

H U R R I C A N E C H A R L I E

A N O V E R V I E W

P A P E R

P R E S E N T E D T O T H E W A T E R E N G I N E E R I N G S E C T I O N

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D U B L I N C O R P O R A T I O N

F L O O D I N G I N D U B L I N C I T Y R I V E R S - 2 5 T H / 2 6 T H A U G U S T , 1 9 8 6

INTRODUCTION

One of the briefs of the Sewers & Main Drainage Section of Dublin Corporation has been to examine and improve the river channels within the city boundary. Over the past few decades, hydrological analysis of flooding on the major and minor rivers has been completed. As a result of this work, many modifications to the channel bed and banks have been carried out. These have led to an increased level of flood protection. They have also enabled the limited funds available for river maintenance to be channelled into the most critical areas.

Five major rivers run through the city, namely, the Dodder, Camac, Tolka, Poddle and Liffey. This paper will deal with the first four rivers with particular emphasis on the River Dodder. The flooding of some of the smaller rivers and streams is not discussed here. The flooding on the R. Liffey is being dealt with by _____ of the E.S.B.

EXTENT OF FLOODING

During the evening of 25th and the early morning of the 26th August 1986 extensive flooding resulted from huge flows in the Dodder and Poddle. The problems in the Camac and Tolka were more limited. An appreciation of the extent and importance of the flooding may be gained from the tables (over) and from the flood plain shown at the rear of this paper.

Many of the flow figures shown below were estimated from the following sources:-

- a) Records of old peak flood levels
- b) Interviews with older residents
- c) Newspaper reports
- d) Other sources

It is possible to be more confident of figures from recent decades as automatic flow recorders had been installed on the Rivers Dodder and Tolka.

It will be noted that a total of 465 properties were flooded. This led to much human misery and anxiety. In some of the single storey houses people, often without household insurance, lost almost everything.

Although no official figures are available we estimate the total insurance cost to be approximately £6 million. This high figure results from the extent of the damage and the high number of commercial premises affected such as Smurfits Ltd. on the River Dodder.

The relatively low level of flooding on the Tolka was due to the lower rainfall on the north side of the city and to the absence of any obstructions of note. Likewise, the return period for the flows on the River Camac is estimated at less than 50 years. This is probably due to the nature of the storm which was of long duration with no very high hourly rainfalls. The much more significant flooding on the River Poddle was caused mainly by chronically inadequate channel capacities at certain points.

TABLE I

NO. OF PROPERTIES FLOODED 25TH/26TH AUGUST, 1987

RIVER DODDER	340
RIVER PADDLE	85
RIVER CAMAC	30
RIVER TOLKA	10
TOTAL:	<u>465</u>

TABLE 2

LIST OF HIGHEST RANKED FLOODS PRIOR TO 1986

DATE	RIVER DODDER		RIVER TOLKA
	Bohernabreena Flow (cu.secs.)	Orwell Flow (cu.secs.)	Drumcondra Flow (cu.secs.)
25th Aug. 1986	3200	7600/9000	2000
25th Aug. 1905	3500/4200	7000	-
3rd Sept. 1931	(?)	5400	1900
27th Sept. 1880	(?)	(?)	2500
19th Oct. 1891	3400	(?)	-
17th Nov. 1965	2300	4900	-
19th Dec. 1958	2000	4100	-
23rd Nov. 1898	(?)	(?)	1600
12th Aug. 1946	2800	3100	-
2nd Nov. 1968	(?)	3000	-
26th Aug. 1912	2300	(?)	-
10th Nov. 1901	(?)	(?)	2000
11th Nov. 1915	(?)	(?)	1500
16th Oct. 1883	1700	(?)	-
3rd Sept. 1883	(?)	(?)	-
25th Sept. 1957	1475	2610	-
29th Sept. 1956	1065	2580	-
20th Sept. 1946	-	-	1700
8th Dec. 1954	-	-	3000

TABLE 3

MAIN AREAS OF FLOODING 25TH/26TH AUGUST, 1986

	<u>DODDER</u>		<u>PODDLE</u>	<u>CAMAC</u>	<u>TOLKA</u>
Lower Dodder Road	Beaver Row	Merrion Road	Kimmage Cross Road	Bow Bridge	Richmond Road
Dodder Park Road	Simmonscourt Terrace	Sandymount Avenue	Ravensdale	Mount Brown	Botanic Avenue
Orwell Gardens	Brookvale Road	Wilfield Road	Lr. Kimmage Road	Riversdale	Holy Faith Convent, Glasnevin
(All Co. Council Area)	Eglinton Road	Gilford Park	Harold's Cross Road	Carrickfoyle Tce.	
Dartry Cottages	Anglesea Road	Wilfield Park,	Parnell Road	Turvey Avenue	
Strand Terrace	Serpentine Avenue	Gilford Road	Greenmount		
Clonskeagh Road	Sydenham Road	Gilford Drive	St. Clare's Avenue		
Beech Hill Road		Wilfield Drive	Limekiln Lane		
		Dodder View Cottages			
		Shelbourne Road			
		Ballsbridge Avenue			
		Beatty's Avenue			

DUBLIN CORPORATION RESPONSE

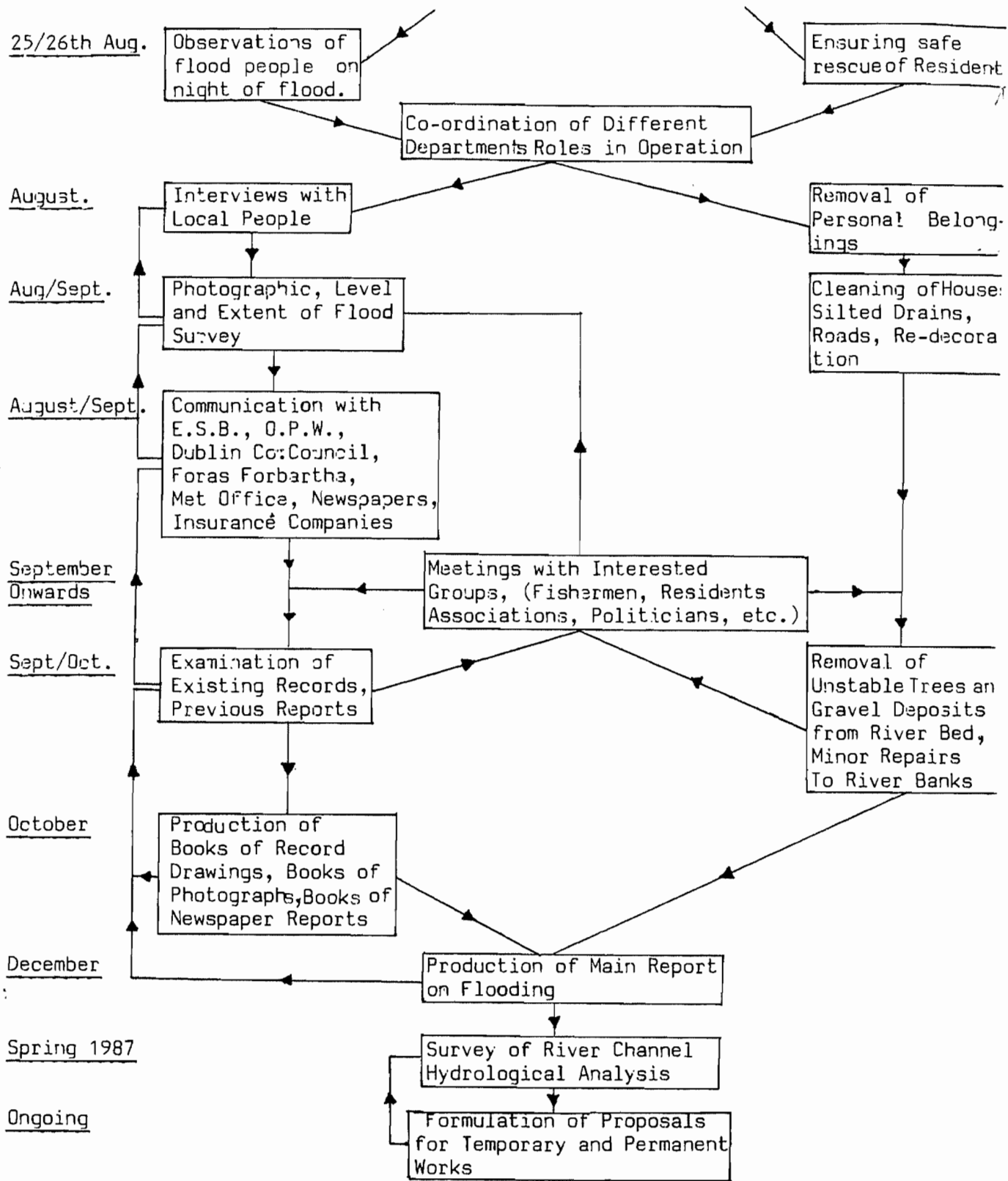
In the immediate aftermath of the storm, Dublin Corporation personnel were engaged in an operation which aimed to bring immediate relief to the more unfortunate victims. Rivers were cleared of obstructions, debris cleaned from roads, water pumped from and re-decoration of many houses carried out. Priority was given to the most needy cases, particularly to those without household insurance. The role played by Engineers from the many divisions of the Corporation in this swift response to a disaster has been publicly commended since the event.

A team of Engineers from the Main Drainage Division began to systematically record details of the flood. In particular, times and levels of peak flood and the extent of the flood plains were noted. A typical interview sheet is shown overleaf. Surveys were carried out along the rivers to ascertain the amount of damage caused and to examine the river bed characteristics in certain crucial areas. Finally, an analysis was initiated into the causes of the flood, the likelihood of its recurrence and possible permanent flood protection schemes were examined. The result of this work is included in 4 reports on the rivers in question presented to the City Council in December 1986 and January 1987. The very detailed records of the flooding are available for inspection at the Civic Offices.

SECTION 4.4 RESULTS OF INTERVIEWS WITH PROPERTY OWNERS.

ADDRESS	TIME OF FLOODING	TIME OF PEAK FLOODING	PAST HISTORY OF FLOODING	VISUAL SURVEY
■ Simmonscourt Terrace	Midnight	Subsided at 3. a.m.	Last flooded in 1963	Water mark 600 mm on front bedroom wallpaper.
■ Simmonscourt Terrace	Midnight	_____	Threatened only	0.875 m outside.
■ Simmonscourt Terrace	Midnight	2.30 a.m.	_____	600 mm water in house
■ Simmonscourt Tce.	ditto	2.30 a.m.	_____	Last house in lane Watermark 0.775m above path level.
Beaver Row	_____	_____	_____	Sunken floor flooded to a depth of 450 mm
Brookvale Road	_____	_____	_____	Water up to the back path only.

DUBLIN CORPORATION RESPONSE TO 1986 FLOOD



RIVER DODDER

The River Dodder is one of Dublin's best known and most important rivers. Its upper reaches stretch from Kippure to Bohernabreena where a system of reservoirs impound an integral part of the Dublin water supply. Flowing through open countryside and thereafter through the city suburbs the river and its surrounding parkland are an extremely important amenity to such diverse groups as fishermen, walkers, joggers, ornithologists, cyclists and nature lovers. The river catchment is shown overleaf.

The river has long been noted for its flashy response to rainstorms. Its catchment area, shown overleaf, is large in proportion to its length and it has been the scene of many major floods in the past few centuries. In a paper read to the Old Dublin Society "Weather in Old Dublin" by F.R. Met. Soc. Vol. 13, 1953, Dublin Historical Society reference is made to floods on the Dodder in September 1787, November 1794, December 1802 ("this must rank as the most serious of all Dublin floods"), September 1807, January 1851, etc. Reasonably detailed records exist since the 1880's. The construction of the reservoir system at Bohernabreena in 1883 has helped to alleviate downstream flooding.

Nevertheless, there have been several major floods in this century. The floods of the 25th August 1905 and 3rd/4th September 1931 are generally accepted as the two greatest recent floods prior to 1986.

The flood plain for the river is shown at the rear of this section of the papers. The main exit points for floodwater are listed below.

TABLE 4 Main Flood Exit Points - River Dodder

1. Lower Dodder Road
2. Dodder Park Road (River Dargle)
3. Orwell Gardens
4. Dartry Park
5. Classon's Bridge Area
6. Strand Terrace
7. Clonskeagh Bridge Area
8. Beaver Row
9. Anglesea Road - the major flow exit point
10. Bective Rugby Ground
11. Ballsbridge
12. Beattie's Avenue
13. Lansdowne Road

The flow recorder at Orwell ceased to function from midday on the 25th August. However, as a result of observations on the night and subsequent surveys it has been possible to produce an approximate record of the flow pattern at the height of the storm. This has been included in the paper from An Foras Forbartha.

The analysis of the flooding carried out by Dublin Corporation has not been included herein but our records have been used by Dublin County Council whose approach using the Flood Studies Report has been roughly parallel to our own.

SUMMARY OF RESULTS OF ANALYSIS OF RIVER DODDER FLOOD

1. The estimated peak flow at Bohernabreena was approximately 3200 cusecs. (91 m³/sec.) while the est. flow at Orwell varied between 7600 cusecs. (215 m³/sec) to 9000 cusecs (254 m³/sec.). The figures at Orwell are greatly in excess of any flows measured since records began. The return period is greater than 100 years and has been estimated to be as high as 460 years by some analysts.
2. A total of 315 residential and 25 commercial properties were flooded within the city boundary.
3. The estimated cost of temporary remedial works to damage caused by the flood is in excess of one million pounds (£1 m.)
4. Expenditure of in excess of £10 m. would be required to protect the most vulnerable areas from a storm with a return period of one in fifty years.

FLOWS AT BOHERNABREENA

The reservoir system at Bohernabreena was constructed in 1883 to serve as a water supply to the city of Dublin.

It consists of 2 reservoirs:-

- a) The Upper Reservoir has a surface area of 57 acres (23 ha) and a capacity of 343 million gallons. Its catchment area is some 1715 acres (6.95 km²) of mountain terrain, principally of metamorphic and silurian formation. The waters from this catchment are clear and suitable for drinking with minimum levels of treatment. Water is drawn from this Upper Reservoir at the rate of up to 6 m.g.d. (million gallons per day).
- b) The Lower Reservoir has a surface area of 30 acres (12.1 ha.) and a storage capacity of 110 million gallons. Its catchment area is 5200 acres (21.04 km²) and produces a light brown-coloured run-off from the peat covered granite uplands. This drains to the lower reservoir via a by-pass canal running alongside the upper reservoir although in recent years these waters have sometimes been diverted into the Upper Reservoir to maintain the water supply during periods of low rainfall.

Recorders are in position in both reservoirs and in the by-pass canal, enabling a comprehensive picture to be obtained about reservoir levels, flows over spillways etc. The levels in the lower reservoir are shown overleaf.

An analysis of the behaviour of the reservoir system during times of heavy rainfall has revealed a very varied and complex response depending on:-

- a) Level in upper reservoir at the beginning of the storm.
- b) Level in lower reservoir at the beginning of the storm.
- c) Time of opening of 24" and 27" scour pipes.
- d) Periodic blocking of channels, bridges, and spillways by debris.
- e) Duration and intensity of the rainfall.

A statistical analysis of 37 annual maximum levels and flows on the lower reservoir was carried out. The EV2 distribution described in later papers was used and the results shown overleaf. A return period of 90 years for a flow of 3200 cusecs was calculated using this method. A detailed hydrological analysis of the catchment is currently being undertaken by Dublin Corporation.

The use of the reservoirs as a means of flood control has been examined.

Although the reservoir surface area is only 1.2% of the contributing catchment it is obvious that reductions in peak flows at Orwell could be achieved. However, such a possibility must be viewed alongside the water supply demands for the city. An analysis of water resources in the vicinity of Dublin has been initiated the results of which may have implications for the future role of the Upper Reservoir.

The Author wishes to thank Chief Engineer, Engineering
Services, for his permission to reproduce the data contained in this report.

WATER LEVEL RECORDER
BOHERNABREENA LOWER RESERVOIR

25th-27th August 1986

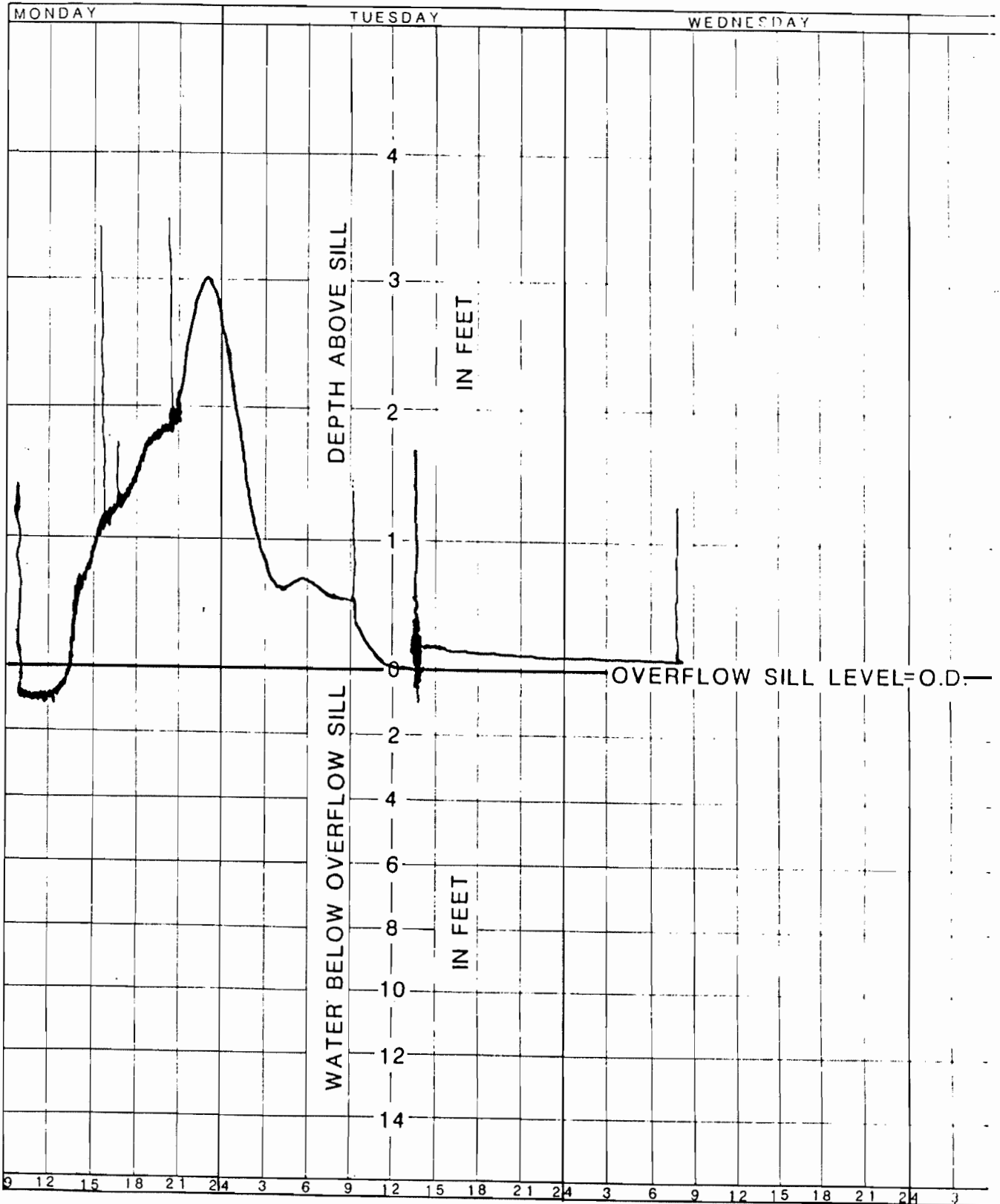
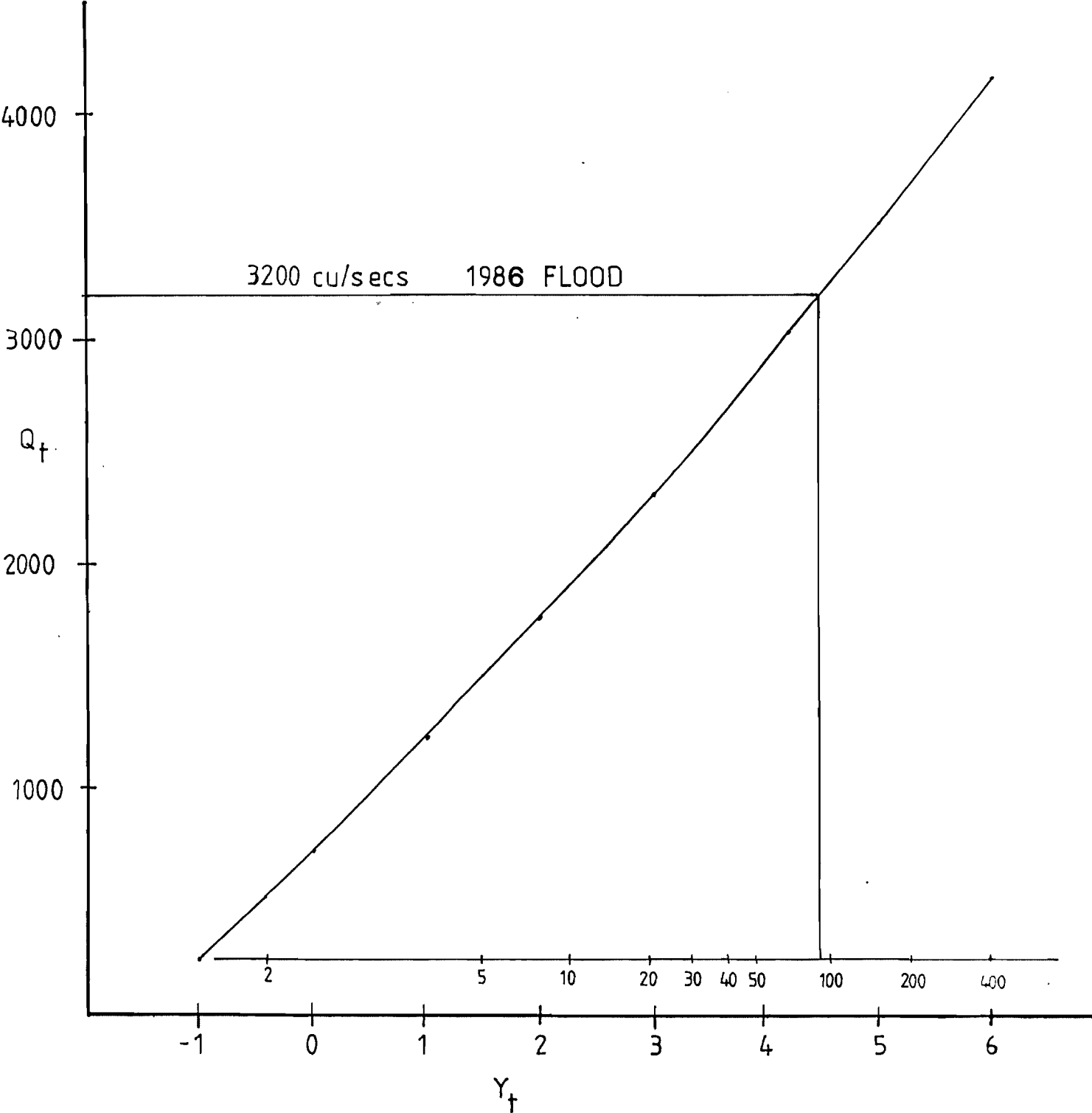


Fig. 4

PEAK FLOW Vs RETURN PERIOD Lower Spillway Bohernabreena

ANNUAL MAXIMA OF 37 YEARS 1949-1986



$$Y_i = -\text{Ln} \left[-\text{Ln} \left(\frac{T-1}{T} \right) \right]$$