PUBLIC WORKS DEPARTMENT N.S.W.

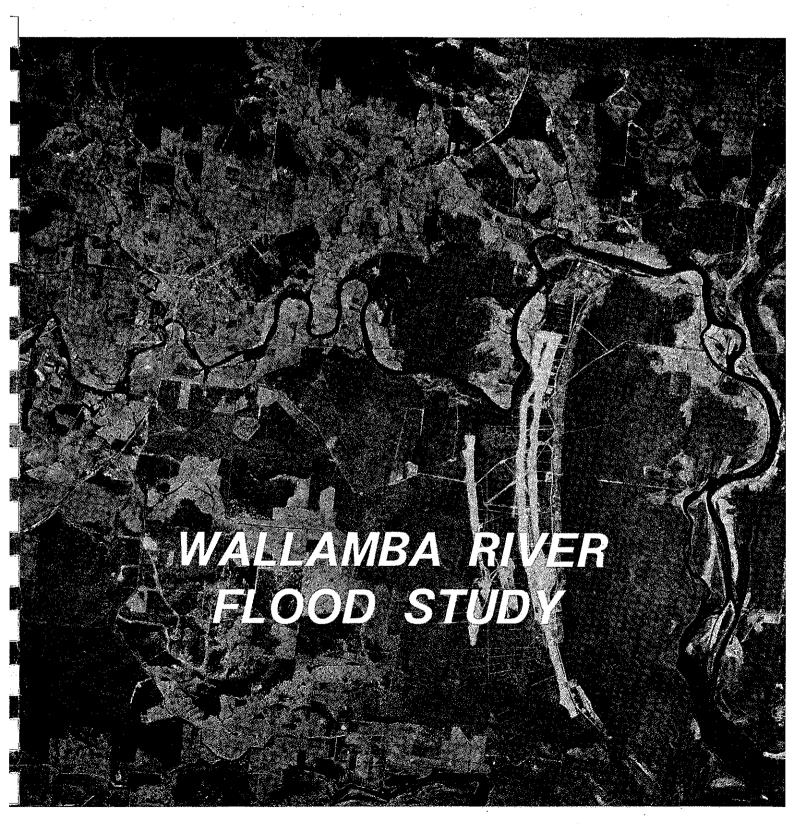## CIVIL ENGINEERING DIVISION

WALLAMBA RIVER FLOOD STUDY

P.W.D. REPORT No. 84021   JANUARY 1985

WALLAMBA RIVER
FLOOD STUDY

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FOREWORD

Coastal areas of N.S.W. are under increasing development pressures. These areas offer a riverine environment that is attractive to residential style living. However, many areas are flood prone and it is necessary to establish and understand the flooding mechanisms. Management plans can then be formulated such that development can proceed and public and private flood losses can be kept to an acceptable minimum.

Consequently the aim of flood reports is to provide an engineering assessment of a flood problem to Local Government so that it may develop an appropriate management plan.

WALLAMBA RIVER FLOOD STUDY

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1.   SUMMARY

This report provides definition of the flood behaviour for the section of the Wallamba River commencing 1 km upstream of the Nabiac Bridge and extending to 1 km below Failford.

In the absence of observed stream flow data, design discharges representing the 1 in 20, 50 and 100 year events were derived.

Steady state backwater model analysis of the design discharges were used to derive peak flood heights. The historical data for the March 1978 flood provided sufficient data to enable calibration of the model. While it was not possible to test the model against other known floods, the calibration fit indicated the model was adequate for the purposes of the study.

Flood contours for the 1 in 100 year flood are shown on Figure 7.

2. INTRODUCTION

The Wallamba River is located on the mid-north coast of N.S.W. The only significant urban centre is the small township of Nabiac, situated adjacent to the Pacific Highway crossing of the Wallamba approximately 30 Km south of Taree.

In the past, the town has served as a service centre to the surrounding rural community. More recently, however, it has developed as a dormitory and rural recreational area for the nearby centres of Taree and Forster/Tuncurry. The town has previously been subject to serious flooding and consequently, this report has been prepared as the basis on which the Great Lakes Shire Council could develop an appropriate management plan.

A fold out reference diagram has been provided at the back of this report to assist in identifying the study area and salient locations within it.

3.0 CATCHMENT AREA

3.1 General

The headwaters of the river's tributaries drain the foothills of the Great Dividing Range and the river flows in a meandering easterly direction before turning southwards at Failford and discharging into the entrance channel to Wallis Lake some 3 kilometres from the Pacific Ocean (see Reference Plan). The major neighbouring catchments are the Manning River to the north and the Coolongolook River, which also flows into Wallis Lake, to the south.

The total catchment of the Wallamba River is in excess of 500 square kilometres. The eastern half lies within the boundaries of the Great Lakes Shire Council the western half is within the Greater Taree City Council. The majority of the catchment is heavily forested with the remainder under pasture with scattered timber.

3.2 Detail Description

The upper catchment is steep (some slopes are greater than 20 degrees) and heavily forested. Wallamba River and its major tributaries, Firefly Creek and Khoribakh Creek, have relatively steep gradients and limited floodplain widths. The Upper Wallamba River floodplain is basically confined to an incised river channel as far downstream as Dargavilles Crossing, approximately three kilometres upstream of the Nabiac Bridge.

Between Dargavilles Crossing and Failford the river has a gentler gradient and a gradually widening floodplain. The river is tidal to a causeway just upstream of Nabiac and has a width ranging from 50 to 100 metres. Within this reach the only significant tributaries joining the Wallamba River are Pipe Clay Creek and Nabiac Creek.

Downstream of Failford, the floodplain broadens further and substantial portions of the adjacent overbank areas have typical marsh-type vegetation and are subject to relatively frequent inundation. There are a further two tributaries, Bungwahl and Darawakh Creeks. The river itself is 100-150 metres wide, has a flat gradient and divides forming a number of midstream islands. By the time the river flows into Wallis Lake the river channel is about 600 metres wide.

4. AVAILABLE DATA

Significant floods have been experienced in 1927, 1929, 1947 and 1978. While a number of flood heights have been reported by residents few relate to the largest events of 1927 and 1929. However, it is known that Nabiac was inundated in 1927, 1929 and 1947.   All levels referred to in this report are to Australian Height Datum (AHD).

4.1 Historical Flood Heights

Due to the long period since the significant floods of 1927, 1929 and 1947 very little information is available by way of resident recollection. Recent floods are quite well remembered, however, these (1978 and 1983) were relatively small events.

The listing of historical flood data in Appendix A has been compiled from a number of sources. These include field interview programmes and survey undertaken by officers of the Great Lakes Shire Council and Public Works Department plus information compiled by D. J. Dwyer and Associates (Ref 4) for a proposed development adjacent to the Wallamba River downstream of Darawank Bridge. An attempt has been made in Appendix A to classify the accuracy of each of the surveyed flood levels and this has been based on the degree of confidence expressed by the observer and the magnitude of the surveyed level relative to adjacent flood levels. The locations of the flood heights are shown in Figure 2.

In 1982 the PWD installed a network of maximum height recorders along the Wallamba River and a number of its tributaries. An automatic continuous river level recorder was also installed.

4.2 Rainfall

Long term rainfall records available within the Wallamba River catchment are from daily read gauges located in the Krambach district (Met Bureau numbers 060021 and 060033). The oldest of the Krambach gauges was installed in 1908. There are a number of long term daily read gauges in an adjacent catchment, however, only five of these (Bulby Brush 060003, Forster 060013, Gloucester 060015, Wingham 060036/060095 and Taree 060030) are located within 15 kilometres of the Wallamba River catchment boundary (see Figure 1).

These long term gauges provide daily rainfall totals for the major flood events experienced in 1927, 1929 and 1947. However, this information is of only limited use because the critical duration for flood producing storms over the Wallamba River catchment has been found to be 24-30 hours. Therefore, there is no information available on historical storm temporal patterns.

For the 1978 and 1983 floods additional data is available from three daily read gauges at Tipperary (060103) and adjacent catchments at Tinonee (060087) and Waukivory (060062), see Figure 1.

Prior to the July 1983 installation by the PWD of a pluviometer at Nabiac there has been no recorder rain gauges (pluviometers) within the Wallamba River catchment. There are five pluviometers located in neighbouring catchments but only the recorders at Taree, operated by the Bureau of Meteorology and at Upper Johnsons Creek, operated by the Hunter District Water Board, are within 15 kilometres of the Wallamba River catchment boundary (as shown in Figure 1).

The Taree and Upper Johnsons Creek recorders were operating during the March 1978 flood event and the recorded rainfall patterns have been analysed to develop an appropriate rainfall pattern for the catchment.

The 1983 output from the Nabiac pluviometer for the October 1983 flood was incomplete and hence could not be used for the analysis.

4.3 Streamflow Data

The only streamflow station within the study catchment was at "The Old Sawmill" (202005) on the Wallamba River, approximately 5.5 kilometres upstream of Nabiac. The station was established by the Water Resources Commission in April 1969 and operated until September 1978. A number of small flood stage hydrographs are available for that period however the March 1978 flood peak exceeded the maximum recorded height of the gauge by approximately 2 metres. The highest flow gauging undertaken at the gauge corresponded to a flow of less than one third the estimated March 1978 peak flow. The station rating is classed as poor by the WRC and consequently, the data available from this station is only of limited value.

4.4 Floodplain Survey

Since the best available maps were 1:25000 scale topographical series with 10 metre contour intervals there was a need to undertake ground and hydrographic survey to adequately define the cross sections required for the hydraulic modelling. A series of cross sections between Darawank Bridge and The Old Sawmill were surveyed by the PWD and their locations are shown in Figure 2. Appendix C provides details of each cross section.

5. INVESTIGATIVE PROCEDURE

5.1 General

Flooding characteristics in the Nabiac area are dependent upon stream discharge and channel geometry. Downstream of Failford, however, the effect of elevated lake levels due to tidal variation or storm related phenomena can result in a range of flood levels for a given discharge. This is known as tailwater effects, which decrease in magnitude moving upstream away from the cause.

5.2 Hydraulic Models

A variety of numerical hydraulic models are available; the choice of the model being influenced by factors such as:

- Stream characteristics
- Level of detail required
- Available data

The section of river being modelled has a confined flood plain and limited natural storage (i.e. simple geometry). Also, the degree of detail required was not excessive and consequently, it was possible to use a one dimensional steady state backwater model. The type adopted was HEC-2, a computer program developed by the US Corps of Engineers, Reference 8.

In establishing a model, it is necessary to ensure that it will simulate actual flooding conditions. This is achieved by calibrating and testing the model against known historical events. The 1978 flood was considered adequate for calibration purposes however no appropriate event was available for testing/verification (the 1983 flood was too low i.e. 1-2 metres below the 1978 with insufficient rainfall data).

The hydraulic model was then used to produce design 1 in 20, 1 in 50 and 1 in 100 year flood profiles. The tailwater levels used in these runs assumed that the flooding was due to the river flows only and were based on the carrying capacity of the stream. These levels were adopted at Darawank Bridge, which was considered to be far enough downstream to give reliable levels at Failford. (Using a backwater profile model, any possible errors in flood levels are reduced as the model calculations progress upstream).

The actual hydraulic modelling is described in detail in Section 7.

5.3 Hydrologic Modelling

As there was no streamflow data available for the Wallamba River Catchment, flood hydrographs had to be produced for the historical calibration event (1978 flood) and the design floods.

The hydrologic model used for this purpose was the Cordery Webb synthetic unit hydrograph method (Reference 2). This model was derived for smaller type rural catchments similar in nature to the Wallamba River watershed. The design flows were also checked using the Pilgrim, McDermott flood estimation method.

The actual hydrologic modelling is described in detail in Section 6.

6. HYDROLOGY

6.1 General

The following sub-sections detail the compilation of the rainfall pattern adopted for the 1978 flood event, the derivation of the design flood rainfall patterns and the calculation of the flows resulting from those historical and design storms. Rainfall patterns and peak flows have been generated for four defined locations along the Wallamba River (The Old Sawmill, Nabiac Bridge, Failford and Chapmans Road).

6.2 Historical & Design Flood Rainfalls

6.2.1 March 1978

As outlined in Section 4.2, there were no recording rain gauges within the study catchment at the time of the March 1978 storm. The nearest pluviometers were located at Upper Johnsons Creek (south west of the catchment) and at Taree to the north east. The rainfall patterns recorded at those two gauges are shown in Figure 3. From Figure 3, it can be seen that there is marked similarity in time of commencement and duration of intense rainfall and the near constant intensity during that same period.

To determine an appropriate rainfall intensity pattern to be applied over the Wallamba River catchment an average rainfall intensity pattern was developed from the Upper Johnsons Creek, Taree and Chichester patterns for the 48 hour period from 0900 hours 18/3/78 to 0900 hours 20/3/78. Daily rainfall totals recorded at a number of gauges that are within or adjacent to the catchment are listed in Table 1.

TABLE 1 : MARCH 1978 DAILY RAINFALL TOTALS (mm)

Rainfall Station Name	Rainfall Station Number	Date of reading (at 0900 hours)		
		18/3	19/3	20/3
Bulby Brush	060003	39	106	149
Krambach	060021	56	126	145
Tipperary (via Krambach)	060103	38	196	150
Forster	060013			234**
Waikivory	060062			292*
Tinonee	060087			230*
Gloucester	060015			311**

*   2 day total
** 3 day total

For the estimation of the rainfall excess patterns the rainfall that fell before 0900 hours 18/3/78 was assumed to represent initial loss. The 48 hour rainfall totals from Table 1 corresponding to the period of the 48 hour average rainfall pattern were used to compile a 48 hour isohyetal map of the Wallamba River catchment. Using this map, weighted 48 hour totals were generated for "The Old Sawmill" (290mm), Nabiac Bridge (280mm), Failford (270mm) and Chapmans Road catchment (250mm). These weighted total were then converted to 48 hour storm intensity patterns using the average intensity pattern.

6.2.2 Design Rainfalls

As described earlier there are no long term pluviograph records available for the Wallamba River catchment. Therefore to develop the 1:20 year, 1:50 year and 1:100 year design storm intensities the procedure outlined in Section 2.5.1.1 of Australian Rainfall and Runoff (Ref 1) has been followed. From Figures 2.18, 2.19, 2.20 and 2.21 (Ref 1) the 12 and 72 hour duration average storm intensities for 2 and 50 year recurrence intervals were obtained. These are given in Table 2.

TABLE 2 - 12 & 72 HOUR STORM INTENSITIES (mm/hr)

Duration (hours)	Recurrence Interval	
	2 years	50 years
12	8.0	16.0
72	2.5	5.5

Utilising Figures 2.46 and 2.47 (Ref 1) the 1:20 year, 1:50 year and 1:100 year rainfall intensities given in Table 3 were then obtained. Table 4 lists the corresponding total storm volumes.

TABLE 3 - 18, 24 & 30 HR STORM INTENSITIES (mm/hr)

Duration (hours)	Recurrence Interval		
	20 year	50 year	100 year
18	11.0	12.5	14.0
24	9.2	10.4	11.8
30	8.0	9.4	10.4

TABLE 4 - 18, 24 & 30 HR STORM VOLUMES (mm)

Duration (hours)	Recurrence Interval		
	20 year	50 year	100 year
18	198	225	252
24	221	252	284
30	240	282	312

The storm volumes listed in Table 4 were converted to storm temporal patterns using the procedure outlined in Chapter 3 of Reference 1.

6.3 Historical And Design Flood Flows

6.3.1 March 1978

To determine the peak discharges at the four Wallamba River locations the 48 hour rainfall patterns derived in Section 6.2.1 were convoluted with derived unit hydrographs. (Details of the Cordery-Webb method parameters are given in Appendix B). Flows, corresponding to rainfall excess patterns produced by subtracting continuing loss rates of 2.5mm/h were computed for trial testing of the hydraulic model. Flows at hydraulic cross sections between the four key locations were estimated on the basis of relative distance from the nearest key location.

6.3.2 Design Floods

As detailed in Section 4.2, the only streamflow station within the study catchment (at "The Old Sawmill" upstream of Nabiac) has only ten years of data and the high flow rating for the station is not satisfactory. For these reasons, an annual or partial series analysis of flood flows has not been considered worthwhile to be taken to generate 1:20 year, 1:50 year and 1:100 year flood flows at the station.

In the absence of streamflow records, design peak flows were derived using the Cordery-Webb synthetic unit hydrograph method, (Reference 2), and the Pilgrim and McDermott flood estimation method (Reference 3). For both methods the design rainfalls derived in sub-section 6.2.2 were utilised. Average initial and continuing losses of 21.0mm and 2.5mm/h (as given in Ref 2) have been adopted for the Cordery-Webb method. After testing a range of design storm durations from 18 to 30 hours the critical duration was found to be 24 hours.

Table 5 lists the computed 1:20 year, 1:50 year and 1:100 year peak flows that were generated using the above two methods. As for the calculations of the 1978 flood flow, flows were computed at "The Old Sawmill", Nabiac Bridge, Failford and Chapmans Road. From that Table it can be seen that there is relatively close agreement between the two sets of flows. Since the two procedures have been developed from non-mutually exclusive data sets it is to be expected that there would be no significant difference between the computed flows. Having utilised the Cordery-Webb procedure for generating the 1978 flood flows, the design flows generated using that procedure have been adopted for the hydraulic modelling of the design floods. As for the 1978 flood modelling, flows at hydraulic cross sections between the four key locations were estimated on the basis of relative distance from the nearest key location.

TABLE 5 – 1:20 YR, 1:50 YR AND 1:100 YR FLOOD FLOWS (m^3/s)

Wallamba River Location	Cordery-Webb Procedure			Pilgrim-McDermott Procedure		
	1:20 yr	1:50 yr	1:100yr	1:20 yr	1:50 yr	1:100 yr
The Old Sawmill	766	896	1027	599	778	963
Nabiac Bridge	937	1098	1260	707	940	1134
Failford	1012	1184	1368	868	1163	1410
Chapmans Road	1095	1283	1482	1045	1373	1725

7. HYDRAULIC MODELLING

7.1 General

The hydraulic properties of the creek were described by a series of cross sections (See Figure 2) and appropriate Mannings 'n' values for channel and overbank areas were determined from field inspection. A complete listing of cross section data used in the model is in Appendix C.

Hydraulic modelling of the creek and adjoining flood plain was carried out to determine the peak height profiles for 20, 50 and 100 year floods under existing catchment conditions. Results are depicted in Figure 6.

7.2 Calibration Using March 1978 Flood Event

The 1978 flood flow estimates (for loss rates of 2.5mm/h) were used as input to the HEC-2 backwater model together with the initial estimates of Mannings 'n' values. A closer fit to the historical flood data was subsequently obtained by adjusting values of Manning's 'n'. These values are listed in Appendix D.

Figure 5 shows the comparison between the HEC-2 calculated flood profile and observed flood levels.

TABLE 6 : 1978 CALIBRATION FLOWS (m^3/s)

Wallamba River Location	March 1978 Flood Peak (Rainfall Loss Rate, 2.5 mm/h)
The Old Sawmill	577
Nabiac Bridge	691
Failford	759
Chapmans Road	756

7.3 Calculation of Design Flood Profiles

The design flood profiles were computed by running the flood discharges (generated in 6.3.2) in the calibrated HEC-2 model. The tailwater levels at Darawank Bridge were estimated using the carrying capacity of the stream. While this method may contain some inaccuracies, errors diminish in a backwater model as the calculation progresses upstream. Any errors could be expected to be negligible upstream from Failford.

The tailwater levels adopted at Darawank Bridge were as follows:

1 : 20 year flood	1.9 m
1 : 50 year flood	2.1 m
1 : 100 year flood	2.3 m

Flood levels downstream of Failford may be influenced by factors other than flows down the Wallamba River, and the determination of design profiles in this area are the subject of further investigations by the Department.

The computed 1:20 year, 1:50 year and 1:100 year flood profiles are shown in Figure 6.

8. RESULTS

Following calibration of the hydraulic model to the 1978 historical flood levels the model was used to compute 1:20 year, 1:50 year and 1:100 year flood profiles for the Wallamba River (see Figure 6). The 1:100 year flood profile has then been translated into a series of flood contours for the river reach extending from Failford upstream to Nabiac (see Figure 7).

Compared with the limited historical flood information available between Failford and Nabiac the computed 1:100 year flood profile is near the higher levels. The highest historical flood levels in that reach are for the 1927 flood event. These levels are above the 1 in 100 year flood profile even though the limited daily rainfall totals available for that flood (see Reference 5) were not particularly large.

The model gives levels along the river. As flood water in the western part of Nabiac drains to a point near the bridge, water levels in this part of the town can be expected to be about 0.3m above the level at the bridge. The levels in Eastern Nabiac will be less, as this part of the town drains to a point near Nabiac Wharf.

Flooding at Nabiac could also be influenced by storm water flows passing through two creeks that run through the township. These creeks are presently chocked with undergrowth and local flooding could conceivably occur in Nabiac, even in the absence of a general rise in river levels.

While the results are considered to give a reasonable estimate of flood levels, a number of water level recorders and a rainfall recorder have been installed to collect more data. Following a major flood, it may be necessary to undertake a more detailed study.

9.   REFERENCES

1.   The Institution of Engineers, Australia, 1977.
      "Australian Rainfall and Runoff, Flood Analysis and Design".

2.   Cordery, I. and Webb, S. N., 1974.
      "Flood Estimation in Eastern New South Wales – A Design Method".
      Civil Eng. Trans. Inst. Engrs. Aust., Vol. CE16, pp 87–93.

3.   Pilgrim, D. H. and McDermott, G. E., 1982.
      "Design Floods for Small Rural Catchments in Eastern New South
      Wales".
      Civil Eng. Trans. Inst. Engrs. Aust., Vol. CE24, No. 3, pp 226–234.

4.   Dwyer, D. J. & Associates Pty. Ltd., 1978.
      "Environmental Impact Statement for Proposed Development Wollomba
      Peninsula, Tuncurry N.S.W.".
      Prepared for Civil Land and Real Estate Pty. Ltd.

5.   Dwyer, D. J. & Associates Pty. Ltd., 1978.
      "Wallamba Peninsula Tuncurry Flood Investigation"
      Prepared for Civil Land and Real Estate Pty. Ltd. (amended May)

6.   Dwyer, D. J. & Associates Pty. Ltd., 1979.
      "Proposed Development at Wollomba Peninsula, Tuncurry – Addendum
      to Environmental Impact Statement. Appendix C – Development and
      Management of Floodplain".

7.   Chow, Ven Te, 1959.
      "Open Channel Hydraulics".
      McGraw-Hill Book Company.

8.   US Army Corps of Engineers, 1979.
      "HEC-2 Water Surface Profiles – Users Manual"
      Hydraulic Engineering Centre.

9.   Laurie, Montgomerie & Pettit Pty. Ltd., 1980.
      "Manning Valley Flood Plain Management Study"
      NSW Coastal River Valley Series.
      Prepared for the NSW State and Commonwealth Governments.

LEGEND

● Daily read Rain Gauge
● Recording Rain Gauge
● Abandoned Stream Flow Station

—— Catchment Boundary

SCALE 1:250000

WALLAMBA RIVER FLOOD STUDY

**Locality Plan
Rain Gauges and
Catchment Boundary**

Figure 1

Historical Flood Level, Model Cross Section, Location Plan

Figure 2

LEGEND

② Historical Flood Level Location

35 HEC-2 Model Cross Section

approx scale   1:60,000

WALLAMBA RIVER FLOOD STUDY

400

300

200

CUMULATIVE DEPTH – mm

100

0

DATE

17   18   19   20

③
⑤
②
④
①

LEGEND

1   Monkerai
2   Upper Johnsons Creek
3   Chichester Dam
4   Karuah Forest
5   Taree

WALLAMBA RIVER FLOOD STUDY

Mass Curves of Rainfall
March 1978

Figure 3

WALLAMBA RIVER FLOOD STUDY

Historical Flood Data

Figure 4
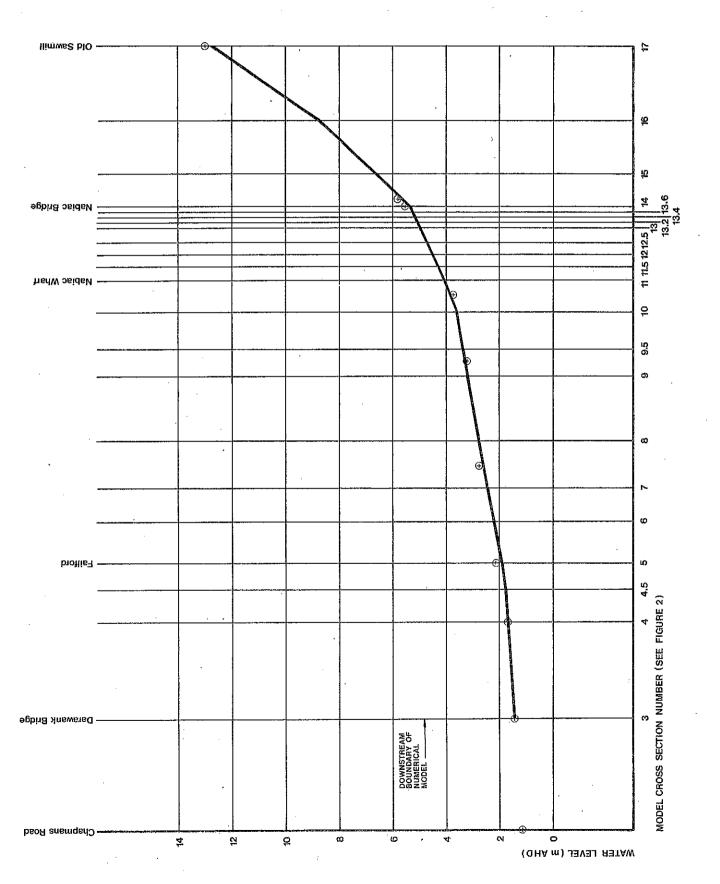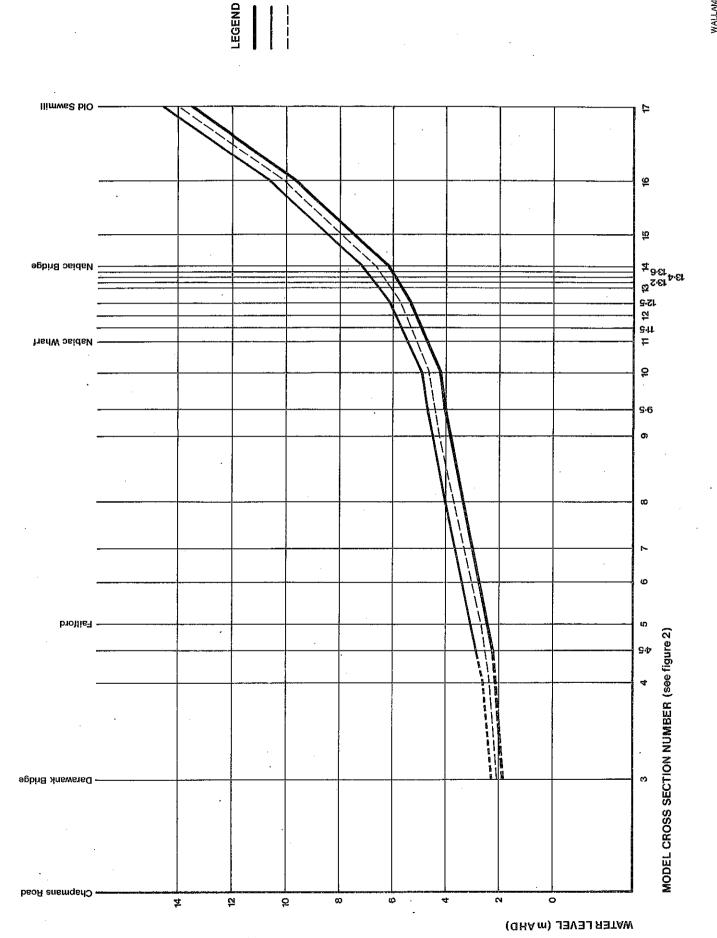
WALLAMBA RIVER FLOOD STUDY

1978 FLOOD CALIBRATION
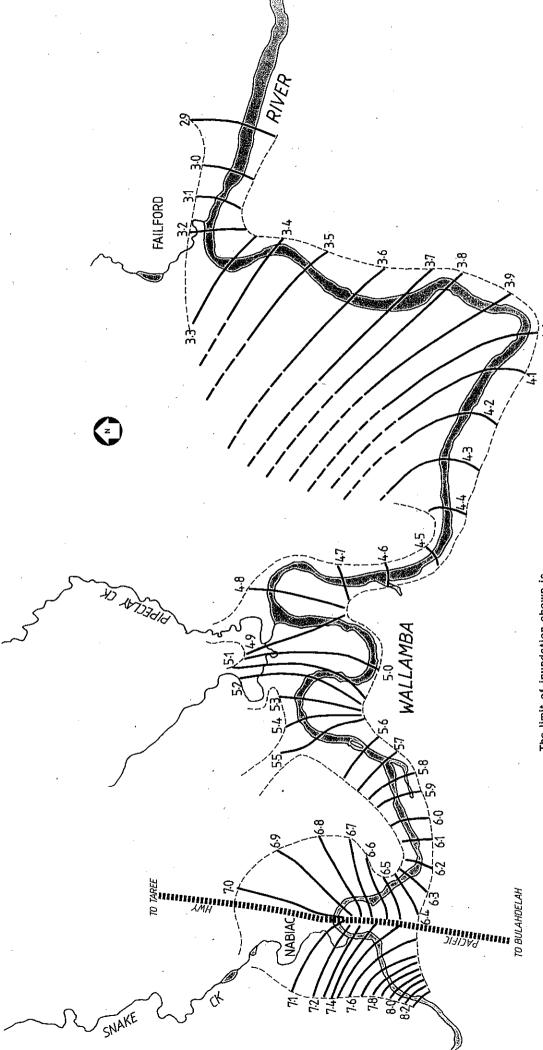
Figure 5

1978 FLOOD LEVELS

⊕   1978 FLOOD LEVELS

WALLAMBA RIVER FLOOD STUDY

Flood Profiles

Figure 6

FAILFORD

RIVER

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PIPECLAY CK

WALLAMBA

NABIAC

SNAKE CK

TO TAREE

HWY

PACIFIC

TO BULAHDELAH

N

The limit of inundation shown is
indicative only and should not be
considered as defining the boundary
of the 1 : 100 year flood

Contours show 1 : 100 year river flood
levels in metres AHD

Scale 1 : 25,000

1:100 Year Flood Contours

Figure 7

HISTORICAL FLOOD INFORMATION

All available historical flood data are summarised in Table A1 with the
levels plotted in Figure 4. The locations of the flood levels are
shown in Figure 2. The information has been compiled from field
interviews and survey undertaken by officers of the Great Lakes Shire
Council and Public Works Department, information compiled by D J Dwyer
and Associates (Ref 5) and a number of October 1983 flood heights were
obtained from the recently installed network of PWD Maximum Height
Recorders (MHR).

TABLE A1 - HISTORICAL FLOOD INFORMATION

1927 FLOOD

LOCATION NO.	FLOOD LEVEL (m AHD)	SOURCE	COMMENT
11	5.56	Mr Elliot McMaster, occupier "Glen Ora"	
12	5.84	Mr Elliot McMaster, occupier "Glen Ora" as told to Mr Hodges, house occupier	
15	5.93	Mr Bob Campbell, Nabiac (former occupier)	Reliability uncertain
17	7.30	Mr Norman Lulham, Nabiac	Local creek level

1929 FLOOD

LOCATION NO.	FLOOD LEVEL (m AHD)	SOURCE	COMMENT
1	1.84	(Ref 5)	
2	1.74	(Ref 5)	
3	1.92	(Ref 5)	
3	1.88	(Ref 5)	
17	7.86	Great Lakes Shire Council	Local creek level ?

1947 FLOOD

LOCATION NO.	FLOOD LEVEL (m AHD)	SOURCE	COMMENT
7	3.35	Mr W Saxby, Willow Point Rd Failford	
17	7.15	Mr Norman Lulham, Nabiac	

1957 FLOOD

LOCATION NO.	FLOOD LEVEL (m AHD)	SOURCE	COMMENT
11	4.96	Mr Elliot McMaster, occupier "Glen Ora"	
15	5.63	Mr Bob Campbell, Nabiac (former occupier)	Reliability uncertain
16	4.81	Mr Clayton Everingham, Nabiac	Considered reliable

1978 FLOOD

LOCATION NO.	FLOOD LEVEL (m AHD)	SOURCE	COMMENT
1	1.04		
3	1.39		
5	1.67	Mr Peter Johnson, resident Wallamba Ski Park	
5	2.69	Proprietor, Shalimar Caravan Park	Considered to be too high
6	2.10		
9	2.75	Great Lakes Shire Council	
10	3.15/4.24?	Bayley, occupier "Belmont" (Great Lakes Shire Council)	
11	2.50	Mr Elliot McMaster, occupier "Glen Ora"	Considered reliable
12	2.78	Mr David Hodges, occupier	Considered doubtful
13	3.75/4.05?	Mr Colman occupier (Great Lakes Shire Council)	
17	5.5	Mr Northam, occupier (Great Lakes Shire Council)	
18	5.8	Mr Abbott, occupier (Great Lakes Shire Council)	
20	13.0-13.2	Water Resources Commission gauge (209005) "The Old Sawmill"	

1983 FLOOD

LOCATION NO.	FLOOD LEVEL (m AHD)	SOURCE	COMMENT
1	1.16	Chapmans Road PWD MHR	
3	1.09	Darawank Bridge PWD MHR	
4	1.17	Gowack Island PWD MHR	
5	1.23	Wallamba Ski Park	Considered doubtful
5	2.06	Shalimar Caravan Park	
6	1.37	Bullocky Way PWD MHR	
8	1.68	Willow Point Road PWD MHR	
11	1.79	Mr Elliot McMaster, occupier "Glen Ora"	
14	2.43	Nabiac Street PWD MHR	
17	3.34	Nabiac Bridge PWD MHR	
19	5.49	Dargavilles Crossing PWD MHR	
20	10.94	The Old Sawmill PWD MHR	

CORDERY-WEBB METHOD PARAMETERS

TABLE B1 - CATCHMENT DETAILS

1. Chapmans Road :

Catchment Area	= 500 km^2
Mainstream Length	= 71.2 km
Average Slope	= 0.00109 m/m
C value	= 16.3 hours
K value	= 7.5 hours

2. Failford :

Catchment Area	= 427 km^2
Mainstream Length	= 61.2 km
Average Slope	= 0.00141 m/m
C value	= 13.6 hours
K value	= 6.9 hours

3. Nabiac Bridge :

Catchment Area	= 328.4 km^2
Mainstream Length	= 47.7 km
Average Slope	= 0.00229 m/m
C value	= 10.0 hours
K value	= 6.0 hours

4. Old Sawmill :

Catchment Area	= 259 km^2
Mainstream Length	= 41.7 km
Average Slope	= 0.00252 m/m
C value	= 9.1 hours
K value	= 5.5 hours
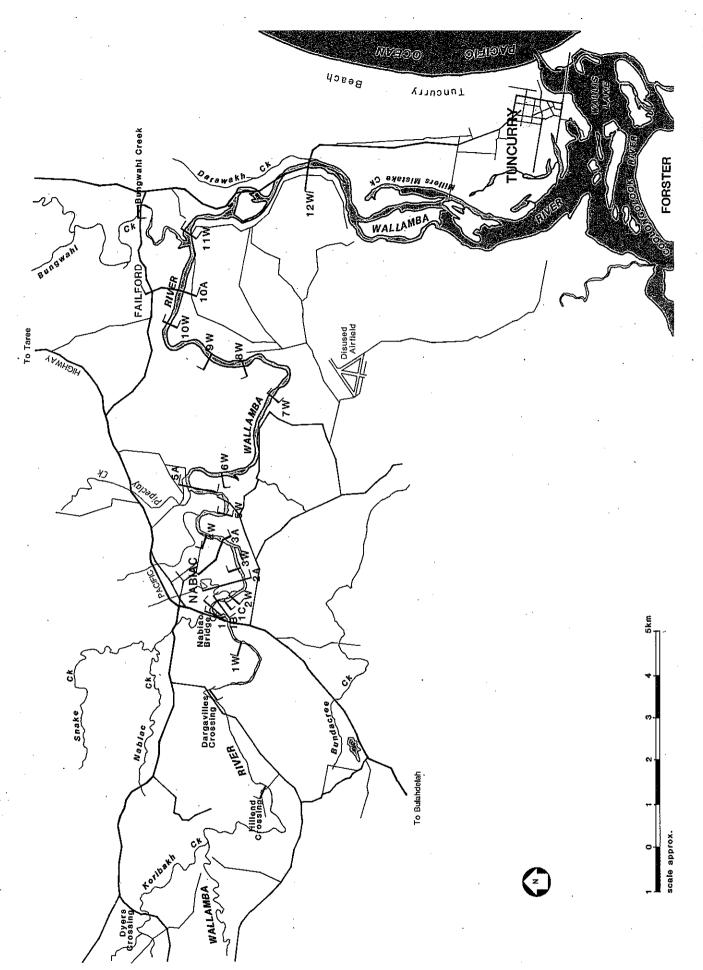
TABLE B2 : DERIVED UNIT HYDROGRAPHS
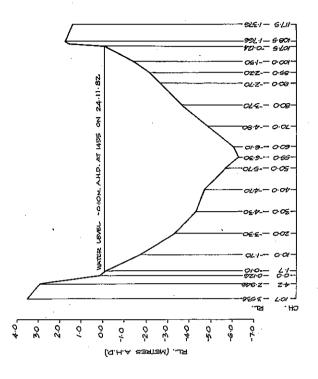
WALLAMBA RIVER - LOCATIONS

TIME INTERVAL (T)	THE OLD SAWMILL (T = 2 hours)	NABIAC (T = 2 hours)	FAILFORD (T = 2 hours)	CHAPMANS ROAD (T = 3 hours)
1	0.359	0.363	0.469	0.372
2	1.446	1.457	1.865	1.464
3	3.161	3.180	4.015	3.137
4	5.313	5.353	6.651	5.197
5	6.628	7.842	7.919	7.439
6	5.728	7.875	6.406	8.221
7	3.967	5.659	4.147	6.568
8	2.761	4.045	2.678	4.395
9	1.921	2.891	1.730	2.940
10	1.337	2.067	1.117	1.968

RIVER CROSS SECTION DATA

Cross Section Location Plan

Drg. No. C1

Map labels:
PACIFIC OCEAN
Tuncurry Beach
Tuncurry
WALLAMBA RIVER
WALLIS LAKE
FORSTER
COOLONGOLOOK RIVER
Millers Mistake Ck
Disused Airfield
Darawakh Ck
Bungwahl Creek
Bungwahl Ck
Bungwahl
FAILFORD
RIVER
To Taree
HIGHWAY
Pipeclay Ck
WALLAMBA
NABIAC
Nabiac Bridge
PACIFIC HIGHWAY
Snake Ck
Nabiac Ck
Dargavilles Crossing
RIVER
Hillend Crossing
Koribakh Ck
Dyers Crossing
WALLAMBA
Bundacree Ck
To Bulahdelah

Cross section labels: 12W, 11W, 10A, 10W, 9W, 8W, 7W, 6W, 5A, 5W, 4W, 3A, 3W, 2A, 2W, 1C, 1B, 1A, 1WL

N

scale approx.
1 0 1 2 3 4 5km

CROSS SECTION 12W (CONTINUATION)

HEAVILY TIMBERED

264° MAG.

78° MAG.

ORIGIN
RIGHT

RIGHT

CROSS SECTION 12W (60m DOWNSTREAM DARAWANK BRIDGE)

WATER LEVEL —0·1m. A.H.D. AT 0950 ON 25·11·82

RL. (METRES A.H.D.)

CH.

CROSS SECTION 11W

WATER LEVEL —0·10M. A.H.D. AT 1455 ON 24·11·82

RL. (METRES A.H.D.)

CH.

CROSS SECTION AT BUNGWAHL CREEK BRIDGE

PIER WIDTH ≈400 MM.

END ABUTMENT

END ABUTMENT

₵ PIER

RL. (METRES A.H.D.)

CH.

CROSS SECTION 10W AT MHR#7

CROSS SECTION 10A

CROSS SECTION 10A (CONTINUATION)

WALLAMBA RIVER FLOOD STUDY

River Cross Sections

Drg. No. C3

River Cross Sections

Drg. No. C4

WALLAMBA RIVER FLOOD STUDY

CROSS SECTION 6W

WATER LEVEL -0·16M A.H.D.
AT 0945 ON 24·11·82

RL. (METRES A.H.D.)

CROSS SECTION 7W

WATER LEVEL -0·20 M. A.H.D.
AT 1050 ON 24·11·1982

CROSS SECTION 8W AT MHR # 8

WATER LEVEL -0·22 M. A.H.D.
AT 1120 ON 24·11·1982

CROSS SECTION 9W

WATER LEVEL -0·18 M. A.H.D.
AT 1208 ON 24·11·82

RL. (METRES A.H.D.)

CROSS SECTION 5A

RL. (METRES A.H.D.)

PACIFIC HIGHWAY
APPROX. 1·2 KM.

FALLING

TIMBERED

ORIGIN RIGHT

186° MAG.

6° MAG.

CROSS SECTION 3A (CONTINUATION)

RL. (METRES A.H.D.)

12·0
10·0
8·0
6·0
4·0

CH. RL.
-903·3 - 10·72
-854·4 - 8·92
-806·0 - 758
-729·9 - 6·95
-655·7 - 7·19

CROSS SECTION 4W

RL. (METRES A.H.D.)

4·0
2·0
0·0
-2·0
-4·0

WL. 0·30 m. A.H.D.
AT 14·30 ON 23·11·82

CH. RL.
-83 - 2·925
-121 - 2·175
-2·3 - 1·505
-1·9 - 1·105
-10·0 - 1·600
-22·0 - 1·600
-35·0 - 2·100
-45·0 - 1·700
-50·0 - 1·900
-70·0 - 0·700
-80·0 - 0·400
-857 - 0·355
-92·7 - 3·152
-99·7 - 4·125

CROSS SECTION 5W

RL. (METRES A.H.D.)

4·0
2·0
0·0
-2·0
-4·0
-6·0

WL. -0·15 m. A.H.D.
AT 08·55 ON 24·11·82

CH. RL.
-83·6 - 2·612
-72·8 - 1·512
-67·3 - 1·522
-64·0 - 0·256
-55·0 - 2·150
-45·0 - 4·350
-35·0 - 6·150
-30·0 - 6·050
-20·0 - 4·550
-15·0 - 4·850
-5·0 - 0·350
-1·4 - 1·832
-7·5 - 2·442
-26·4 - 2·292
-350 - 3·152

CROSS SECTION 3A

RL. (METRES A.H.D.)

10·0
8·0
6·0
4·0
2·0
0·0
-2·0
-4·0

135° MAG.
100° MAG.
100° MAG.
300° MAG.
ORIGIN RIGHT
355° MAG.

SWAMP

CH. RL.
-655·7 - 7·19
-471·7 - 6·62
-381·3 - 6·42
-314·6 - 6·44
-333·4 - 6·01
-315·5 - 3·50
-283·7 - 1·23
-197·2 - 1·43
-172·3 - 2·13
-142·2 - 3·62
-134·7 - 3·53
-128·7 - 3·53
-109·4 - 3·41
-81·9 - 1·60
-74·9 - 1·4
-64·1 - 2·1
-63·9 - 1·9
-49·1 - 2·1
-30·9 - 2·2
-29·9 - 2·0
-24·1 - 2·1
-11·4 - 2·08
-4·3 - 5·87
0·0 - 6·60
1·1 - 6·96
-2·24 - 7·17
-75·2 - 6·92
-118·8 - 6·44
-180·6 - 7·11
-216·8 - 8·28

CROSS SECTION 2A

CROSS SECTION 2A (CONTINUATION)

CROSS SECTION 3W

R.L. (METRES A.H.D.)

CROSS SECTION 2A

CH. — R.L.
314·4 — 7·82
280·1 — 7·26
256·0 — 2·76
218·2 — 3·97
204·0 — 2·27
190·8 — 2·27
182·2 — 3·94
116·17 — 2·61
103·15 — 2·60
92·1 — 3·62
89·6 — 1·19
79·6 — 2·4
64·6 — 1·6
54·6 — 1·1
39·6 — 1·1
24·6 — 0·6
19·4 — 1·49
13·1 — 3·60
4·11
2·6 — 7·37
0·0 — 7·83
ORIGIN RIGHT
47·0 — 7·44
121·4 — 7·32
195·1 — 7·67
240·7 — 8·29
291·9 — 9·12

345½° MAG.
340° MAG.
160° MAG.

RL (METRES A.H.D.)
10·0
8·0
6·0
4·0
2·0
0·0
-2·0
-4·0

CROSS SECTION 2A (CONTINUATION)

CH. — R.L.
1128·6 — 13·36
1069·5 — 9·33
1021·6 — 7·56
926·1 — 7·72
730·5 — 7·55
639·1 — 7·59
514·2 — 7·27
461·2 — 7·27
371·4 — 7·87

347½° MAG.

SPORTS GROUND

RL (METRES A.H.D.)
14·0
12·0
10·0
8·0
6·0
4·0
2·0
0·0

CROSS SECTION 3W

CH. — R.L.
0·0 — 4·698
6·0 — 1·407
20·0 — 2·67
35·0 — 2·67
45·0 — 2·27
55·0 — 0·77
66·5 — 0·071
70·7 — 1·812
87·0 — 2·176

WL. -0·07m. A.H.D.
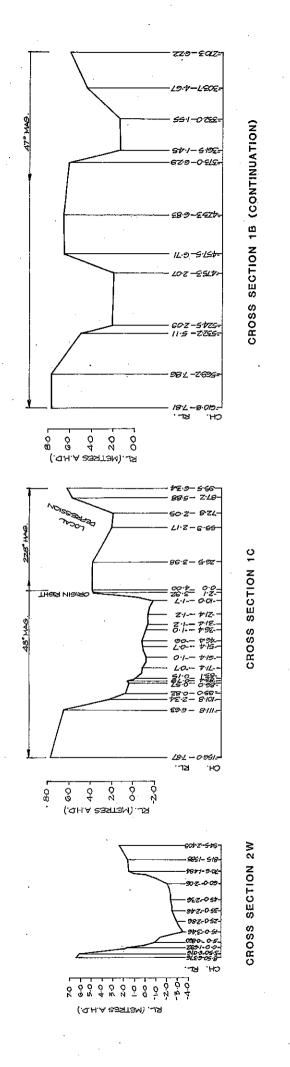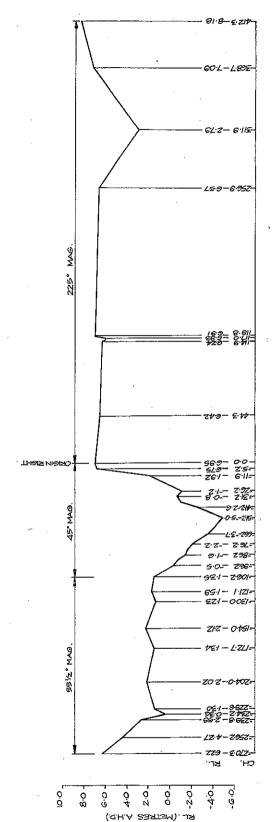AT 1600 ON 23·11·82

RL (METRES A.H.D.)
5·0
4·0
3·0
2·0
1·0
0·0
-1·0
-2·0
-3·0

CROSS SECTION 1B (CONTINUATION)

CROSS SECTION 1C

CROSS SECTION 2W

CROSS SECTION 1B

River Cross Sections

Drg. No. C7

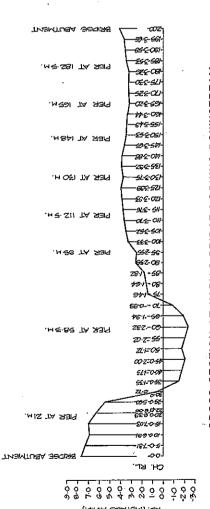CROSS SECTION 1A

CROSS SECTION 1W

CROSS SECTION AT NABIAC BRIDGE LOOKING DOWNSTREAM

WALLAMBA RIVER FLOOD STUDY

River Cross Sections

Drg. No. C8

RL. (METRES A.H.D.)

13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

CH. RL.

CROSS SECTION LOOKING DOWNSTREAM AT DARGAVILLES CROSSING

RL. (METRES A.H.D.)

16
14
12
10
8
6
4
2
0

CH. RL.

CROSS SECTION AT HILLEND CROSSING LOOKING DOWNSTREAM

River Cross Sections

Drg. No. C9

APPENDIX D

TABLE D1
CHANNEL ROUGHNESS COEFFICIENTS

HEC 2 CROSS-SECTION NO.	CALIBRATED VALUES OF MANNING's "n"
1	0.015
2	0.015
3	0.015
4	0.015
4.5	0.02
5	0.03
6	0.03
7	0.03
8	0.03
9	0.045
9.5	0.045
10	0.045
11	0.058
11.5	0.058
12	0.058
12.5	0.058
13	0.062
13.2	0.062
13.4	0.062
13.6	0.062
14	0.062
15	0.062
16	0.12
17	0.17