
%EF (R)	27	85	95	96	96		96	97	94	90

Bankfull never exceeded

RIVER COLE @ COLESHILL

	01	02	03	04	05	06	08	09	10	11
FLOW		36.0	27.0	18.0	21.0	12.0	55.0	30.0	8.0	24.0
SMD		90	0	0	0	1	18	3	2	90
PSRC		-	0.3	0.212	0.25	0.32	-	0.349	-	-
PSRS		-	0.07	0.114	0.09	0.062	-	0.05	-	-
PRPM		0.75	0.67	0.76	0.89	0.73	0.7	0.71	0.55	0.71
PMPC		0.3	0.1	0.84	0.9	0.6	0.3	0.48	0.1	0.45
PGWF		33410	16000	16200	34430	13600	5980	9820	-	1000
PLAG		0.788	0.305	1.442	1.075	0.015	1.0	0.067	0.175	0.005
PDUR		3.159	1.697	1.713	1.926	2.98	2.748	1.93	2.982	5.757
PCIF		0.100	0.055	0.020	0.027	0.051	0.036	0.015	0.053	0.065
PCOF		-	-	-	-	-	0.062	-	-	-
PCOX		-	-	-	-	-	1.318	-	-	-
PCBF		-	-	-	-	-	53.5	-	-	-
%ER (f)		540	107	19	78	34	139	166	16	273
%EF (l)		88	95	99	91	93	99	98	98	89

U/S Bankfull discharge 7 m^3/s

Never exceeded at gauging site.

RIVER ANKER @ POLESWORTH

	01	02	03	04	05	06	08	09	10	11
FLOW	9.0	6.5	46.0	37.0	30.0		28.0	55.0		36.0
SMD	60	90	0	0	0		18	3		90
PSRC	0.64	0.504	0.62	0.49	0.488		0.63	0.545		0.788
PSRS	0.03	0.027	0.04	0.025	0.043		0.036	0.031		0.024
PRPM	0.63	0.64	0.58	0.56	0.54		0.61	0.67		0.6
PMPC	0.72	0.81	0.90	-	0.82		0.81	0.9		0.49
PGWF	21750	26050	25000	30400	17550		15200	15700		3595
PLAG	6.45	0.002	1.72	2.26	4.85		3.7	4.8		9.14
PDUR	16.76	7.25	26.59	22.77	22.4		21.27	20.68		23.55
PCIF	0.021	0.091	0.029	0.048	0.029		0.026	0.014		0.054
PCOF	-	-	0.058	-	-		0.035	0.025		0.029
PCOX	-	-	1.512	-	-		1.843	1.437		1.617
PCBF	-	-	24.6	-	-		24.07	20.77		20.39
%ER (f)	13	17	84	51	28		3	553		93
%EF (l)	98	93	99.6	99.6	99		100	98		99

G/S Bankfull 80 m^3/s
Local Bankfull 20-30 m^3/s

RIVER DOVE @ IZAAK WALTON

	01	02	03	04	05	06	08	09	10	11
FLOW	9.5	2.3	8.5	13.5	10.5	12.0	8.5	11.5	11.0	1.5
SMD	52	100	0	0	0	1	18	3	0	80
PSRC	0.14	0.114	0.13	0.168	0.15	0.196	0.153	0.14	0.161	0.104
PSRS	0.007	0.02	0.01	0.021	0.007	0.014	0.002	0.02	0.008	0.012
PRPM	0.61	0.59	0.60	0.62	0.6	0.6	0.64	0.69	0.56	0.61
PMPC	0.55	0.6	0.1	0.73	0.9	0.73	0.85	0.86	0.1	0.54
PGWF	96340	99990	99990	83000	69500	81932	84100	76600	98630	99990
PLAG	4.98	7.38	2.16	1.49	0.17	2.02	0.91	2.35	2.16	4.2
PDUR	5.94	3.186	5.07	2.32	1.84	6.75	4.16	5.42	7.59	3.52
PCIF	0.026	0.093	0.046	0.041	0.014	0.018	0.021	0.015	0.048	0.053
PCOF	-	-	-	-	-	-	-	-	-	-
PCOX	-	-	-	-	-	-	-	-	-	-
PCBF	-	-	-	-	-	-	-	-	-	-
%ER (F)	50	3	10	10	28	39	6	28	20	1
%EF (E)	87	81	94	99	94	93	96	94	92	74

Bankfull U/S 20 m^3/s

RIVER MANIFOLD @ ILAM

	01	02	03	04	05	06	08	09	10	11
FLOW	37.0	12.0	32.0	52.0		55.0	51.0	65.0	50.0	2.0
SMD	52	100	0	0		1	18	3	0	80
PSRC	0.47	0.422	0.32	0.433		0.35	0.41	0.771	0.441	0.712
PSRS	0.022	0.027	0.001	0.046		0.061	0.009	0.031	0.012	0.03
PRPM	0.55	0.41	0.59	0.72		0.061	0.63	0.51	0.48	0.58
PMPC	0.49	0.1	0.9	0.5		0.1	0.6	0.8	0.32	0.49
PGWF	90110	99540	99990	81950		99820	99750	87900	99400	99950
PLAG	4.73	5.86	3.0	2.39		2.66	1.92	1.99	2.7	9.1
PDUR	1.46	1.14	1.46	1.61		1.87	2.41	1.61	1.855	3.21
PCIF	0.031	0.032	0.066	0.013		0.032	0.044	0.039	0.061	0.012
PCOF	-	-	-	-		-	-	-	-	-
PCOX	-	-	-	-		-	-	-	-	-
PCBF	-	-	-	-		-	-	-	-	-
%ER (f)	1088	62	432	780		297	363	1653	856	1
%EF (f)	80	87	88	96		98	96	92	90	96

Bankfull 130 m^3/s

RIVER CHURNET @ BASFORD BRIDGE

	01	02	03	04	05	06	08	09	10	11
FLOW		12.0	22.0	35.0	34.0	27.0	17.0	34.0	25.0	5.0
SMD		10.0	0	0	0	1	18	3	0	80
PSRC		0.222	0.455	0.288	0.406	0.25	0.331	0.12	0.195	0.755
PSRS		0.017	0.016	0.076	0.042	0.09	0.042	0.08	0.044	0.018
PRPM		0.65	0.84	0.54	0.76	0.9	0.72	0.83	0.75	0.75
PMPC		0.72	0.11	0.10	0.27	0.2	0.51	0.89	0.41	0.40
PGWF		99140	99990	99970	90900	68420	99999	63900	99990	43900
PLAG		1.14	0.01	0.64	0.66	0.4	0.11	0.47	4.57	0.14
PDUR		7.33	12.01	12.24	7.66	13.29	9.32	13.01	10.71	2.13
PCIF		0.046	0.028	0.012	0.013	0.011	0.040	0.012	0.089	0.016
PCOF		-	-	0.009	0.041	-	-	-	-	-
PCOX		-	-	0.302	1.0	-	-	-	-	-
PCBF		-	-	32.6	27.8	-	-	-	-	-
%ER (f)		42	124	85	194	294	156	379	4642	9
%EF (ℓ)		95	97	99	95	92	96	96	5	91

Bankfull 36 + m^3/s

RIVER WYE - ASHFORD

	01	02	03	04	05	06	08	09	10	11
FLOW	27.5	6.2	9.5	15.5	11.0	19.0	9.0	12.0	14.0	3.0
SMD	80	80	0	0	0	1	18	3	0	70
PSRC	0.15	0.10	0.10	0.101	0.28	0.21	0.22	0.23	0.14	0.15
PSRS	0.013	0.016	0.001	0.011	0.007	0.006	0.014	0.015	0.030	0.014
PRPM	0.74	0.71	0.89	0.79	0.61	0.64	0.73	0.69	0.83	0.74
PMPC	0.90	0.77	0.05	0.90	0.20	0.90	0.88	0.87	0.05	0.59
PGWF	86230	99999	99999	99984	65920	64571	75230	71400	99999	89490
PLAG	2.99	3.00	1.47	0.88	0.24	0.21	0.28	1.09	0.647	0.00
PDUR	1.23	5.46	1.52	3.17	3.45	1.80	3.79	3.56	8.26	2.01
PCIF	0.009	0.020	0.010	0.014	0.004	0.005	0.008	0.007	0.018	0013
PCOF	-	-	-	-	-	-	-	-	-	-
PCOX	-	-	-	-	-	-	-	-	-	-
PCBF	-	-	-	-	-	-	-	-	-	-
%ER (f)	477	9	141	21	16	374	8	35	71	3
%EF (ℓ)	83	91	13	97	94	79	94	92	76	74

Bankfull = 27 m^3/s

RIVER AMBER - WINGFIELD PARK

	01	02	03	04	05	06	08	09	10	11
FLOW	20.0	2.0	14.0	17.5	20.0	21.0	19.0	14.0		4.0
SMD	65	100	0	0	0	1	18	3		70
PSRC	0.70	0.22	0.24	0.36	0.47	0.34	0.44	0.36		0.19
PSRS	0.019	0.019	0.009	0.004	0.033	0.025	01015	0.023		0034
PRPM	0.63	0.65	0.59	0.79	0.73	0.80	0.49	0.59		0.65
PMPC	0.73	0.6	0.90	0.89	0.36	0.80	0.54	0.90		0.57
PGWF	19000	79700	24220	20550	17200	26000	13700	8800		
PLAG	1.005	2.07	0.001	0.176	1.25	1.46	0.06	0.621		0.184
PDUR	13.58	9.02	10.69	10.34	8.53	5.42	10.26	6.28		7.51
PCIF	0.019	0.090	0.034	0.019	0.016	0.033	0.023	0.017		0.037
PCOF	0.004	-	-	-	-	0.011	-	-		-
PCOX	1.09	-	-	-	-	1.56	-	-		-
PCBF	15.9	-	-	-	-	19.4	-	-		-
%ER (f)	25	1	148	76	71	92	42	26		3
%EF (ℓ)	99	97	85	94	96	97	98	98		94

Bankfull = 15 m^3/s

RIVER SOAR @ NARBOROUGH

	01	02	03	04	05	06	08	09	10	11
FLOW	10.0	2.0	16.5	16.0	12.0	18.5	13.5	21.0		12.0
SMD	50	110	0	0	0	1	18	3		100
PSRC	0.72	0.70	0.45	0.50	0.41	0.45	0.63	0.69		0.75
PSRS	0.016	0.030	0.040	0.055	0.020	0.010	0.039	0.033		0.029
PRPM	0.60	0.63	0.89	0.72	0.86	0.58	0.53	0.11		0.69
PMPC	0.49	0.45	0.90	0.52	0.31	0.85	0.46	0.75		0.48
PGWF	13340	33720	17650	19900	13660	8960	14900	4450		2890
PLAG	1.70	0.0	0.02	0.71	0.08	0.11	0.002	0.972		0.80
PDUR	14.60	12.31	30.26	28.9	23.5	24.62	19.41	15.25		10.37
PCIF	0.031	0.157	0.025	0.045	0.072	0.018	0.058	0.011		0.045
PCOF	-	-	-	-	-	-	-	-		-
PCOX	-	-	-	-	-	-	-	-		-
PCBF	-	-	-	-	-	-	-	-		-
%ER (F)	32	0.8	67	73	27	26	7	87		59
%EF (R)	96	98	98	97	97	99	99	99		96

Bankfull 10 m^3/s

RIVER SENCE @ BLABY

	01	02	03	04	05	06	08	09	10	11
FLOW	9.0	3.6	21.0		11.5	22.0	14.5	27.0		12.0
SMD	40	110	0		0	1	18	3		100
PSRC	0.78	-	0.69		0.59	0.67	0.63	0.69		0.79
PSRS	0.032	-	0.034		0.021	0.035	0.016	0.020		0.024
PRPM	0.71	0.63	0.69		0.58	0.90	0.64	0.60		0.68
PMPC	0.67	0.43	0.71		0.90	0.71	0.47	0.79		0.67
PGWF	13880		12540		13450	7030	11300	3920		1002
PLAG	6.36	0.03	3.81		2.05	3.09	0.02	0.77		0.06
PDUR	11.56	3.97	15.19		14.55	15.79	15.46	20.10		12.41
PCIF	0.032	0.140	0.028		0.032	0.049	0.021	0.012		0.045
PCOF	-	-	-		-	-	-	0.007		-
PCOX	-	-	-		-	-	-	1.60		-
PCBF	-	-	-		-	-	-	26.4		-
%ER (F)	21	4	60		29	632	14	123		97
%EF (ℓ)	97	91	98		96	88	99	99		92

Bankfull 16 m^3/s

RIVER WREAKE @ SYSTON

	01	02	03	04	05	06	08	09	10	11
FLOW	6.0	1.0	45.0	58.2		55.0	15.0	47.0		8.0
SMD	50	110	0	0		1	18	3		100
PSRC	0.65	0.80	0.80	0.67		0.76	0.51	0.69		0.79
PSRS	0.041	0.047	0.048	0.075		0.024	0.052	0.107		0.047
PRPM	0.74	0.75	0.80	0.78		0.80	0.78	0.78		0.77
PMPC	0.55	0.53	0.22	0.24		0.89	0.57	0.87		0.51
PGWF	4570	5450	1000	8960		5042	-	5850		2050
PLAG	6.10	0.004	9.86	5.46		6.39	0.63	3.12		0.45
PDUR	11.43	17.09	24.80	38.60		38.20	13.17	31.6		7.95
PCIF	0.061	0.123	0.214	0.140		0.036	0.062	0.014		0.154
PCOF	-	-	0.04	0.013		0.040	-	0.012		-
PCOX	-	-	0.37	1.17		0.45	-	0.627		-
PCBF	-	-	41.2	52.8		50.86	-	44.50		-
%ER (P)	4	0.8	159	989		1154	3	237		14
%EF (Q)	99	82	99	98		97	100	99		97

Bankfull 20 m^3/s

APPLICATION OF UCM WITH ESTIMATED PARAMETERS

(i) Catchment - River Ecclesbourne.

Equivalent Figure 90.

Area - 50.0

PGWF	51525	PSRC	0.320
PCIF	0.040	PSRS	0.021
PLAG	0.001	PRPM	0.640
PDUR	13.47	PMPC	0.282

Starting Discharge - 0.8 Cumecs

Starting Soil Moisture Deficit - 10.0mm

Number of Rainfall Ordinates - 19

Rainfall (mm/hr)	0.0	0.7	1.5	2.6	2.8	3.7
	3.4	2.0	1.8	1.7	4.6	2.7
	1.4	0.7	2.2	1.0	0.0	0.0
	0.8					

(ii) Catchment - River Ecclesbourne

Equivalent Figure 91.

Area - 50.0

PGWF	51525	PSRC	0.320
PCIF	0.040	PSRS	0.021
PLAG	0.001	PRPM	0.640
PDUR	13.47	PMPC	0.280

Starting Discharge - 0.8 Cumecs

Starting Soil Moisture Deficit - 0.0

Number of Rainfall Ordinates - 13

Rainfall	0.0	0.1	0.6	0.6	0.6	5.6
	7.0	6.5	5.2	6.2	3.6	0.7
	0.1					

(iii) Catchment - River Ecclesbourne

Equivalent Figure 92.

Area - 50.0

PGWF	51525	PSRC	0.320
PCIF	0.040	PSRS	0.021
PLAG	0.001	PRPM	0.640
PDUR	13.47	PMPC	0.282

Starting Discharge - 1.4 Cumecs

Starting Soil Moisture Deficit - 0.0

Number of Rainfall Ordinates - 12

Rainfall	0.0	0.6	0.6	0.4	1.0	3.4
	4.8	3.2	2.0	2.0	0.6	0.3

(iv) Catchment - Kingston Brook

Equivalent Figure 93.

Area - 58.0

PGWF	1000	PSRC	0.680
PCIF	0.056	PSRS	0.050
PLAG	1.870	PRPM	0.730
PDUR	17.30	PMPC	0.660

Starting Discharge - 1.4 Cumecs

Starting Soil Moisture Deficit - 0.0

Number of Rainfall Ordinates - 16

Rainfall	0.0	0.2	2.0	2.4	2.0	0.6
	0.6	0.8	0.8	3.2	1.6	1.6
	1.4	0.7	0.3	0.1		

(v) Catchment - Kingston Brook

Equivalent Figure 94

Area - 58.0

PGWF	1000	PSRC	0.680
PCIF	0.056	PSRS	0.050
PLAG	1.87	PRPM	0.730
PDUR	17.30	PMPC	0.660

Starting Discharge - 1.4 Cumecs

Starting Soil Moisture Deficit - 15.0

Number of Rainfall Ordinates - 24

Rainfall	0.0	0.1	0.3	1.9	1.6	0.6
	1.4	2.2	2.0	2.0	2.0	1.7
	1.0	1.1	0.5	0.7	1.9	1.4
	1.4	0.9	0.7	0.6	0.6	0.5

(vi) Catchment - Kingston Brook

Equivalent Figure 95

Area - 58.0

PGWF	1000	PSRC	0.680
PCIF	0.056	PSRS	0.050
PLAG	1.870	PRPM	0.730
PDUR	17.30	PMPC	0.660

Starting Discharge - 0.8 Cumecs

Starting Soil Moisture Deficit - 70.0 mm

Number of Rainfall Ordinates - 10

Rainfall	0.0	0.8	3.2	13.5	5.8	4.0
	6.7	3.3	1.0	0.2		

APPENDIX 12

DESIGN HYDROGRAPHS - INPUT DATA

Model Parameters and Areas - As Appendix 9

Rainfall :-

Kingston		Ecclesbourne	
1:10	1:25	1:10	1:25
0.00	0.00		
0.72	0.90	0.00	0.00
0.72	0.90	1.00	1.20
0.87	1.09	1.10	1.40
1.02	1.29	1.40	1.80
1.02	1.29	2.20	2.70
1.94	2.44	3.00	2.80
1.94	2.44	4.50	5.70
2.91	3.66	6.90	8.70
3.88	4.88	7.70	9.60
3.88	4.88	6.90	8.70
5.32	6.68	4.50	5.70
5.32	6.68	3.00	3.80
4.60	5.78	2.20	2.70
3.88	4.88	1.40	1.80
3.88	4.88	1.10	1.40
1.94	2.44	1.00	1.20
1.94	2.44		
1.48	1.86		
1.02	1.29		
1.02	1.28		
0.72	0.90		
0.72	0.90		
0.14	0.20		
SMD 0.0mm	0.0mm	0.0mm	0.0mm
Q_o 0.6 cumecs	0.6 Cumecs	1.6 Cumecs	1.6 Cumecs

APPENDIX 13

ESTIMATION OF DESIGN HYDROGRAPHS USING THE UNIT HYDROGRAPH TECHNIQUE

(Flood Studies Report, NERC (1975), Section 6.8.2)

Catchment - R. Ecclesbourne

Area - 50 km^2

Main stream length (L) - 11.2 km.

Channel Slope(s) - 4.9 m/km

Average Annual rainfall (SAAR) - 825 mm

M5 - 24 hrs/M5 - 2 day ratio - 0.873

M5 1 day rainfall - 42.47 mm

RSMD (5 yr, 1 day rainfall excess) = (42.47 x 0.956) - 7mm = 33.6mm

URB = 5%

URBT = 1.05

Time to Peak

$$Tp = 46.6\ L^{0.15}\ S^{-0.38}\ URBT^{-1.99}\ RSMD^{-0.4}$$

Tp = 7.94 hrs.

T (data interval) = 1 hour

D (Design storm duration) = $(1.0 + \frac{SAAR}{1000})\ Tp$

= 14.42 hrs.

nearest odd integer = 15 hours.

Required rain return period for a 1 in 10 year flow is 1 in 18 years (fig. 6.61, p.464).

M5 (D) / M5 (2d) = 0.75%

54mm x 0.75 = 40.5mm

MT/M5 growth factor = 1.25

$\therefore$ M 18 (15 hour) = 50.63mm

ARF (Area Reduction factor) = 0.945

$\therefore$ precipitation = 47.84mm

Catchment Wetness Index = 118mm

Soil (90% No.4, 10% No.1) = 0.42

Standard percentage runoff (SPR) = 95.5 Soil + 0.12 URB

= 40.76%

Event percentage runoff (PR) = SPR + 0.22 (CWI - 125) + 0.1 (P-10)

= 43.0%

Timestep = 1 hr or 6.7% of D.

Using 75% Winter Profile (Fig 6.65)

% D	6.7	20.1	33.5	46.9	60.3	73.7	87.1	100.0
% rain	16	45	64	76.5	85.5	91.5	96	100.0
% Inc	16	29	19	12.5	9.0	6.0	4.5	4.0
Inc Rain(mm)	7.65	13.8	9.09	5.98	4.31	2.87	2.15	1.91
Net Rain (mm)	3.29	5.96	3.91	2.57	1.85	1.23	0.92	0.82

∴ 18 year hyetograph (mm)

0.41 0.46 0.615 0.925 1.285 1.955 2.98
3.29 2.98 1.955 1.285 0.925 0.615 0.46
0.41

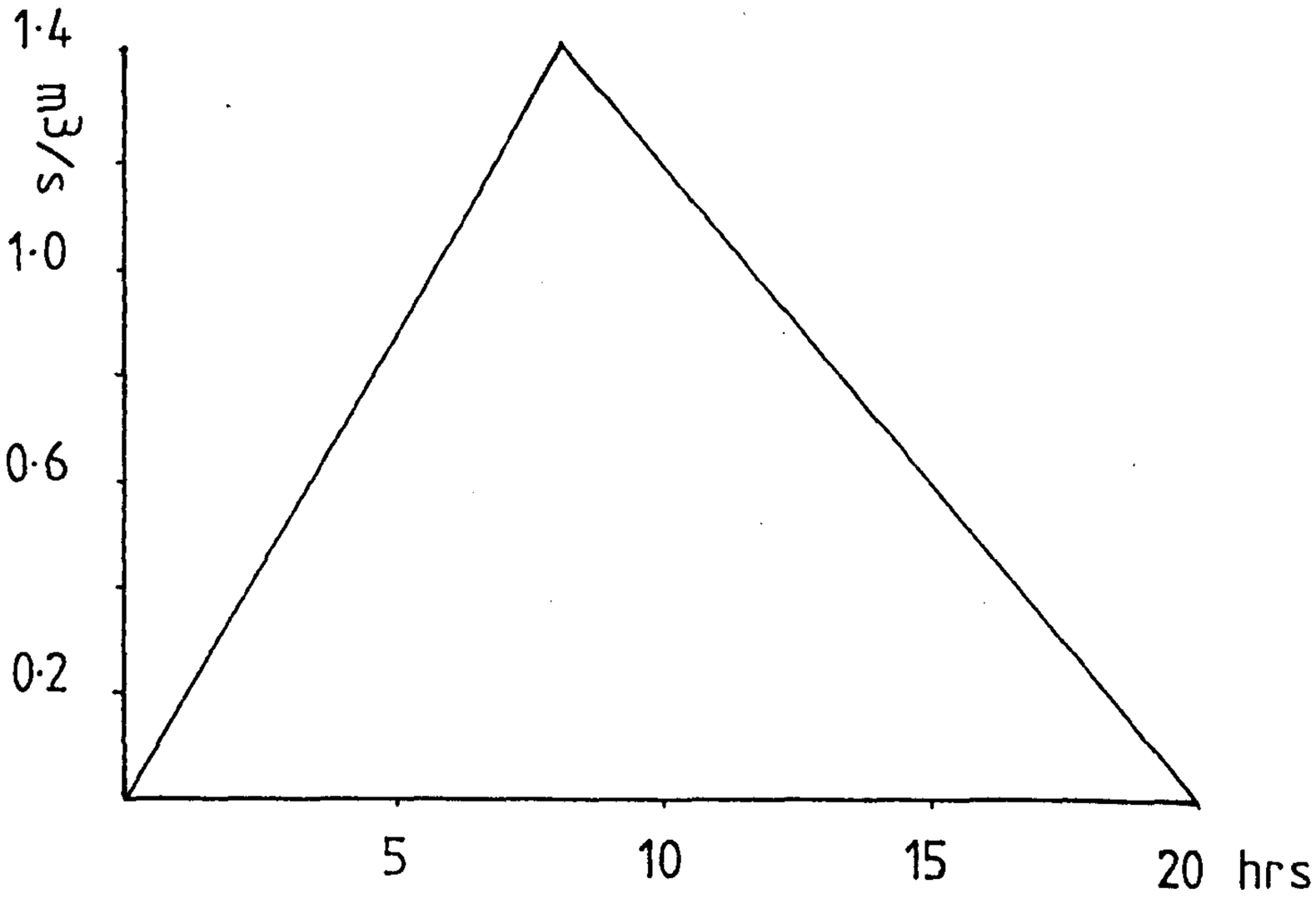
Unit Hydrograph.

T_p = 7.94 hours.

$Q_p = \left(\frac{220}{T_p} \times \frac{50}{100}\right) \div 10 = 1.39$ cumecs

$T_B = 2.25 \times T_p = 20.01$ hours

figure 99



From Figure 99, ordinates of 1 hour are:-

0.00	0.16	0.34	0.52	0.69	0.87
1.04	1.22	1.39	1.27	1.16	1.04
0.93	0.81	0.69	0.58	0.46	0.35
0.23	0.12	0.0			

Convaluting rainfall and the unit hydrograph

0.00	0.07	0.22	0.47	0.89	1.52
2.49	3.98	6.04	8.50	11.18	13.92
16.54	18.90	20.77	21.84	21.96	21.21
19.89	18.21	16.26	14.18	12.01	9.81
7.71	5.76	4.04	2.67	1.67	1.02
0.60	0.32	0.15	0.05	0.0	

Baseflow = 0.00033 (CWI - 125) + 0.00074 RSMD + 0.003

= 1.3 Cumecs

1 in 10 year design flow hydrograph for the Ecclesbourne (cumecs)

1.30	1.37	1.52	1.57	2.29	2.82
3.79	5.28	7.34	9.80	12.48	15.22
17.84	20.20	22.07	23.14	23.26	24.51
21.19	19.51	17.56	15.48	13.31	11.11
9.01	7.06	5.34	3.97	2.97	2.32
1.90	1.62	1.45	1.35	1.30	