FLOODING & WATERWAYS

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GOSFORD CITY COUNCIL

PEARL BEACH – FLOODING AND DRAINAGE INVESTIGATION

DRAFT

Received 25-11-1992

ADOPTED - 14.12.93

Min. No. 1601/93

GHD

Gutteridge Haskins & Davey Pty Ltd

GOSFORD CITY COUNCIL

PEARL BEACH - FLOODING AND DRAINAGE INVESTIGATION

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September 1992
214/024071/00
R2452

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EXECUTIVE SUMMARY

The objective of this drainage investigation is to produce a management plan for the northern end of the Pearl Beach residential area, to ensure that houses remain flood free during the 100 year ARI event and that property flooding is minimised. The investigations included collation of information from Council records, resident interviews and ground survey to identify house floor levels and details of the drainage system and surface flow paths. A computer model was established to define the 20, 50 and 100 year ARI storm flows and hydraulic grade lines and evaluate likely mitigation options.

The study area receives runoff from the fringing Brisbane Water National Park and drains to a lagoon, aligned parallel to the beach, and thence flows to Broken Bay. Significant flooding of the area has occurred in recent years (April 1988, January 1989, May 1989 and February 1990) causing property damage and inconvenience to the local residents.

It was found from the computer modelling that the underground stormwater drainage system capacity was generally limited to less than the 5 year ARI event and significant overland flows occurred throughout the area.

A number of measures were evaluated to improve the local drainage, including combinations of a retarding basin, new underground pipelines, improved inlet pits and collection and diversion of runoff from the National Park.

Recommended works include a new pipeline duplicating Line 6 through the centre of Catchment A, with sufficient capacity to convey the 20 year ARI flood with associated works, including improved headworks and stormwater collection in Garnet Road, Cornelian Road and Diamond Road. It would be necessary to carry out roadworks on Beryl Boulevard to prevent stormwater from entering these roads and other works to collect the stormwater at the eastern end of the Boulevard and direct it to the Lagoon.

A number of minor works have been identified to improve the efficiency and effectiveness of the main drainage line 6.

In catchment B it will be necessary to augment the pipe inlets in Jade Place and collect runoff from Pearl Beach Drive and convey it to Jade Place, or in the event that it is not possible to obtain an easement, to convey it to Onyx Road. Minor fencing works are required between Cornelian Road and Diamond Road to improve the overland flow path.

In respect of the outlet from the lagoon to Broken Bay it is recommended that the sand bar not be allowed to exceed an elevation of 2.75 m AHD, as the culvert remains inlet controlled up to this elevation, and downstream restrictions do not affect the culvert performance. Significant storm events would be expected to scour out any sand accumulation, but lower intensity storms may not generate sufficient velocities to remove the sand bar, thus affecting the performance of the outlet.

In addition to normal Council maintenance of the drainage system it is recommended that a representative of the local community takes responsibility for regular inspections of the main inlets to the drainage system to ensure that the inlets are free of debris at all times.

DRAINAGE STUDY

STAGE 1

1 DRAINAGE STUDY - STAGE 1

1.1 Introduction

The objective of the study is to develop a feasible drainage strategy for Pearl Beach to ensure that houses affected by the 100 year Average Recurrence Interval (ARI) flood are made flood free and that flooding of properties is reduced to a standard acceptable to Council. The study consists of a three part investigation as follows:

- Drainage Study
- Management Study
- Management Plan

The major elements of the investigation were as follows:

- Collation of all available information from Council records
- Resident Interviews to collect further information on flooding behaviour
- Ground survey to identify house floor levels, levels and details of the drainage system, major services and surface flow paths
- Establishment of a computer model to define the 20, 50 and 100 year ARI storm flows
- Review of Likely Mitigation Options
- Recommendation of a Management Plan

The objectives of the Management Plan as set out by Council are to develop drainage strategies to relieve flooding problems. These are to include works and/or drainage easements where augmentation of the existing drainage system is found to be impractical. A preliminary estimate of costs is required together with recommendations for staging of the works. Measures to be taken by householders to reduce the risk of flooding to their properties are also to be considered.

A Catchment Plan is shown in Drawing 1.1. The study area includes the following streets, located at the northern end of the Pearl Beach residential area:

Beryl Boulevard
Cornelian Road
Diamond Road
Garnet Road
Jade Place
Onyx Road

The existing drainage system is shown in Drawing 1.2. The drainage system consists of a number of isolated pipeline systems which mostly drain eastward to a Lagoon located parallel to the beach, and thence via a weir and culvert to the ocean. The study area receives runoff from the Brisbane Waters National Park, which fringes the area.

1.2 Data Collection

1.2.1 Council Records

Council supplied details of inlet pits and pipelines, water supply lines, telecom and sewer lines. Copies of correspondence from local inhabitants on drainage/flooding issues were also obtained from Council.

1.2.2 Resident Information

During the ground survey, questionnaires were handed out to those houses where it was known from Council records that flooding problems had been experienced or it was considered that there was the potential for such problems.

Many of the houses are unoccupied for most of the time and despite two visits to the area, it was not possible to carry out interviews and therefore most of the questionnaires could not followed up. Efforts were then made to contact the owners at their permanent addresses, and a further round of questionnaires was sent out to these addresses.

Copies of the responses are provided in Appendix A. Tables 1.1 to 1.3 show details of the inundated properties as obtained from Council records and the results of questionnaires.

Photographs of recent flooding events were made available by some residents, and a selection of these is used in this report.

1.2.3 Ground Survey

An initial site inspection was carried out with Council staff in October 1991 to evaluate the nature and extent of the problems. Then, following the collation and review of available data, a specification for ground survey was drawn up and the following information was collected:

- Inlet pits – invert levels, pipe sizes, ground and kerb levels in vicinity of the inlets
- House floor levels

Table 1.1
Properties in Vicinity of Drain Lines - Cornelian Road

No	Lot	Stories	Type	Floor Lev (m AHD)	House(H), Property(P) Flooding April 88	Jan 89	May 89	Feb 90	Date Unknown	Letter to council	Questionnaire Received
Cornelian Road (East)											
42	133	1	Slab	7.01							
44	134	2	Slab	7.21							
44A	135	2	Slab	6.90					P	Yes	
46	136	1	Slab	6.67							
52	139	1	Pier	7.83							
54	140	1	Pier	7.74							
56	141	2	Pier	7.21		P				Yes	Yes
58	142	Split	Pier	6.66				H		Yes	
60	142	2	Slab	6.77							
62	144	1	Slab	6.61							
64	145	1	Pier	6.97							
66	146	1	Pier	7.06							Yes
68	147	2	Slab	6.52							
Cornelian Road (West)											
57	69	1	Pier	8.73		P				Yes	Yes
59	68	1	Pier	8.51							
61	67	1	Pier	8.63							
63	66	1	Pier	8.64							
65	65	2	Pier	9.09				P		Yes	Yes
67	64	2	Slab	7.91				P		Yes	Yes

Table 1.2
Properties in Vicinity of Drain Lines - Diamond Road

No	Lot	Stories	Type	Floor Lev (m AHD)	House(H), Property(P) Flooding April 88	Jan 89	May 89	Feb 90	Date Unknown	Letter to council	Questionnaire Received
Diamond Road (East)											
61	5	2	Slab	3.87							
63	6	2	Slab	4.15							
73	11	1	Pier	4.47							
75	12	2	Pier	4.57							
83	13	2	Slab	3.69		H				Yes	
85	14	2	Slab	3.62				H		Yes	Yes
93	18	Split	Slab Garage	5.79 4.40							
95	19	1	Slab	3.76	H	H		3.86(H)		Yes	Yes
97	20	2	Slab	3.79					H	Yes	Yes
99	21	2	Slab	4.81							
Diamond Road (West)											
78	167	2	Slab	5.66							
80	166	1	Pier	6.07							
82	165	1	Slab	5.84							
84	164	1	Slab	5.58							
90	31	1	Slab (Pier)	5.68							
92	32	1	Slab	5.35							Yes
96	158	1	Slab	5.78							Yes
98	157	1	Pier	5.47							
106	153	2	Slab	5.07							

TABLE 1.3
Properties in Vicinity of Drain Lines - Beryl Boulevarde, Garnet Road, Onyx Road, Jade Place

No	Lot	Stories	Type	Floor Lev (m AHD)	House(H), Property(P) Flooding April 88	Jan 89	May 89	Feb 90	Date Unknown	Letter to council	Questionnaire Received
Beryl Boulevarde (North)											
4	5					P		P		Yes	Yes
16	11									Yes	
20	13									Yes	
68										Yes	
Beryl Boulevarde (South)											
5	235						P			Yes	Yes
19	522										
29	40								P	Yes	Yes
31	39										
Garnet Road (East)											
10	54	1	Pier	10.66							
12	55	1	Pier	10.87						Yes	Yes
14	56	1	Pier	11.22							
16	57	1	Pier	10.40		P	P	P		Yes	Yes
18	58							H		Yes	
Garnet Road (West)											
7	45	1	Pier	12.97		P	P			Yes	Yes
9	44	1	Slab	11.70							
13	42										
Onyx Road											
	77	1	Pier	23.02						Yes	
Onyx Road (South)											
3										Yes	

Following identification of likely mitigation options, further more detailed survey was carried out, including location of flood affected houses and overland flow routes.

1.2.4 Catchment Topography

Cadastral mapping of the area is available at a scale of 1:2000 and orphophoto maps at 1:2000 (dated 1971) are also available with one metre contours.

The catchment boundaries, at elevations up to 240 m AHD, are located within the National Park which fringes the study area.

1.2.5 Public Utility Services

Details of public utilities are shown in Drawing 1.2.

1.2.6 Flood Levels and Rainfall

No flood levels are available for the study area, although indications of flood extent and depth have been obtained from resident interviews and photographs. There is no raingauge in the vicinity of the study area.

1.3 Design Rainfall

The rainfall intensity-frequency-duration data adopted for this study consists of Council data for Woy Woy and is shown in Appendix B.

1.4 Hydrologic and Hydraulic Modelling

1.4.1 Results

All the analysis carried out for this report is in accordance with the recommendations of Volume 1 of Australian Rainfall and Runoff (ARR, 1987)

The RatHGL computer model was used to establish peak flows and hydraulic grade lines through the drainage systems for the 20, 50 and 100 year ARI storms and then used to evaluate improvement options.

Details of the drainage system and results of the analysis are given in Tables 1.4-1.5. The model results indicate that existing pipe capacities are generally below the 5 year ARI, based on a pipe-limiting approach. A summary of the approximate pipeline capacities is given in the Tables. The hydraulic grade lines for the pipe systems are shown in Figures 1.1-1.3. Details of the model formulation and results are shown in Appendix D.

A summary of 20 and 100 year flows passing through the area are shown in Figure 1.4.

From the results of resident interviews and correspondence it is possible to build up a picture of the overland flow paths for recent storm events. It is not possible to define a precise hydraulic grade line because of the convoluted nature of the overland flow paths, but indicative flow depths are in the range 100 to 200 mm for the 100 year event. Approximate overland flow paths are shown in Drawing 1.2.

A brief description of the drainage system and its performance is given below, based on modelling results and discussions with Council officers and local residents.

1.4.2 Catchment A

Line 1

This consists of approximately 92 m of 375 mm diameter pipeline with 3 inlets in Beryl Boulevard discharging to the Lagoon. Problems have been reported at **4 Beryl Boulevard** where runoff from the National Park at the rear flows through to the road and **3 and 5 Beryl Boulevard**, where runoff from Beryl Boulevard, the northern end of Coral Crescent and the National Park overflows through the two properties to the lagoon.

Main Line 2

Line 2 is approximately 200 m long with pipe sizes ranging from 375 to 525 mm. The downstream length from Diamond Road to the Reserve consists of a 35 m length of twin 600 mm pipes (drainage reserve 1.8 m). In the main branch there are 3 inlets in Cornelian Road (Line 3), 2 inlets in Beryl Boulevard and 2 inlets in Diamond Road. In the smaller branch (Line 4) there are 3 inlets in Diamond Road, and 2 inlets in Beryl Boulevard.

There are no reports of flooding along the main branch between Cornelian Road and Diamond Road (an open channel in a 1.8 m drainage reserve), but serious flooding has been reported at the lower end of the system where the only overland flow path is between houses **95 and 97 Diamond Road**. This finding corresponds with the capacity of the lower end of the system as shown in Table 1.4, ie, the capacity of the twin 600 mm diameter pipes is equivalent to only a 1 year ARI capacity.

Table 1.4
Design Flows - Catchment A

U/S Pit	D/S Pit	No. of Conduits	Pipe Length (m)	Dia (mm)	Inlet Capacity (m3/s)	App Capacity ARI (yrs)	20 Year ARI Existing Flows (m3/s) Pipe	Overland	Total	50 Year ARI Existing Flows (m3/s) Pipe	Overlan	Total	100 Year ARI Existing Flows (m3/s) Pipe	Overland	Total
1/1	1/2	1	10	375	0.42	<1	0.04	0.94	**0.98**	0.04	1.18	**1.22**	0.04	1.36	**1.40**
1/2	1/3	1	25	375	0.28	<1	0.21	0.79	**1.01**	0.21	1.04	**1.25**	0.21	1.21	**1.43**
1/3	1/4	1	57	375			0.25	0.00	**0.25**	0.25	0.00	**0.25**	0.26	0.00	**0.26**
1/4									**1.02**			**1.26**			**1.43**
2/1	2/2	1	15	375	0.26		0.18	0.27	**0.45**	0.16	0.40	**0.56**	0.14	0.49	**0.63**
2/2	2/3	1	26	450	0.48		0.48	0.00	**0.48**	0.60	0.00	**0.60**	0.64	0.04	**0.68**
3/1	3/2	1	9	375	0.22		0.06	1.54	**1.61**	0.07	2.60	**2.67**	0.06	3.41	**3.47**
3/2	2/3	1	32.5	375	0.41		0.08	1.57	**1.65**	0.08	2.71	**2.63**	0.08	3.44	**3.52**
2/3	2/3A	1	93	525	0.19	1	0.55	0.03	**0.57**	0.55	0.14	**0.69**	0.55	0.18	**0.73**
2/3A									**0.57**			**0.69**			**0.73**
2/4	2/5	1	5.5	525			0.26	0.29	**0.56**	0.23	0.43	**0.66**	0.23	0.47	**0.70**
2/5	2/6	1	19.5	525	0.18		0.38	2.71	**3.09**	0.40	4.00	**4.40**	0.40	4.99	**5.40**
5/1	2/6	1	9	375	0.24		0.10	3.18	**3.28**	0.10	4.92	**5.02**	0.10	6.17	**6.27**
4/1	4/2	1	11.5	375	0.29		0.18	0.31	**0.49**	0.18	0.43	**0.61**	0.18	0.52	**0.70**
4/2	4/3	1	11	450	0.21		0.38	0.15	**0.53**	0.38	0.27	**0.65**	0.38	0.36	**0.74**
4/3	4/4	1	28	450	0.12		0.50	0.04	**0.54**	0.50	0.17	**0.67**	0.50	0.26	**0.76**
4/4	4/5	1	16	525	0.18		0.46	0.08	**0.55**	0.47	0.21	**0.68**	0.46	0.31	**0.77**
4/5	4/6	1	5	525	0.3		0.37	0.11	**0.48**	0.37	0.11	**0.48**	0.37	0.12	**0.49**
4/6	4/7	1	37	600	0	1	0.37	0.11	**0.48**	0.37	0.11	**0.48**	0.37	0.12	**0.49**
2/6	2/7	2	37	600	0	1	0.46	0.00	**0.46**	0.46	0.02	**0.48**	0.46	0.02	**0.48**
2/7									**3.56**			**4.39**			**5.84**
	6/2	1	12.5	450			0.00	0.00	**0.00**	0.01	0.00	**0.01**	0.01	0.00	**0.01**
7/1	6/2	1	13	450	0.21		0.08	0.00	**0.08**	0.11	0.00	**0.11**	0.12	0.00	**0.12**
6/2	6/3	1	22	450			0.12	0.00	**0.12**	0.14	0.00	**0.14**	0.16	0.00	**0.16**
6/3	6/4	1	48	450	0.18		0.13	0.00	**0.13**	0.16	0.00	**0.16**	0.18	0.00	**0.18**
6/4	6/5	1	17	450			0.13	0.00	**0.13**	0.16	0.00	**0.16**	0.18	0.00	**0.18**
8/1	6/5	1	28.5	900	1.06		1.00	1.28	**2.28**	1.00	1.85	**2.85**	1.00	2.26	**3.26**
6/5	6/6	1	21	900			1.08	1.28	**2.36**	1.11	1.85	**2.96**	1.11	2.26	**3.37**
6/6	6/7	1	8.5	900	0.05		1.13	1.41	**2.54**	1.15	2.02	**3.17**	1.15	2.47	**3.61**
9/1	9/2	1	23	375	0.48		0.11	0.29	**0.40**	0.11	0.39	**0.50**	0.11	0.46	**0.57**
9/2	6/7	-	-	-				0.42	**0.42**	0.00	0.52	**0.52**		0.59	**0.59**
6/7	6/8	1	10	750	0.8		0.64	2.28	**2.92**	0.64	3.00	**3.64**	0.62	3.53	**4.15**
6/8	6/9	1	45.5	750	0.63		1.25	1.72	**2.97**	1.25	2.44	**3.69**	1.25	2.95	**4.20**
6/9	6/10	1	50	750			1.24	1.70	**2.94**	1.24	2.42	**3.66**	1.24	2.93	**4.18**
6/10	6/11	1	11	900	0.84		2.07	0.92	**2.98**	2.07	1.64	**3.71**	2.07	2.18	**4.24**
6/11	6/12	1	50	900	0.52	5	2.07	0.00	**2.07**	2.07	0.00	**2.07**	2.07	0.01	**2.08**
6/12	6/13	1	21.5	900	0.05	5	2.04	0.01	**2.05**	2.04	0.01	**2.05**	2.04	0.01	**2.05**
6/13	6/14	2	26	675	0.05	5	1.32	0.72	**2.04**	1.32	0.72	**2.04**	1.32	0.73	**2.05**
6/14	6/15	2	17	675	0.48	2	1.81	1.43	**3.24**	1.81	2.23	**4.04**	1.81	2.86	**4.67**
6/15				1.2*0.55BC					**1.80**			**1.80**			**1.80**

Table 1.5
Design Flows - Catchment B

U/S Pit	D/S Pit	No. of Conduits	Pipe Length (m)	Dia (mm)	Inlet Capacity (m3/s)	App Capacity ARI (yrs)	20 Year ARI Existing Flows (m3/s) Pipe	Overland	Total	50 Year ARI Existing Flows (m3/s) Pipe	Overlan	Total	100 Year ARI Existing Flows (m3/s) Pipe	Overland	Total
10/1	10/2	1	5.5	375	0.10		0.10	0.25	**0.35**	0.10	0.33	**0.43**	0.10	0.39	**0.49**
10/2	10/3	1	42	375	0.10		0.20	0.18	**0.38**	0.20	0.27	**0.47**	0.20	0.34	**0.54**
10/3	10/4	1	46	375	0.00		0.20	0.00	**0.20**	0.20	0.00	**0.20**	0.20	0.00	**0.20**
10/4	10/5	1	54	375	0.10		0.19	0.17	**0.36**	0.19	0.21	**0.40**	0.19	0.23	**0.42**
11/1	10/5	1	22	600	0.42		0.27	0.58	**0.85**	0.27	0.81	**1.08**	0.27	0.98	**1.26**
12/1	10/5	1	9.5	450	0.08		0.08	0.65	**0.73**	0.08	0.91	**0.99**	0.08	1.12	**1.19**
10/5	10/6	1	5	600	0.00		0.44	0.00	**0.44**	0.44	0.00	**0.44**	0.44	0.00	**0.44**
10/6	10/7	1	98	600	0.52	2-5	0.94	0.47	**1.41**	0.94	0.78	**1.72**	0.94	0.99	**1.93**
10/7	10/8	1	10	600	0.14		0.87	0.59	**1.47**	0.87	0.92	**1.79**	0.87	1.15	**2.03**
10/8	10/9	1	45	600	0.2	2	0.74	0.14	**0.88**	0.74	0.14	**0.88**	0.74	0.15	**0.89**
10/9									**0.73**			**0.73**			**0.73**
13/1	13/2	1	10	450	0.47		0.26	1.26	**1.52**	0.26	1.80	**2.06**	0.26	2.18	**2.43**
13/2	13/3	1	59.5	525	0.15	<1	0.41	1.32	**1.72**	0.41	1.85	**2.26**	0.41	2.23	**2.64**
13/3									**1.67**			**2.19**			**2.59**

The problem at the lower end is exacerbated by the fact that overflow from line 6 finds its way into Line 2 along Diamond Road.

Main Line 6

Line 6 is the main piped system for Catchment A. The system has not been constructed at the lowest point of the catchment and no floodway has been provided. Overland flows in excess of the pipe capacity pass through a number of properties and gravitate to the north along Diamond Road where they increase flows in Line 2.

Line 6 collects runoff at node 8/1 from a fairly large catchment in the National Park, and also at node 6/1 (see Photograph 1.6).

Property inundation occurs at **5 and 7 Garnet Road (West)** due to limited pipeline capacity and headworks. Stormwater ponds in Garnet Road to depths of 800 mm at inlet 6/8 from overland flow from the west and overland flow from Beryl Boulevard.

Frequent blockage at the inlet to the system (node 8/1) by palm leaves, in particular, aggravate flooding problems.

Garnet Road - Cornelian Street

Overflow flow occurs through **16 and 18 Garnet Road (East)** and **57 and 65 Cornelian Road (West)**. Overland flow through 14 is prevented by a brick wall and garage. House inundation has been recorded at **18 Garnet Road.**

Overland flow depths are in the order of 100 - 150 mm. There is considerably more space between dwellings in Cornelian Road than in Garnet Road.

Cornelian Road - Diamond Road

Overflow occurs through **56, 58 and 64 Cornelian Road (East)** and **96 and 98 Diamond Road (West)** (See Photographs 1.1, 1.2). House inundation has occurred at **58 and 64 Cornelian Road.** At Diamond Road the flowpath has been limited by recent construction at 96 and 100 on mounding. The underground pipeline has not been constructed at the lowest point. Overland flows to the north of the pipeline have depths in the order of 100 - 150 mm.

Diamond Road - Reserve

Overland flow and house inundation occurs through **83, 85** (see Photographs 1.3 - 1.5) and **95, 97 Diamond Road.**

It is not possible to collect this volume of water in inlet pits to discharge to the drainage reserve. The road is too flat to allow sufficient ponding to generate sufficient head to a pipeline. The drainage easement at node 6/15 is not located at the low point in the road.

1.4.3 Catchment B

Line 10

Flow from Jade Place and Onyx Road is conveyed between Cornelian Road and Diamond Road by a 675 mm diameter pipe within a 1.5 m easement. Flooding problems have been reported in this system at the upper end at Jade Place, where stormwater flows down the hillside at the west side of Jade Place and flows through **Lot 77 Onyx Road.** The pipeline from Jade Place to Cornelian Road has a 100 year ARI capacity, although its capacity is not fully utilised due to limited pit inlet capacity.

The capacity of the underground pipe system between Cornelian Road and Diamond Road is estimated at ARI 2–5 years and the capacity below Diamond Road at ARI 2 years. The main overland flow path for flows in excess of the pipeline capacity between Cornelian Road and Diamond Road lie between **44 and 44A Cornelian Road** and **80 and 82 Cornelian Road.** If the flow is confined to this section the estimated depth of flow is limited to 200 mm. It is estimated that house inundation would not occur during the 100 year flood.

Line 13

The system consists of a short length (69.5m) of drain from Diamond Road to the Reserve. There are no reports of flooding in this area.

1.4.4 Lagoon and Outlet to Broken Bay

The outlet to the Lagoon consist of 3 no 1050 mm culverts, 13 m long, with an upstream invert of 2.10 m AHD and a downstream invert of 1.93 m AHD. Coral Parade road level is 3.66 m AHD, at approximately the same elevation as the lowest known house level in the study area at **85 Diamond Road.** An analysis of the culvert hydraulics at the outlet was carried out and the results of the analysis are shown in Table 1.6.

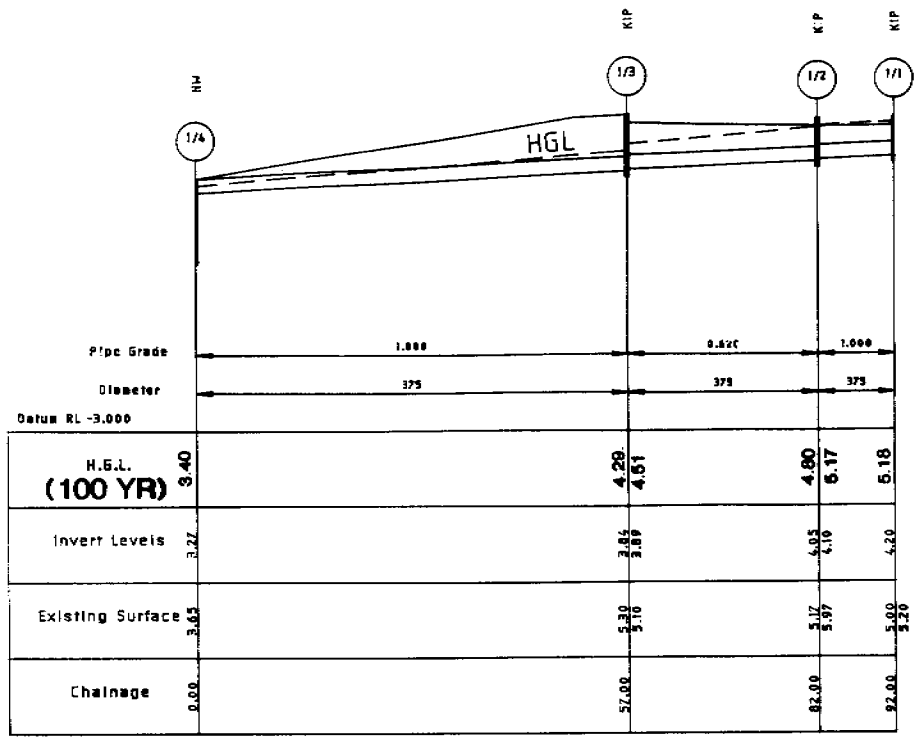
The analysis shows that for the 100 year ARI event the outlet capacity is not sensitive to downstream restrictions up to at least 2.75 m AHD, as the flow though the culverts is inlet controlled to at least this elevation.

An analysis of the behaviour of the lagoon in times of flood based on the ILSAX model is reproduced in Appendix E. With an inflow of 20 000 m^3 for the 100 year ARI 20 minute storm, outflow is approximately 6.2 m^3/s for a lagoon water level of 3.37 m AHD, corresponding to a storage volume of 9000 m^3. Reference to Table 1.6 indicates that even with a tailwater level of 2.75 m AHD, a lagoon water level of 3.45 m AHD would provide sufficient head to discharge the flood without impinging on house floor levels. In reality, any restrictions on the outlet due to a build up of the sand bar, would be expected to be cleared in the early stages of an intense storm as was found to be the case of the Green Point Creek outlet, just south of the study area (Pearl Beach and Green Point Creek Management Study). The inflow-outflow hydrograph is shown in Figure 1.5.

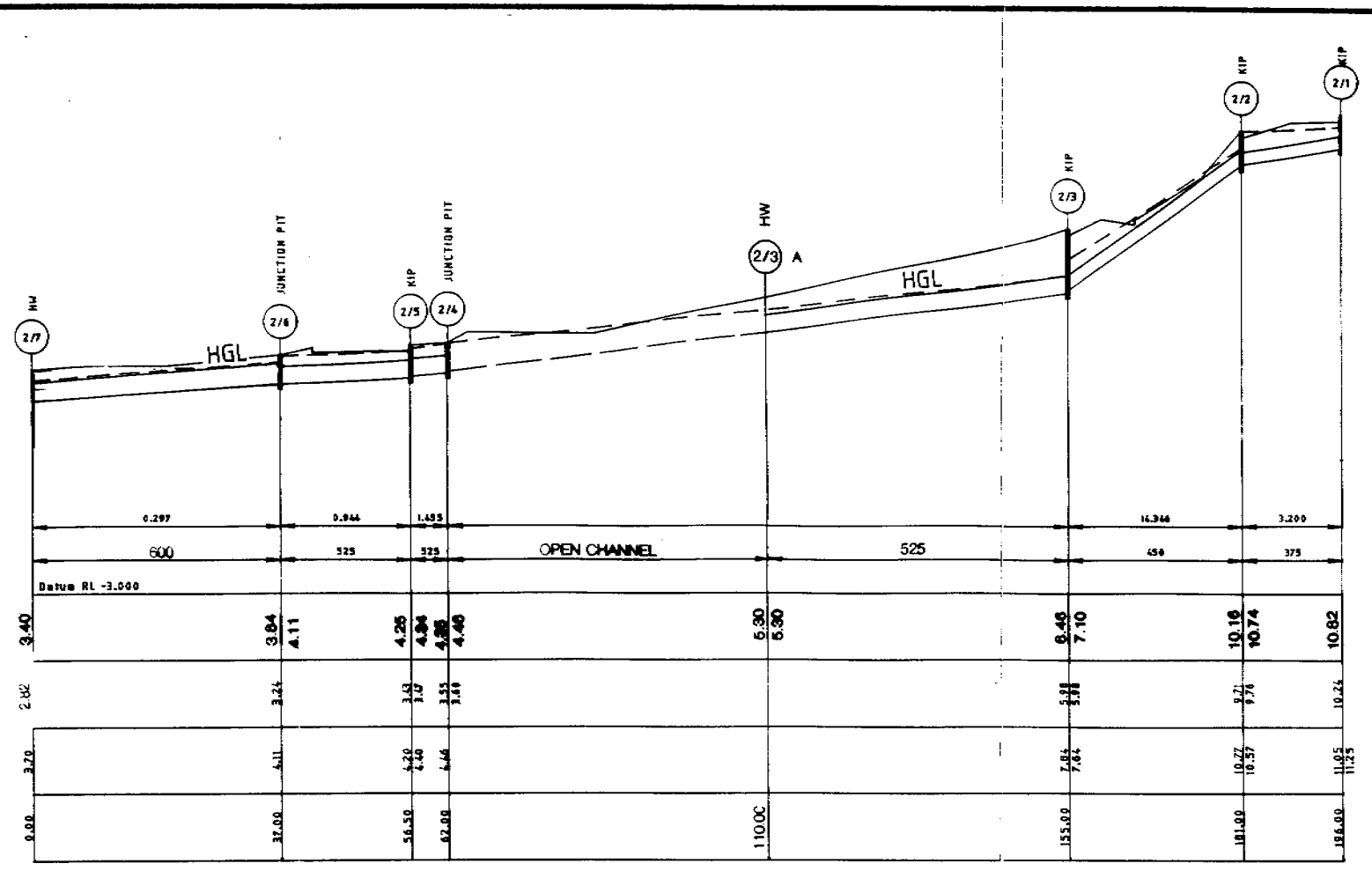
However, during periods of prolonged low intensity rainfall, it is possible that the flow velocities at the culvert outlet would be insufficient to scour the sand bar. Hence a high sand bar level could create a flood risk for upstream properties. The inflow-outflow hydrograph for this eventuality is shown in Figure 1.6.

Table 1.6
Lagoon Outflow Characteristics

Tailwater Level m (AHD)	Maximum Lagoon Water Level m (AHD)	Maximum Outflow (m^3/s)	Maximum Culvert Exit Velocity (m/s)	Type of Control	Flow Regime
2.0	3.37	6.2	3.3	Inlet	Supercritical
2.5	3.37	6.2	3.3	Inlet	Supercritical
2.75	3.37	6.2	3.3	Inlet	Subcritical
3.0	3.45	5.8	2.0	Inlet	Subcritical
3.5	3.59	3.1	1.2	Outlet	Subcritical
Culvert Blocked	3.96	5.6	-	-	-



LINE 1



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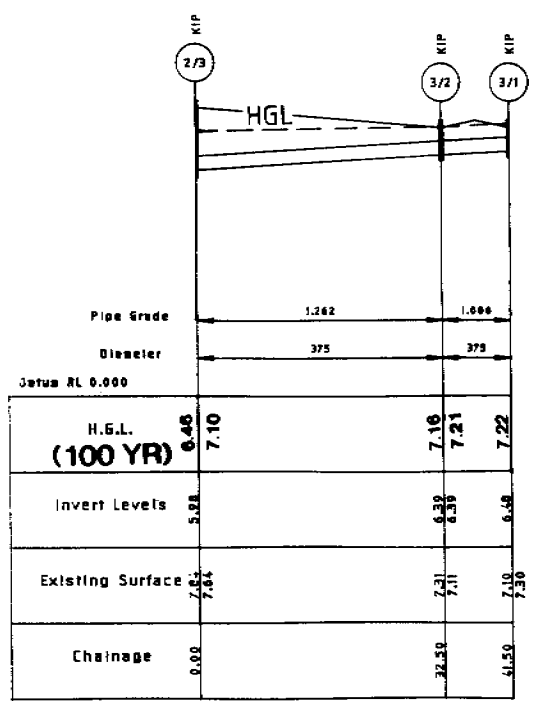

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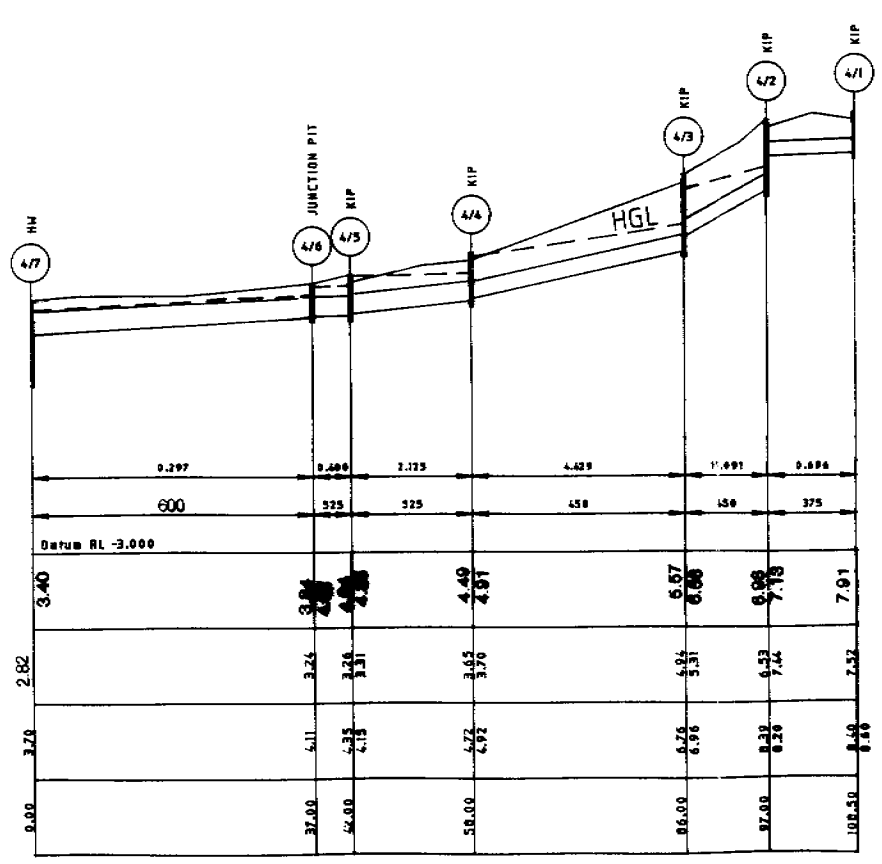

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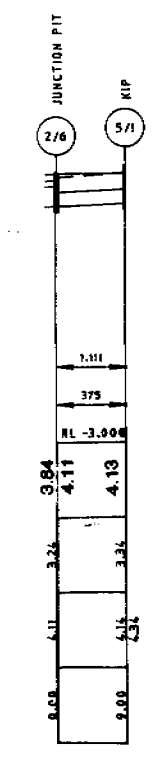

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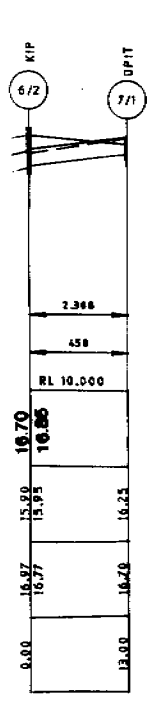

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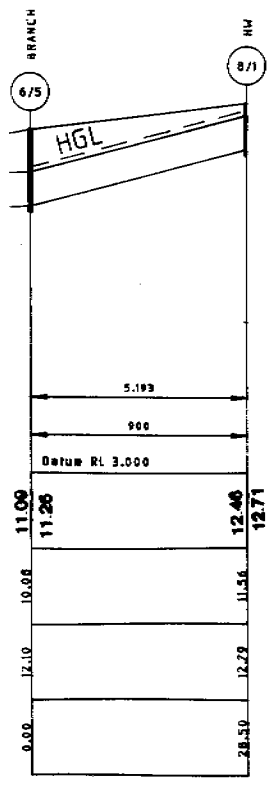

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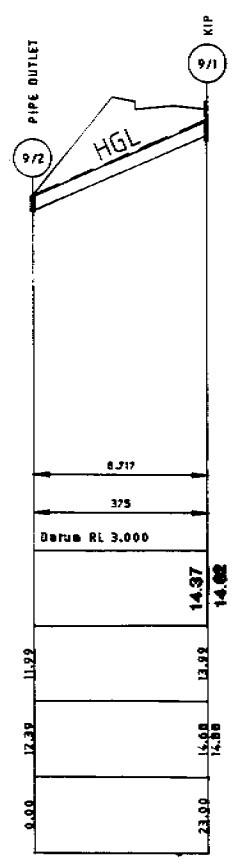


LINE 9

24071-06

No.	Description	Date	Inits.

Revisions

Job

FLOODING & DRAINAGE INVESTIGATION - PEARL BEACH

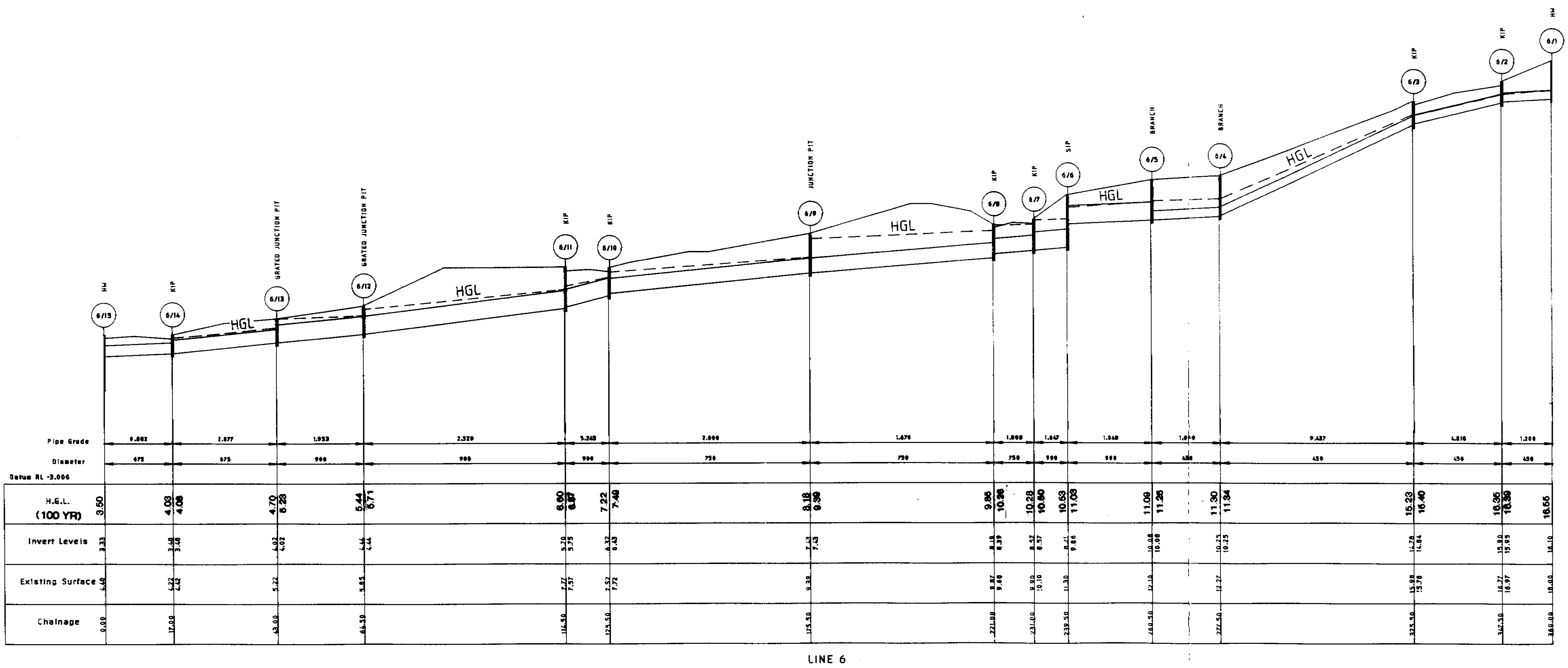
Design		Traced	
Drawn		Checked	
Scale	1:1000H 1:200V		
Approved			
Date			

Gutteridge, Haskins & Davey Pty Ltd
Incorporated in ACT
Consulting Engineers – Planners – Surveyors

30 Regent St., Railway Square
Tel. 699 7070

FIGURE 1.1
DRAINAGE LONG SECTIONS
LINES 1-5, 7-9

Job No.
214/024071



24071-07

No.	Description	Date	Inits.

Revisions

Job

FLOODING & DRAINAGE INVESTIGATION - PEARL BEACH

Design		Traced	
Drawn		Checked	
Scale	1:1000H 1:200V		
Approved			
Date			

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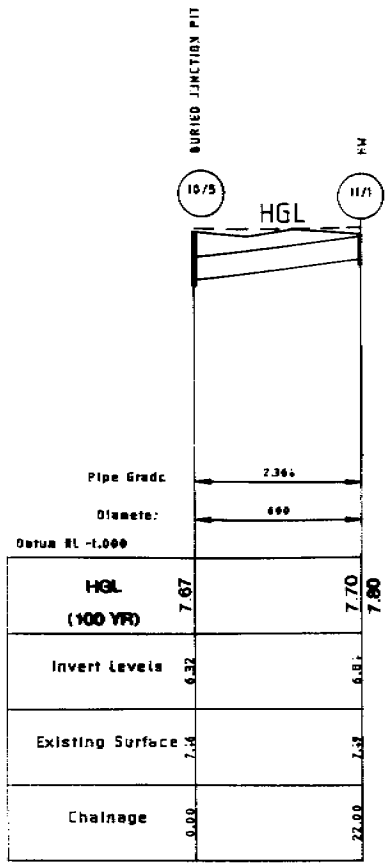
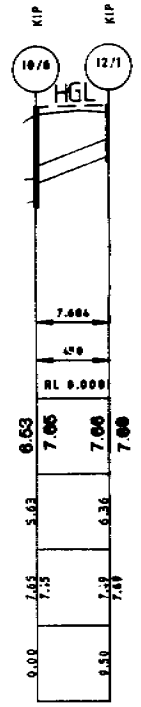
FIGURE 1.2
DRAINAGE LONG SECTION
LINE 6

39 Regent St., Railway Square
Tel. 690 7070

Job No.
214 / 024071



LINE 11



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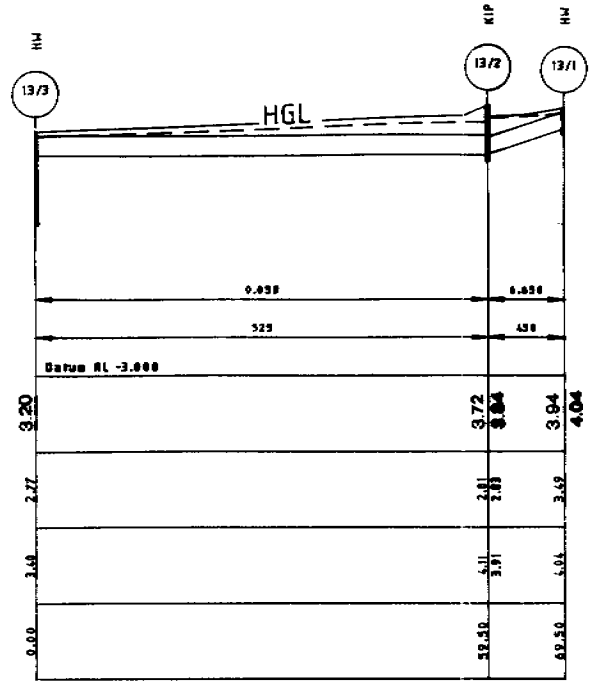
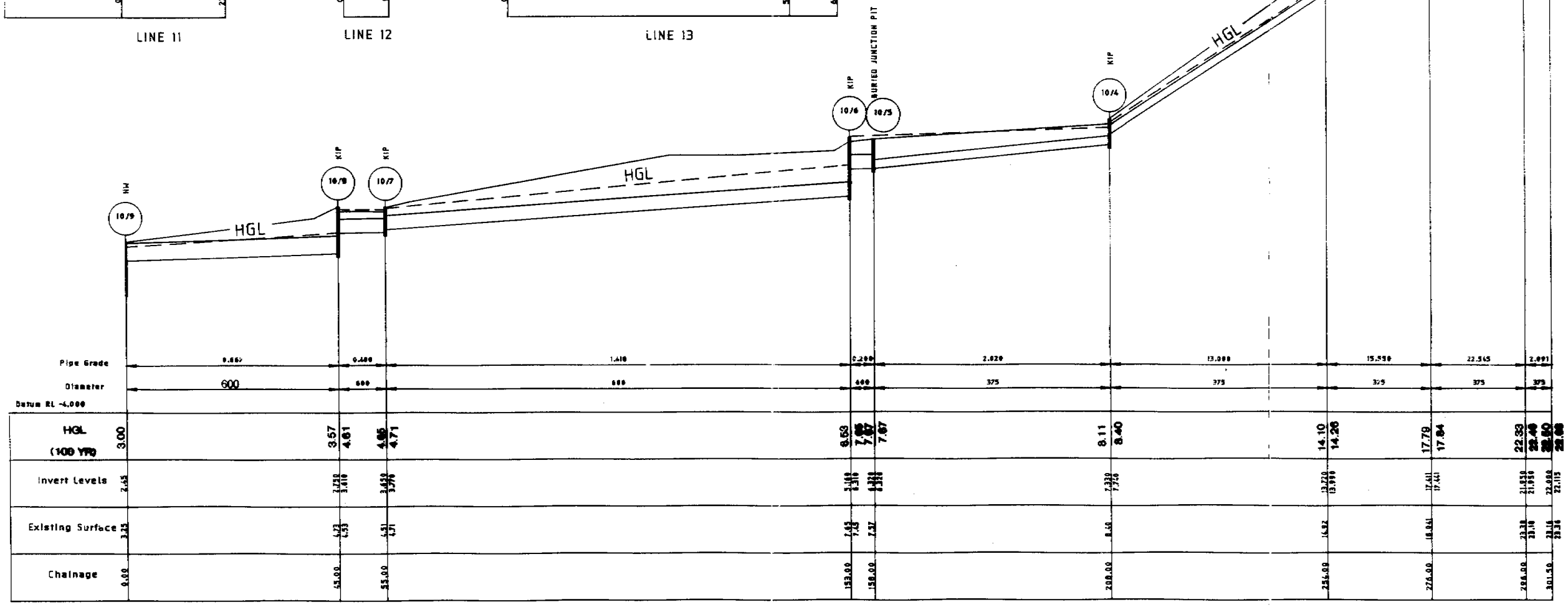


LINE 13



LINE 10

24071-08

No.	Description	Date	Initls.

Revisions

Job

FLOODING & DRAINAGE INVESTIGATION - PEARL BEACH

Design		Traced	
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Scale	1:1000H 1:200V		
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Date			

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30 Regent St., Railway Square
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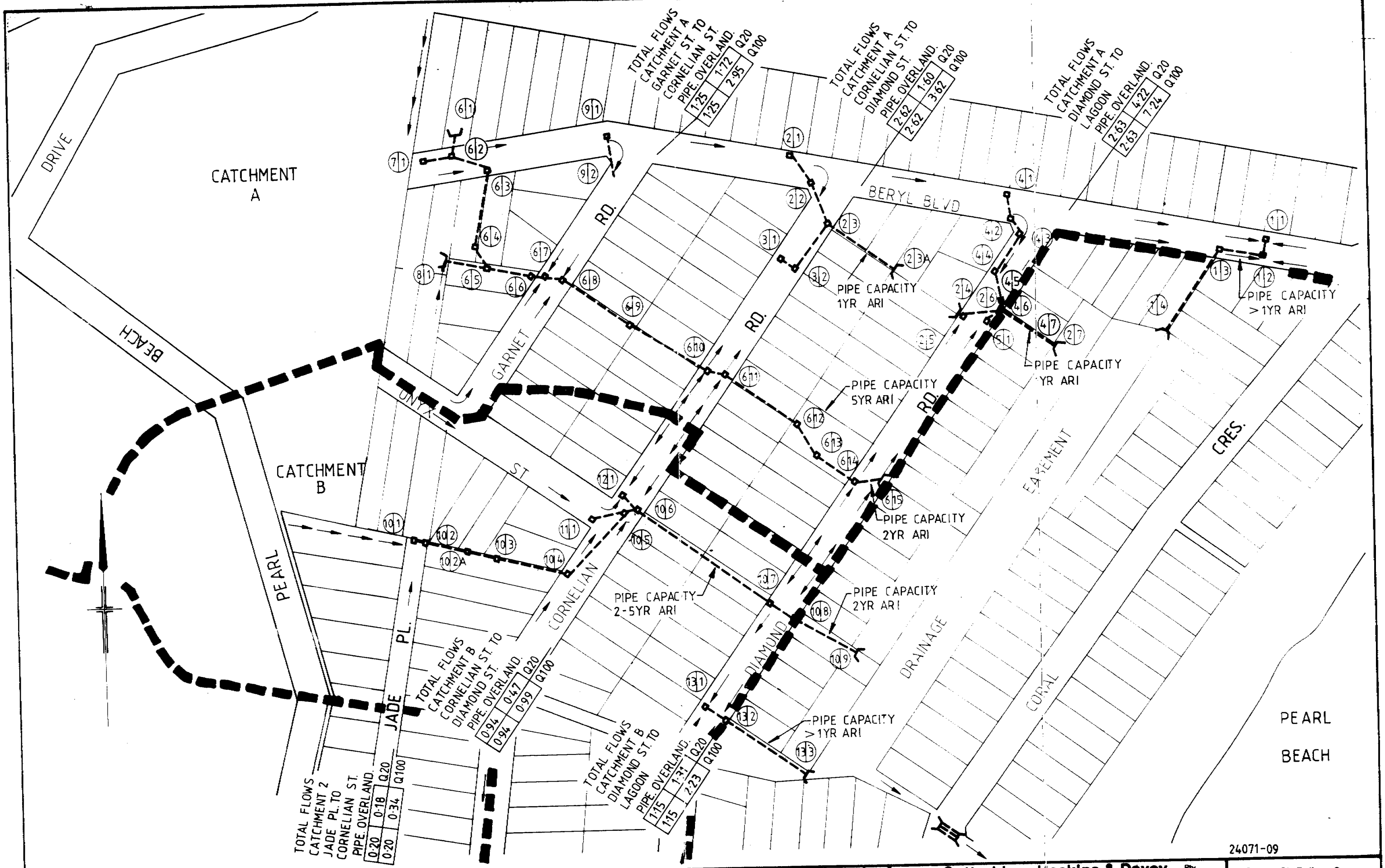
FIGURE 1.3
DRAINAGE LONG SECTIONS
LINES 10 - 13

Job No.
214 /024071



No.	Description	Date	Init.
	Revisions		

Job

FLOODING & DRAINAGE INVESTIGATION - PEARL BEACH

Design		Traced	
Drawn		Checked	
Scale	1 : 2000		
Approved			
Date			

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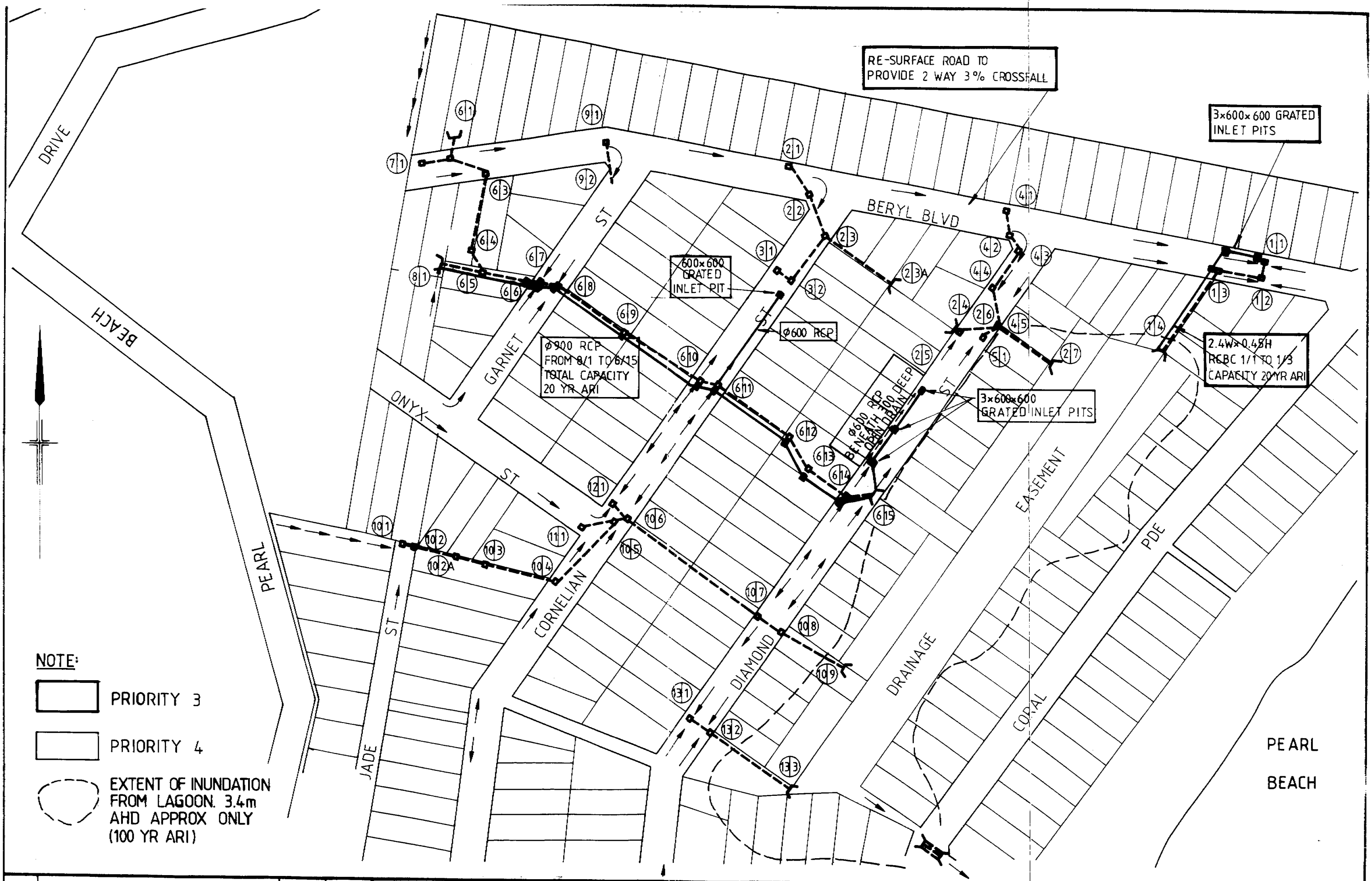
FIGURE 1.4

EXISTING 20 AND 100 YEAR FLOWS

Job No.
214 / 024071



No.	Description	Date	Inits.
	Revisions		

Job
FLOODING & DRAINAGE INVESTIGATION- PEARL BEACH

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FIGURE 3.2

PROPOSED MAJOR WORKS

Job No.
214/024071

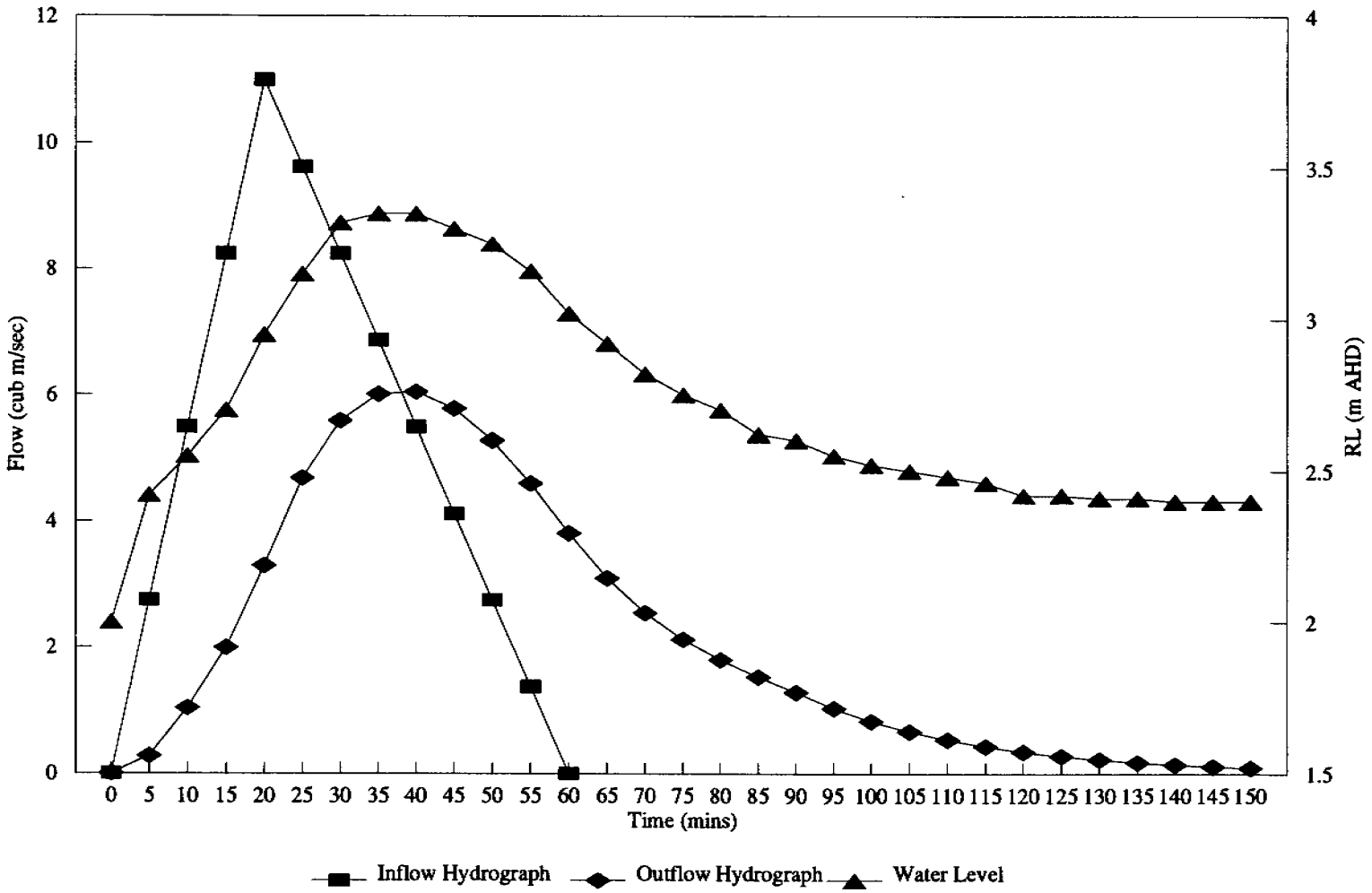
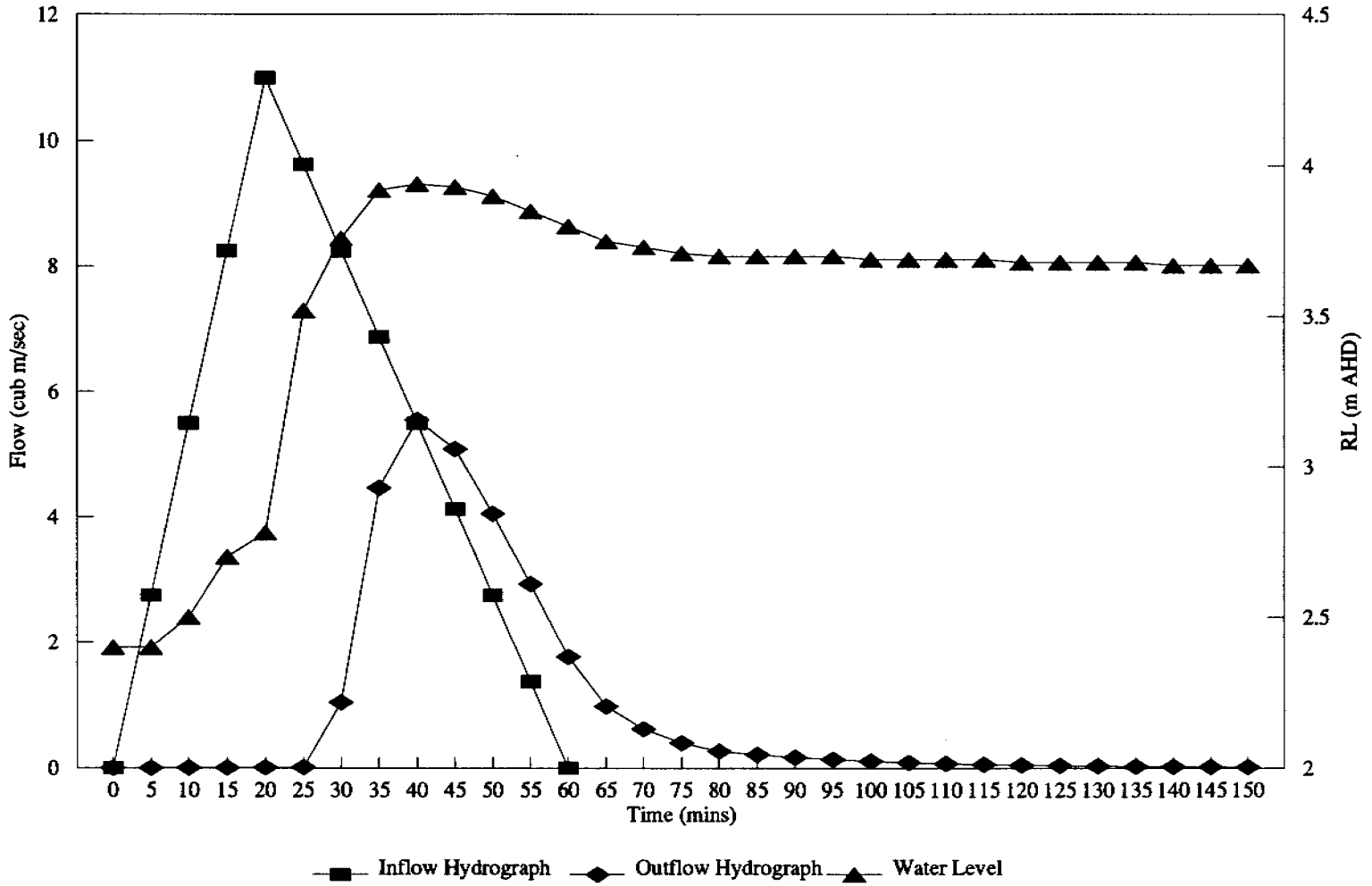


Figure 1.5
Lagoon Inflow/Outflow Hydrographs
100 yr ARI
Tailwater Level 2.0 m AHD



{GDLAGX} Pearl Beach Stormwater - Flooding and Drainage Investigation

Figure 1.6
Lagoon Inflow/Outflow Hydrographs
100 yr ARI
Blocked Outlet Culvert

LEGEND

- (13-2) NODE NUMBER
- STORMWATER PIPE
- (1.8m) STORMWATER PIPE WITHIN EASEMENT (WIDTH)
- SEWER PIPE
- 8 / 501 LOT NUMBERS / STREET NUMBERS
- T TELECOM SERVICE
- W WATER MAIN SERVICE
- FL5.35(S) / FL4.76(P) FLOOR LEVEL S - SLAB, P - PIERS
- HOUSE (SURVEYED)
- OVERLAND FLOWPATH OR REPORTED PROPERTY INUNDATION
- PROPERTY & HOUSE INUNDATION (88,90) (FROM QUESTIONNAIRES)
- HOUSE - SCHEMATIC ONLY (UNSURVEYED)
- DRAINAGE RESERVE
- PUBLIC RESERVE
- EXTENT OF INUNDATION FROM LAGOON, 3.4m AHD APPROX ONLY (100 YR ARI)

CAD Drawing File Name & Plot Date

DWG NAME : 24071-12.DWG
PLOT DATE : 01/10/1992

No.	Date	Amendment	Initial

No.	Date	Amendment	Initial

No.	Date	Amendment	Initial

Client: GOSFORD CITY COUNCIL

Gutteridge Haskins & Davey Pty Ltd
NSW ACT
Consulting Engineers, Planners, Surveyors, Project Managers
GHD 39 Regent Street, Railway Square
Tel No. (02) 690 7070 Fax No. (082 666 1780

Design Engineer	D BANNIGAN	Scale 1 :	1000
Draftsperson	P STARC	Checked	

Job: FLOODING & DRAINAGE INVESTIGATION PEARL BEACH

Checked	Date		
Approved	Date		

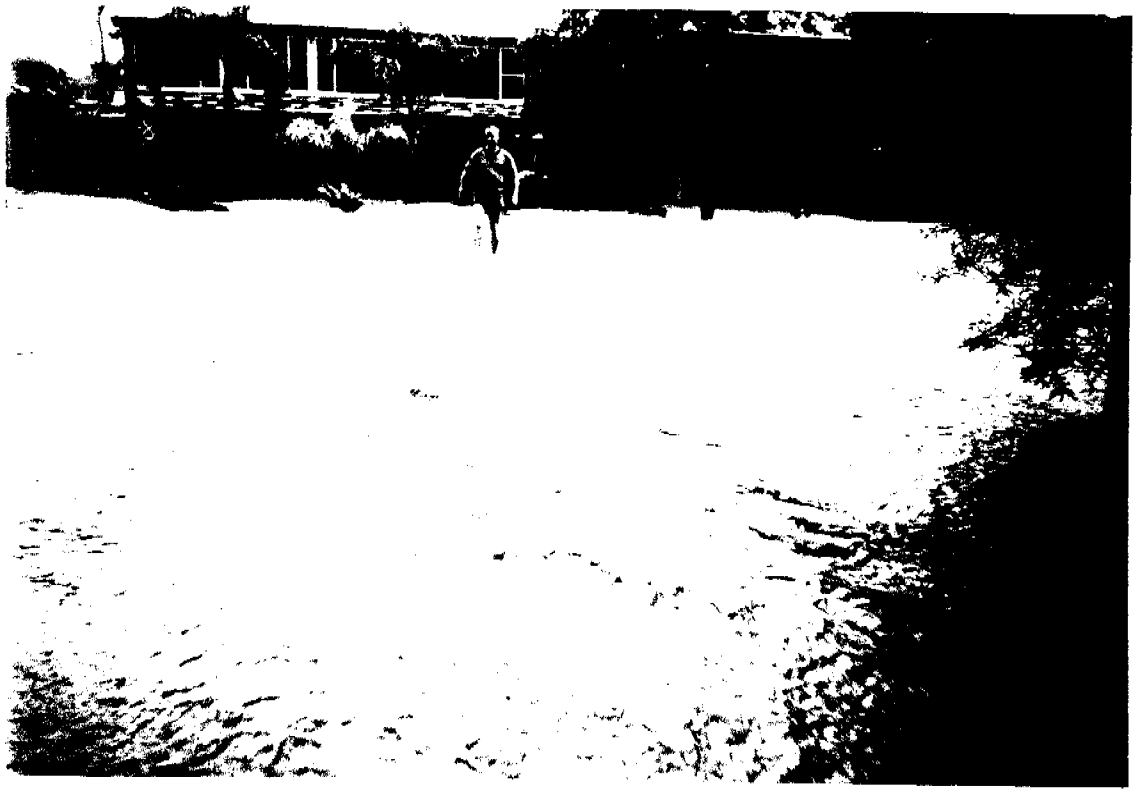
Title: EXISTING DRAINAGE SYSTEM

Job No.	Drg. No.	Amdt.
214-024071	1.2	

PHOTOGRAPH 1.1
98 DIAMOND ROAD
Looking Toward Road from Rear

PHOTOGRAPH 1.2
98 DIAMOND ROAD
Looking Toward Front of House from Road

PHOTOGRAPH 1.3
85/87 DIAMOND ROAD
Looking Toward Road



PHOTOGRAPH 1.4
85 DIAMOND ROAD
From Road

PHOTOGRAPH 1.5
85 DIAMOND ROAD
Frontage

PHOTOGRAPH 1.6
31 BERYL BOULEVARDE
Back Yard

MANAGEMENT STUDY

STAGE 2

2 MANAGEMENT STUDY - STAGE 2

2.1 Drainage Strategies

Generally, in considering options for reducing flooding and drainage problems, it is possible to make a distinction between structural and non-structural options.

Non-structural options include such measures as flood forecasting and warning systems, zoning, building and development controls, voluntary purchase of flood prone land and public information and education.

Being such a small catchment and a virtually fully developed area, flood forecasting and warning systems, and zoning, building and development controls are not viable options. Public information and education is already promoted within the Gosford City area (see Flood Facts, Information and Precautions). Voluntary purchase of flood prone land is considered in this investigation, but is not found to be a viable option.

Appropriate structural options for such an area include improvement of the underground stormwater system, by means of increasing the system capacity by installation of additional pipes and/or collection pits, minor control of surface flows by means of kerb and guttering and road re-grading, retarding basins and by-pass floodways or channels, levees and flood proofing of buildings. These possibilities are considered in relation to the individual catchments below.

2.2 Drainage and Management Options

In discussing the options available to reduce flooding problems in the area the various options fall under the following headings:

2.2.1 Catchment A

Diversion or Retardation

Most of the storm runoff causing flooding problems in the area is derived from the National Park adjoining the developed area. Problems would be considerably reduced by either diverting or retarding stormwater runoff.

A significant proportion of the runoff entering the study area at the northern end of the catchment could be diverted by means of a cut-off ditch at the rear of premises on the northern side of Beryl Boulevard, with a collection system at the bottom of the slope and augmentation of Line 1 drain to direct the flow under Beryl Boulevard to the drainage reserve. However, construction of this drain does not seem a practical proposition due the need to construct the dam in National Park land and the steep nature of the ground to the rear of the properties.

The largest component of Park runoff is collected in Line 6 at node 8/1. It is not possible to divert this runoff, however, it is possible to retard flows by constructing a retarding basin at the Park boundary. An earthfill berm would not be advisable due to the steep nature of the ground, and the most effective solution could be a 4 metre high gabion wall, 80 m long, equipped with a small outlet pipe of 300 mm diameter (**If such a solution were to be pursued then the hazard rating of the embankment should be assessed using a dam break analysis**). Such a retarding basin would reduce flows in the system by approximately 3 m^3/s and eliminate most of the flooding problems. The estimated cost is $350 000.

Provision of overland flow paths

For the main line 6 an overland flow path of width up to 16 m and approximately 200 mm deep would be required over the full length. Housing development has precluded the possibility of providing such a floodway. The only means of providing such a floodway would be to purchase properties on a voluntary basis as follows:

7 and 14 Garnet Road
59 and 58 Cornelian Road
98 and 85 Diamond Road

Lowering of road pavement by approximately 200 mm at Cornelian Road and Diamond Road would be required. An alternative property for **85 Diamond Road** for dwelling construction would be the public reserve adjacent to and south from 83. The cost of this option would be in excess of $1 million and is not considered to be a practical proposition.

Augmentation of Drainage System

In order to eliminate flooding, augmentation of Line 6 would be required. Duplication of the existing pipelines with twin 900 mm diameter pipes would be required to convey the 100 year ARI flood. A single 900 mm pipe would be required for the 20 year ARI flood.

Either of these improvements would eliminate the significant flows which currently drain northward into Line 2. However, as the capacity of this piped system is limited it would be necessary to carry out works on Beryl Boulevard to provide a 2 – way cross fall to reduce surface runoff into Garnet Road, Cornelian Road and Diamond Road where line 2 would otherwise collect runoff from Beryl Boulevard.

This diversion would significantly increase flows arriving at Line 1, which is already inadequate. In order to collect these additional flows down Beryl Boulevard additional inlet pits would be required and line 1 would require upgrading to eliminate flooding for the 20 year ARI flood through **3,5 Beryl Boulevard.**

In order to eliminate overland flow for the 100 year ARI flood, purchase of one property could be considered (notional cost $200 000) for a grassed floodway, or purchase of a part of the property could be considered and a surface channel constructed (notional cost $100 000). It is considered that this expenditure cannot be justified.

Small "levees" constructed at the roadside to divert floodwaters have been constructed by certain landowners. Construction of further such works is not recommended as these would merely exacerbate flooding in adjacent properties.

Floodproofing of houses with a surrounding low concrete wall could be provided at an estimated cost of $16 000. This option is not recommended as there other more appropriate options available.

Package of Measures to Improve Efficiency of Existing System

The following low cost measures will increase the effectiveness and efficiency of the existing drainage system.

- Improved collection of runoff from National Park:

  Stabilisation of existing channel and provision of trash rack to pipe system to reduce potential for blockage

  New grated inlet and pipe to drain low point in Garnet Road

- Improve efficiency of drainage from Garnet Road to Cornelian Road

  Replace pit 6/8 cover with 600 x 600 grated inlet

  Modification of fence line to provide clear floodway

- Improve efficiency of drainage from Cornelian Road to Diamond Road

  Increase height of pit 6/13 to reduce overflows

2.2.2 Catchment B

Local residents are concerned that runoff from Pearl Beach Drive is responsible for flooding at the northern end of Jade Place. Construction of the road is not likely to have had a significant effect on flood flows as the natural state of steep slopes and consequent thin soil cover west of Jade Place would have had little detention effect on runoff. However, the table drain discharge and culvert under Pearl Beach Drive is likely to have had a concentrating effect on flows which might have exacerbating effects on flooding in Jade Place.

In order to overcome the concentration effect the flow from the table drain can be collected from the outlet in a 300 mm diameter pipeline. The optimum solution would be to connect the pipe directly to node 10-2, downstream of which there is sufficient capacity for the 100 year ARI flows. This alignment would require an easement through Lot 1 Jade Place.

If it is not possible to obtain the easement an alternative would be to construct a pipeline to discharge to the channel on the southern side of Onyx Road.

Four additional inlets are required at node 10/1 to collect overland flow from the steep slopes in the National Park above Jade Place which at present flows overland to Onyx Road, particularly through **Lot 77 Onyx Road**, and Cornelian Road.

Opening of the fence line between Cornelian Road and Diamond Road is required to improve the overland flow path. There is insufficient space to provide a formal floodway between Cornelian Road and Diamond Road. Overland flow can be reduced by increasing inlet capacity in Cornelian Road but can only be eliminated by installing an additional underground pipe and additional inlet pits near node 10/5 in Cornelian Road at an estimated cost of $ 40 000.

As there are no reports of house flooding in Cornelian Road and Diamond Road, upgrading of the underground capacity cannot be justified.

2.2.3 Lagoon and Outlet to Broken Bay

The results in Table 1.6 indicate that with a lagoon level of 3.45 m AHD, approximately 170 mm below the lowest floor level in the study area, even with a tail water level of 3.0 m AHD, the culvert can discharge 5.8 m^3/s, which is adequate to drain the lagoon. It is recommended that the sand bar not be allowed to exceed 2.75 m AHD, in the event of inadequate scouring velocities for low intensity storms.

It should be noted that a storm surge could induce high water levels upstream of the Coral Parade culvert, (as was reported in 1986, for example). However, the consideration of storm surge levels is beyond the scope of this report, as is the coincidence of a storm surge and design flood in the study area, which would provide an event with a return period well above the 100 year ARI event.

MANAGEMENT PLAN

STAGE 3

3 MANAGEMENT PLAN - STAGE 3

3.1 Drainage Management Plan

Figures 3.1 and 3.2 show the minor and major works recommended as part of the management plan and the works and their costs are summarised in Table 3.1. Major works are based on improving underground pipeline capacity to 20 year ARI. Detailed cost estimates are given in Appendix C.

The works have been arranged in categories to allow for staged construction and are described below. Recommended minimum floor levels are shown in Table 3.2. These levels have been established by setting the recommended floor levels 500 mm above the 100 year ARI level which is taken to be 200 mm above surrounding ground level.

3.1.1 Catchment A

Measures to increase efficiency of existing system (Minor Works)

The additional inlet on Garnet Road relies on maintenance of road surface levels at existing levels to ensure that sufficient water head is generated at the inlets to enable the inlets to function at their capacity.

Augmentation of the main drainage line from node 8/1 to 6/15 (Major Works)

Augmentation to convey the 20 year ARI flow, will remove house inundation and reduce the annual risk of property inundation along this drainage line, allowing overland flow to occur for more severe floods. A 900 mm pipeline is required with the existing easement between Garnet Road and Diamond Road widened to 2.5 m. Houses removed from flooding risk up to the 100 year ARI flood are **18 Garnet Road, 58 Cornelian Road and 83, 85 Diamond Road.**

Modification of road surfacing in Beryl Boulevard and drainage improvement from node 1/1 to 1/4 (Major Works)

These works will eliminate flooding from **64 Cornelian Road and 95/97 Diamond Road** and reduce the annual risk of property inundation in the northern end of the study area.

3.1.2 Catchment B

The minor works proposed for catchment B involve additional inlets at node 10/1 to collect more runoff from the steep slopes above Jade Place which at present flow overland to Onyx Road, and a pipeline to collect runoff from Pearl Beach Drive and convey the runoff to node 10/2. In the event that a drainage easement cannot be obtained, then an alternative is to discharge the runoff to Onyx Road.

There is an informal floodway through **44, 44A Cornelian Road** and **82 Diamond Road**. This can be improved by providing a more open fence at the rear of no 44 Cornelian Road.

3.1.3 Lagoon and Outlet to Broken Bay

The sand bar downstream of Coral Parade should not be allowed to exceed 2.75 m AHD in elevation.

3.1.4 General

It is expected that the existing and upgraded drainage system will be subject to normal Council maintenance procedures, which should consist of regular inspection and clearing of all inlet pits. It is recommended that the local Resident's Association be made aware of these maintenance intervals. There is one service which a local resident could usefully provide and that is to regularly inspect the inlets to the drainage system at nodes 8/1 and 6/1 to ensure that they are clear of debris.

To accompany publicity on this study findings, distribution of the Council's flood leaflet would provide the local community with background information with which to better appreciate the nature of the problems and solutions.

It should be noted that the recommended minimum floor levels shown in Table 3.2 are usually higher than the floor levels of existing houses. It is recommended that no mounding or land shaping be undertaken on individual properties until the drainage works have been implemented to avoid affecting flood levels on neighbouring properties.

An "open" type fence construction should be used in the vicinity of the drain lines and overland flow paths to avoid interference with existing flood paths.

Table 3.1
Recommended Works

Priority	Objective	Works	Benefit	Cost ($)	
				Minor Works	Major Works
CATCHMENT A – PACKAGE OF MEASURES TO INCREASE EFFICIENCY OF EXISTING SYSTEM (MINOR WORKS)					
1	Improved Collection of Runoff from National park	Stabilise existing channel and provide trash rack at entry to pipe system at 8–1 and 6–1	Reduces potential for blockage	7200	
2		New grated inlet and pipe to Garnet Road for Line 6	Drains low point in 5 Garnet Road	5900	
2	Improve efficiency of drainage from Garnet Road to Cornelian Road	Raise outlet invert pit 6/6 to match inflow inv Replace pit 6.8 with 600 x 600 grated inlet Modification of fenceline	Reduces energy losses Removes inlet restriction Improves flow path	1200 1200 220	
2	Improve efficiency of drainage from Cornelian Road to Diamond Road	Increase efficiency of pit 6–13	Reduces pipe overflows	1200 Tot. $16,920	
CATCHMENT A – AUGMENTATION OF MAIN DRAINAGE LINE FROM NODE 8/1 TO NODE 6/15 TO 20 YEAR ARI CAPACITY (MAJOR WORKS)					
4	Pipeline System Augmentation	Additional length of 900 mm pipe for 20 year capacity (2.5 m easement required) or ? Line 6			132200
4	Improvement of Drainage from low spot on Cornelian Road	Install 600 x 600 grated inlet pit and 600 mm pipeline to node 6/11	Reduces overland flow Cornelian – Diamond		14000
4	Improvement of drainage from low spot on Diamond Road	Install 300 mm deep open drain, 3 x 600 x 600 grated inlet pits and 600 RCP to 6/15	Reduces flow through 85/87 Diamond Road		17300

Tot. $163,520

Table 3.1
Recommended Works

Priority	Objective	Works	Benefit	Cost ($)	
				Minor Works	Major Works
	CATCHMENT A – MODIFICATION OF ROAD SURFACING IN BERYL BOULEVARD AND IMPROVEMENT TO DRAINAGE LINE, NODE 1/1 TO 1/4 TO 20 YEAR ARI CAPACITY (MAJOR WORKS)				
3	Diversion of Runoff from north of Beryl Boulevard	Resurface road to provide 2-way 3% crossfall from Western end to no 7 node 7/1	Reduces runoff to Garnet Road, Cornelian Road and Diamond Road		51600
3	Improvement of drainage from lowpoint in Beryl Boulevard	Provide augmented inlets at low spot Beryl, 3 x 600 x 600 grated inlets and 2.4W x 0.45H RCBC discharge to Lagoon	Removes additional flows from Beryl generated by road works		104 400
2	Improve drainage upstream of Diamond Road lowpoint	Pipe open channel in Line 2 from 2-3A to 2-4	Reduces maintenance	11 300	
	CATCHMENT B (MINOR WORKS)				
1	Collect runoff from Pearl Beach Drive	-300 RCP from culvert to Jade Place OR -300 RCP from culvert to Onyx Road		11 300 24 500	
1	Improve collection of runoff from end of Jade Place	Increase inlet capacity with 4 x 600 x 600 inlet pits and 375 RCP	Reduces flow through 5 Jade Place	14 000	
1		Modify fence at rear of 44A Cornelian Road	Improves flow path	220	

SUMMARY

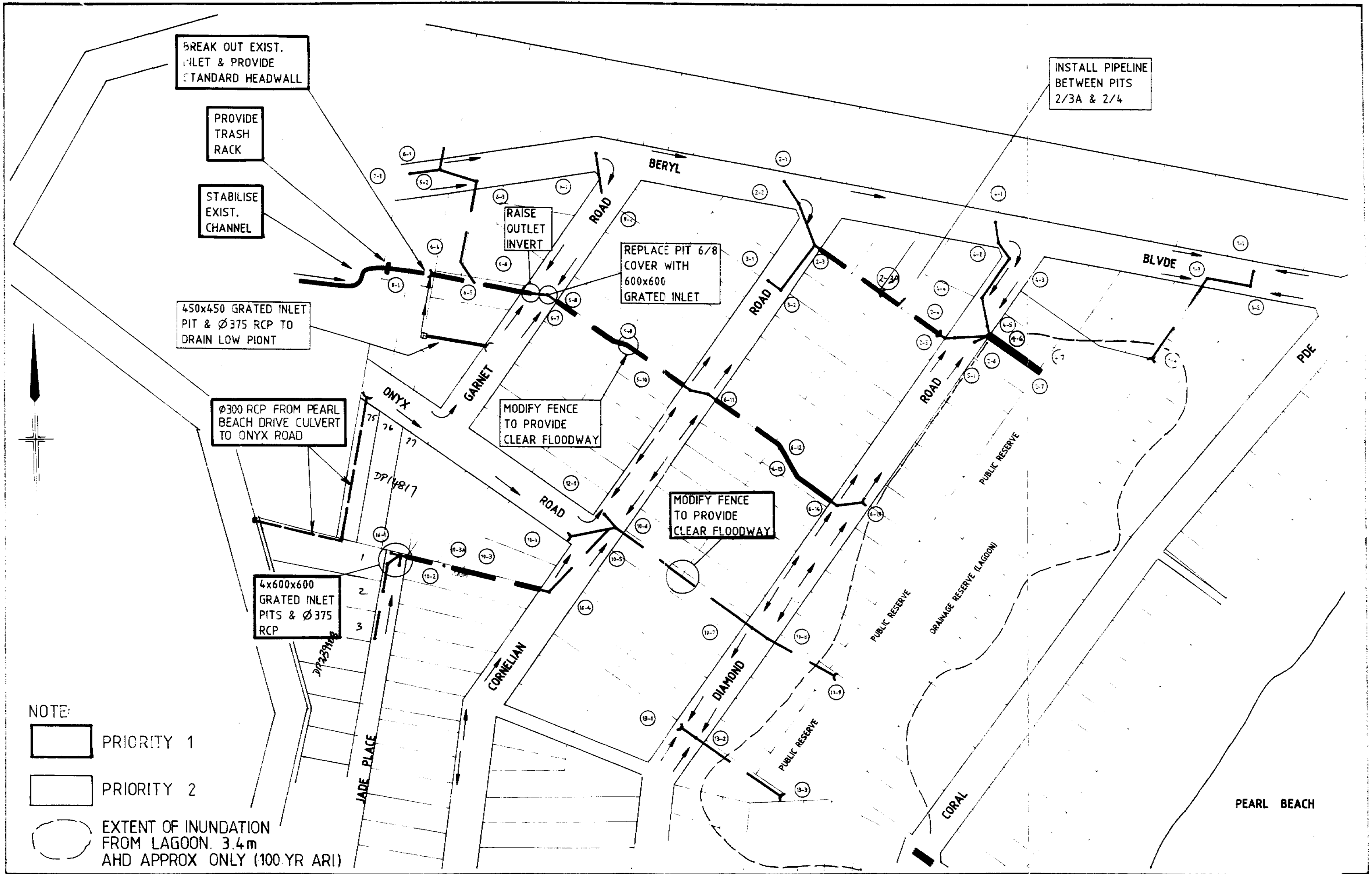
Priority 1 – Minor Works	$ 32 700 – $45 900
Priority 2 – Minor Works	$ 21 000
Priority 3 – Major Works – Modification to Beryl Boulevard and Improve Line 1	$156 000
Priority 4 – Major Works – Augmentation Line 6	$163 500

Table 3.2
Recommended Minimum Floor Levels

Location	Elevation (m AHD)
Node 1/1 to 1/4	
Beryl Boulevarde (South)	4.5*
Node 2/1 to 4/7	
Cornelian Road (East)	8.1
Diamond Road (West)	5.7
Diamond Road (East)	4.9
Node 8/1 to 6/15	
Garnet Road (West)	11.8
Garnet Road (East)	11.1
Cornelian Road (West)	9.3
Cornelian Road (East)	8.4
Diamond Road (West)	5.9
Diamond Road (East)	4.5*
Node 10/1 to 10/9	
Cornelian Road (East)	7.7
Diamond Road (West)	6.3
Diamond Road (East)	4.5*

NOTE: Levels 500 mm above estimated 100 year ARI Flood (set at 200 mm above surrounding ground level)

NOTE: * Controlled by Lake Levels



No.	Description	Date	Inits.
	Revisions		

Job

FLOODING & DRAINAGE INVESTIGATION – PEARL BEACH

Design		Traced	
Drawn		Checked	
Scale	1:2000		
Approved			
Date			

Gutteridge, Haskins & Davey Pty Ltd.
Incorporated in ACT
Consulting Engineers – Planners – Surveyors

39 Regent St., Railway Square
Tel. 690 7070

FIGURE 3.1
PROPOSED MINOR WORKS

Job No.

REFERENCES

4 REFERENCES

Gosford City Council, Flood Facts – Information and Precautions

Institution of Engineers, Australia, (1987) Australian Rainfall and Runoff Vol 1: A Guide to Flood Estimation

Pearl Beach and Green Point Creek Management Study

WP Software, (1990) RatHGL-XP User Manual

APPENDIX A

RESPONSE TO QUESTIONNAIRES

RESIDENTS INTERVIEW SHEET - GOSFORD

ident's name F. LANGLEY ..... Interviewer .....
dress 4 BERYL BOULEVARDE ..... Date .....
PEARL BEACH ..... Interview No .....
Telephone (02) 858 5189 .....

How long have you owned this property? [17] Yrs

How long have you been a resident in this area? [17] Yrs

Have there been large floods in this area? [✓] Yes [ ] No

Did the highest flood enter the house? [ ] Yes [✓] No

4. Can you show us where the highest flood came to? [ ] Yes [ ] No
(If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
How did you know about this flood level? Resident was here at time [ ]
Past house owners told resident [ ]
Neighbours told resident [ ]

at was the approximate year and month of this highest flood?
.....

We think floods may have occurred about the following dates. Do you have any recollection of these floods?

Please refer to the correspondence attached

Mangley
4/3/92

January 1988	[ ] Yes	[ ] No
April 1988	[ ] Yes	[ ] No
July 1988	[ ] Yes	[ ] No
October 1988	[ ] Yes	[ ] No
January 1989	[✓] Yes	[ ] No
April 1989	[ ] Yes	[ ] No
February 1990	[✓] Yes	[ ] No

If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

Have you any recollections of floods, besides the dates given above? [ ] Yes [ ] No
If "Yes" response, what was the year and month?
.....
(If "Yes", Interviewer to complete sketches on supplementary sheet)

We are also looking for additional data. Do you have ....

7.1 Any photographs shown flooding? [ ] Yes [ ] No

7.2 A diary in which you record flood information? [ ] Yes [ ] No

If "Yes", can we borrow the items for a short period?

In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

28 Cowells Lane
Ermington
N.S.W. 2115
Tel: (02)858.5189

The City Engineer,
Gosford City Council,
Gosford.

12th February 1990

Dear Sir,

4 BERYL BOULEVARDE, PEARL BEACH

I wish to bring to your attention a drainage problem behind my property and adjacent properties at Pearl Beach which has existed for many years but has rapidly deteriorated as a result of the rains of January 1989 and February 1990.

At 4 Beryl Boulevarde my property lies at the foot of the southern side of Mt Ettalong, near the beach end of the road. When we bought the land in 1975 there already existed a shallow trench a few metres from the land's back boundary, which was intended to intercept water running down the hill and take it past adjacent properties in the direction of the sea. The recent saturation of the land has not only meant a greater volume of water coming down, but more importantly, a stream has developed on the hill behind No.6 which falls into the shallow ditch, has weakened it, undermined soft strata, and caused a subsidence of land about 6m x 6m by 1m to 2m deep. Water has flowed into my property and been caught by a transverse ditch which I have made to take it into the street. This transverse ditch did not cope with the increased volume and spilled into the adjacent property, No.2. A large amount of sand has now been deposited on that land and in the street where it interferes with street drainage (please refer to the sketch map attached).

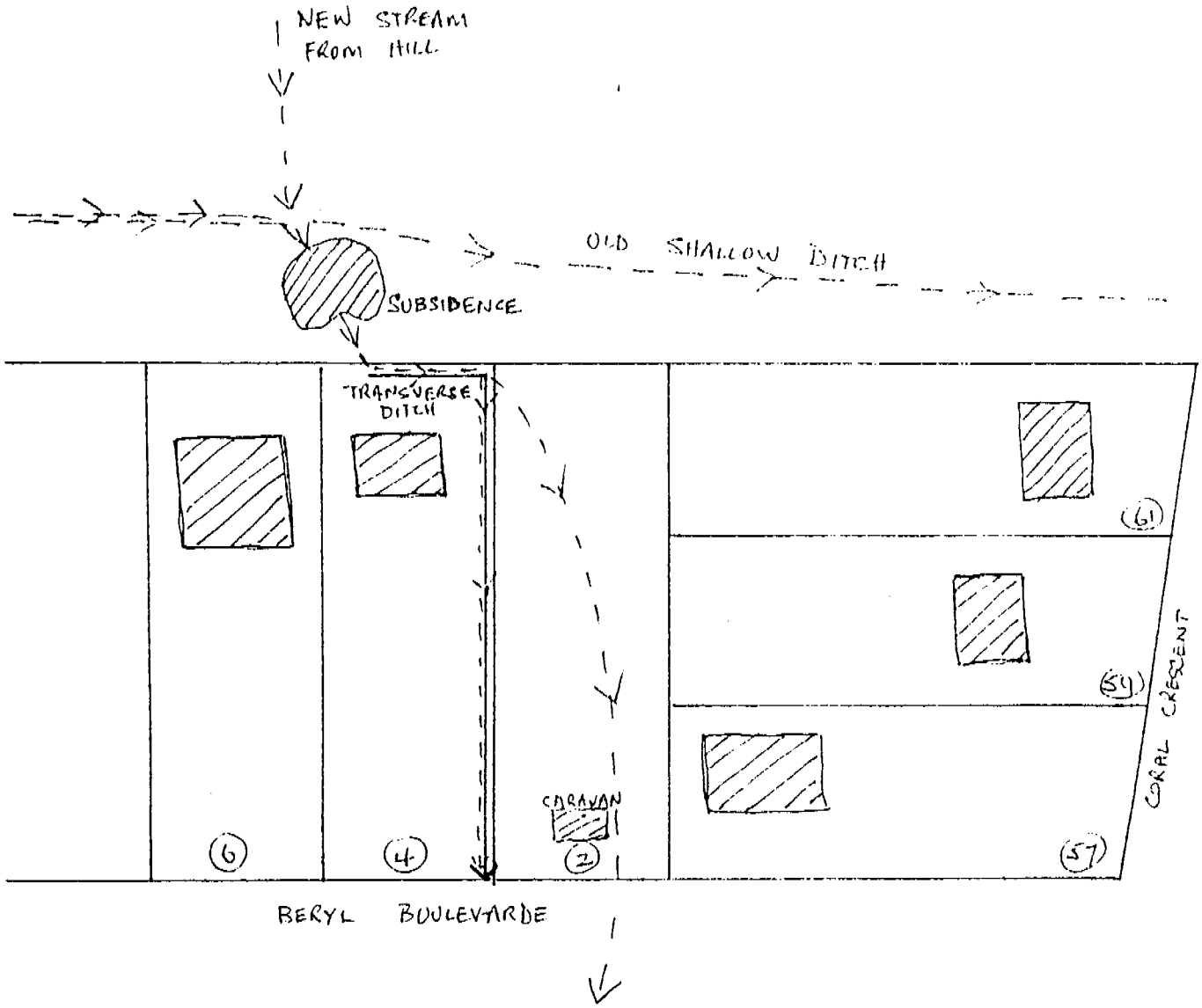
We are concerned that the subsidence mentioned above, which has already felled some trees and threatens others, will worsen and possibly threaten my house. We believe that a substantial and permanent trench needs to be established to intercept water running down Mt Ettalong before it reaches the back of my property and that of my neighbours.

On the recommendation of local resident Fay Austin my wife contacted Mr.Robert Olzomer on the morning of the 5th February. The following day your Mr.Lawley inspected the subsidence. He understood the problem and said he would report it to Council.

I would appreciate your acknowledging receipt of this letter, and advising me and my neighbours what action you propose to take.

Yours sincerely,

Frank J. Langley)


NEW STREAM FROM HILL
OLD SHALLOW DITCH
SUBSIDENCE
TRANSVERSE DITCH
CARAVAN
6
4
2
61
59
57
CORAL CRESCENT
BERYL BOULEVARDE

Water pouring onto property from concentrated uphill flow.

Results of water flow scouring out sewerage pipe backfill.

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name J. F. GRIMSLEY ..... Interviewer .....
Address ... 5 BERYL BLVD ..... Date .....
..... PEARL BEACH 2256 ..... Interview No .....
Telephone .. (043) 41 3100 .....

How long have you owned this property? [10] Yrs

How long have you been a resident in this area? [8] Yrs

2. Have there been large floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [✓] Yes [ ] No

4. Can you show us where the highest flood came to? [ ] Yes [ ] No
(If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
How did you know about this flood level? Resident was here at time [✓]
Past house owners told resident [ ]
Neighbours told resident [ ]

What was the approximate year and month of this highest flood? Not Sure
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[✓] Yes	[ ] No
April 1988	[✓] Yes	[ ] No
July 1988	[✓] Yes	[ ] No
October 1988	[✓] Yes	[ ] No
January 1989	[✓] Yes	[ ] No
April 1989	[✓] Yes	[ ] No
February 1990	[✓] Yes	[ ] No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [ ] Yes [ ] No
If "Yes" response, what was the year and month?
.....
(If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

7.1 Any photographs shown flooding? [✓] Yes [ ] No

7.2 A diary in which you record flood information? [ ] Yes [✓] No

If "Yes", can we borrow the items for a short period? Yes

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

The Following 1 document(s) is/are an exact copy.

The original document(s) is/are either:

- ✓ A photocopy of turned corners.
- A photocopy of over lapped pages.
- Contains dark lines/patches from photocopying.
- Damaged or unrepairable.
- Other: _____

Data Imaging Solutions Corporation
43 Young Street WEST GOSFORD NSW 2250
T: (02) 43250811 F: (02) 43250814 E: ddataima@bigpond.net.au

FLOODING/DRAINAGE - BERYL BLV

5 Beryl Boulevarde,
PEARL BEACH 2256

March 5, 1990

Mr Neville Prince,
City Manager,
Gosford City Council,
49 Mann Street,
GOSFORD.

Dear Sir,

RE: FLOODING OF LOWER BERYL BOULEVARDE

For five years from the date of purchase of my home in 1982 this area was virtually unaffected by constant heavy rain. However, since 1987, such conditions have resulted in frequent flooding of my ground floor area, and this is due entirely to the gross inadequacy of the street drainage facilities.

Situated on the lower side of the street and at its lowest point, surface rain water and silt are coming from both directions (i.e. Down the hill from the west and out of Coral Crescent into Beryl Blvd from the east). Any deluge results in an enormous build-up of water and sand in my immediate vicinity, drains are choked, and a river of water pours down the driveway into my home, flooding the lower area. (The enclosed photographs were taken in April 1989 and clearly illustrate the problem I have outlined).

I paid to have a grating drain constructed across my garage entrance but any such drain is ineffective under intensive flood conditions.

Short of kerbing and guttering the lower south side of Beryl Boulevarde AND up-grading the existing stormwater drains, I doubt whether any other action could achieve any worthwhile improvement in what has become a nerve-wracking wet weather environment.

The combined costs of these liquid incursions plus formidable council rate charges have convinced me that something must be done to prevent any re-occurrence of such conditions as I have had to suffer so often in recent times.

Yours faithfully,

JOHN F. GRIMSLEY

J. F. Grimsley
5 Beryl Blvd.
Pearl Beach

SUPPLEMENTARY NOTES RE ATTACHED SHEET:

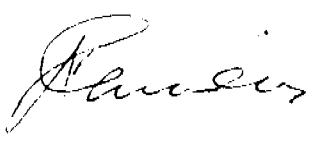
My home is situated on the low side of the road and very close to its lowest point. Consequently, when road-surface water builds up due to the inadequate drainage in my immediate vicinity whenever there is prolonged, heavy rain my short but steep driveway tends to resemble a sluice and the water flows down relentlessly underneath the garage doors into the ground floor area and on towards the back of the house. At various points of entrapment the water reaches heights of up to 30cm or so.

After the first of the 1988 floods I had a gutter/drain constructed across the front of the garage but this has proved relatively ineffective in all but the lightest downfalls.

In the heavier floods a mini-lake forms outside my neighbour's house at number 3 and courses diagonally across this block to settle across the backs of both our properties. This "damming" effect is due to the fact that the nearby Coral Crescent is higher than the low point in Beryl Boulevarde and the run-off from Coral comes only 30-odd metres into Beryl before meeting up with the water pouring down the full length of Beryl Blvd.

I have photographs which adequately illustrate this phenomena.

It is my firm belief that the worsening conditions experienced in this regard over the years of my residence in this area are due in no small measure to the increase in development on the high side of Beryl Blvd. There seems little doubt that the increased run-off from the houses which back into the lower slopes of Mt Ettalong has made the long-established drainage system significantly less able to cope.



[✓] Yes [ ] No

Property 29 Beryl Boulevarde Pearl Beach

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name V R STREET ..... Interviewer .....
Address 25 BELINDA CRS ..... Date .....
NORTH EPPING 2121 ..... Interview No .....
Telephone 02 86 83346 BUS 02 7362911

1. How long have you owned this property? [10] Yrs

2. How long have you been a resident in this area? [—] Yrs

3. Have there been large floods in this area? [✓] Yes [ ] No

4. Did the highest flood enter the house? [✓] Yes [✓ was] No

5. Can you show us where the highest flood came to? [✓] Yes [ ] No
(If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
How did you know about this flood level? Resident was here at time [✓]
750 mm on side fence Past house owners told resident [—]
Neighbours told resident [✓]

What was the approximate year and month of this highest flood?
.....

6. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[ ] Yes	[ ] No
April 1988	[ ] Yes	[ ] No
July 1988	[ ] Yes	[ ] No
October 1988	[✓] Yes	[ ] No
January 1989	[ ] Yes	[ ] No
April 1989	[ ] Yes	[ ] No
February 1990	[✓] Yes	[ ] No

* I invite you to observe the silt difference between mine & the adjoining property. Also attached is correspondence to Gosford City Council & their typically inadequate reply

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

7. Have you any recollections of floods, besides the dates given above? [ ] Yes [ ] No
If "Yes" response, what was the year and month?
.....
(If "Yes", Interviewer to complete sketches on supplementary sheet)

8. We are also looking for additional data. Do you have ....

8.1 Any photographs shown flooding? * [ ] Yes [✓] No

8.2 A diary in which you record flood information? [ ] Yes [✓] No

If "Yes", can we borrow the items for a short period?

9. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

Vic Street,
25 Belinda Crescent,
NORTH EPPING. 2121

18th September, 1987.

The Town Clerk,
Gosford City Council,
P.O. Box 21,
GOSFORD. 2250.

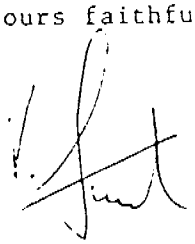
Dear Sir,

As the owner of dwelling at 29 Beryl Boulevarde, Pearl Beach, I draw your attention to condition of the road and drainage pattern at the western end of Beryl Boulevarde.

The current unsatisfactory condition has been caused by development of several properties on the northern side of the Boulevarde. In particular, access tracks to these properties have been constructed across the drainage line and extend well on to the bitumen. This has entirely destroyed any semblance of drainage on the northern side of the Boulevarde, as a consequence, all run off is carried across the road to the southern side.

I urge you to give this matter your urgent attention.

Yours faithfully,



RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name BOB DWYER
Address 56 CORNELIAN RD
PEARL BEACH
Telephone (02-4847749)

Interviewer .....
Date .....
Interview No .....

1. How long have you owned this property? [7] Yrs

How long have you been a resident in this area? [—] Yrs

2. Have there been large floods in this area? [ ] Yes [✓] No

3. Did the highest flood enter the house? [ ] Yes [✓] No → SEE OVER PAGE

Can you show us where the highest flood came to? [ ] Yes [✓] No
(If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)

How did you know about this flood level?
- Resident was here at time [✓]
- Past house owners told resident [ ]
- Neighbours told resident [ ]

4. What was the approximate year and month of this highest flood?
MAY 1989

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[ ] Yes	[✓] No
April 1988	[ ] Yes	[✓] No
July 1988	[ ] Yes	[✓] No
October 1988	[ ] Yes	[✓] No
January 1989	[✓] Yes	[ ] No
April 1990	[ ] Yes	[✓] No
February 1990	[ ] Yes	[✓] No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [ ] Yes [✓] No
If "Yes" response, what was the year and month?
.....
(If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

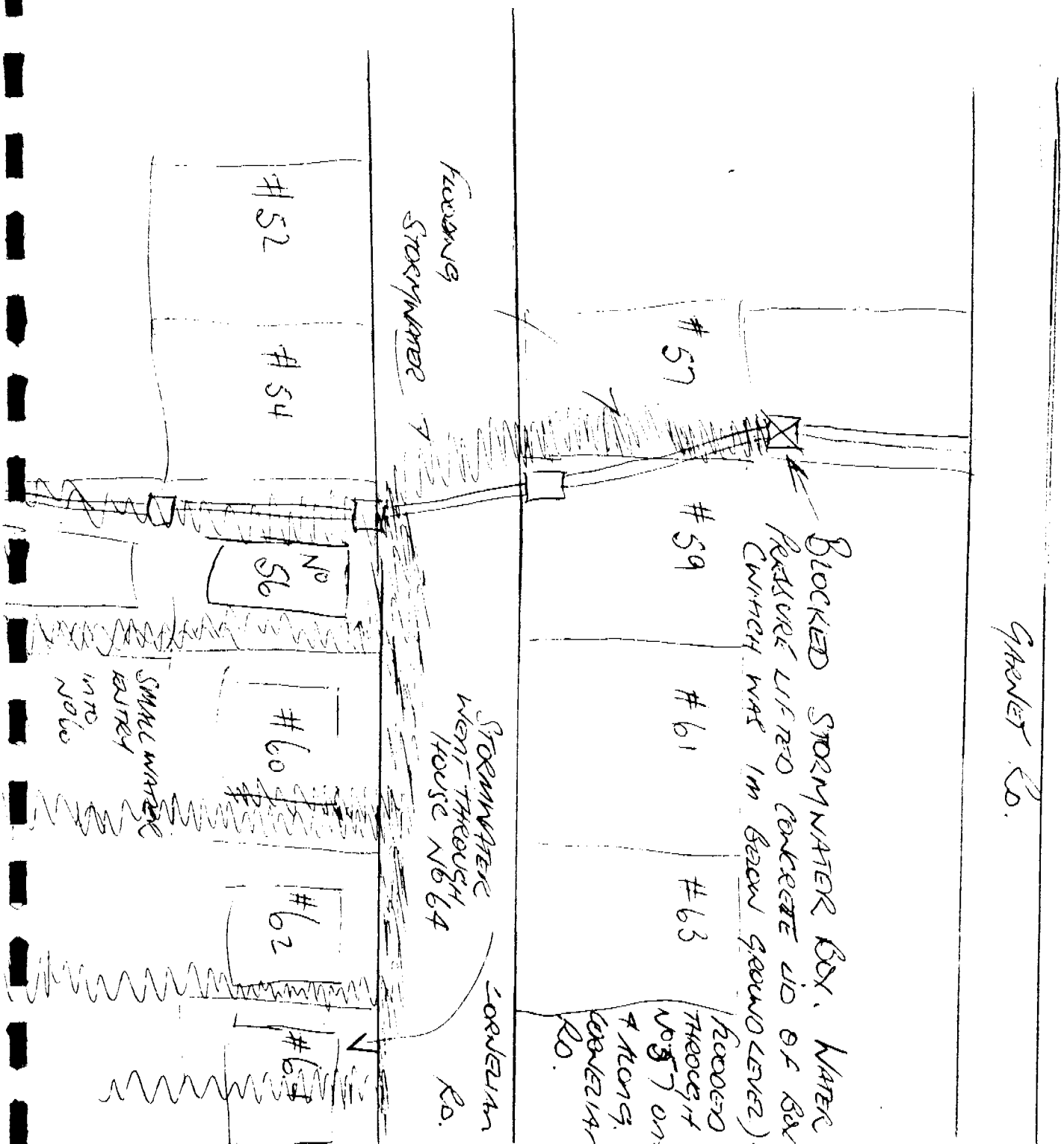
7.1 Any photographs shown flooding? [ ] Yes [✓] No

7.2 A diary in which you record flood information? [ ] Yes [✓] No

If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [ ] Yes [✓] No

THE ONLY PROBLEM THAT OUR PROPERTY HAS HAD WITH EXCESS WATER WAS IN JANUARY '89, DUE TO A BLOCKED STORMWATER UNDERGROUND PIPING SYSTEM. THE STORMWATER CHAMBER BOX WAS BLOCKED WITH PALM FRONDS, TIMBER, A REAL ESTATE SIGN + EVEN AN OLD IRONING BOARD.



RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name CAROLE SAINT ..... Interviewer .....
Address 57 CORNELIAN ROAD ..... Date .....
PEARL BEACH ..... Interview No .....
Telephone 41 6791 .....

1. How long have you owned this property? 10 Yrs

   How long have you been a resident in this area? 10 Yrs

2. Have there been large floods in this area? ☐ Yes ☑ No

3. Did the highest flood enter the house? ☐ Yes ☑ No

4. Can you show us where the highest flood came to? ☐ Yes ☑ No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level? Resident was here at time ☐
   Past house owners told resident ☐
   Neighbours told resident ☐

What was the approximate year and month of this highest flood?
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	☐ Yes	☑ No
April 1988	☐ Yes	☑ No
July 1988	☐ Yes	☑ No
October 1988	☐ Yes	☑ No
January 1989	☐ Yes	☑ No
April 1989	☐ Yes	☑ No
February 1990	☐ Yes	☑ No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? ☐ Yes ☑ No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? ☐ Yes ☑ No

   7.2 A diary in which you record flood information? ☐ Yes ☑ No

   If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? ☑ Yes ☐ No

Carole Saint
57 Cornelian Road
Pearl Beach 2256

9th March, 1992

J R Lawrence
Gutteridge Haskins & Davey Pty Ltd
PO Box 39
RAILWAY SQUARE 2000

Dear Madam/Sir

FLOODING AND DRAINAGE INVESTIGATION - PEARL BEACH

Please accept my apologies for having taken so long to reply to your letter, and for any inconvenience this may have caused. Attached is your completed questionnaire. Further to this, I would like to add that I have lived at the above address in Pearl Beach for ten years: this property is not flood prone. (A fact I have always considered fortunate.)

Apart from living at Pearl Beach for ten years I have been visiting and holidaying here for over forty years. I have experienced many severe rainstorms over the years, on occasions it was not possible to get out of Pearl Beach until trees and rockfalls had been cleared from the main access road. Nevertheless the only flood I have ever experienced at Pearl Beach was on my property in January, 1989. This was as a result of a blocked Council easement. The easement runs across the back of the property which adjoins the rear of my block. Attached is an extract from my letter to Gosford Council, and my notes regarding the incident.

As far as I am concerned, the flooding to my property was as a direct result of Council neglecting to maintain the drains. While I understand and sympathise with mitigating circumstances such as lack of funds etc. they do not alter this fact.

Yours faithfully,

Carole Saint

FLOODING & DRAINAGE PROBLEMS - PEARL BEACH
JANUARY, 1989

An easement runs across the back of the property which adjoins the rear of my block. During very heavy rains on 6th January, 1989 the manhole cover on this easement, which was apparently blocked, was blown off by the build-up of water within. Such was the quantity and force of the water that it flattened the dividing paling fence (at the rear of the property), this, in turn, knocked an aluminium garden shed off its footing and squashed a hedge. As the water rushed through my property it deposited a layer of sand and dirt on the patio behind the garage to a depth of 7-10 cm over an area of about 4.5 square metres: the garage was flooded. The water raced on around the garage, down the drive, blew the double wooden gates off their hinges and finally gouged a hole in the asphalt road at the end of the drive of about 2.5 metres long by 70 cm deep, ripping three rows of pavers from my driveway in the process. The water was also diverted down the other side of my house dislodging the side gatepost from its support. Had the house not been on piles it would have been flooded and the contents severely damaged.

The properties on either side of mine were untouched. Although a house further up, affected by the same drain, was also flooded. The easement was re-capped and filled in and about a fortnight later more flooding was experienced - the blockage had not been fully cleared. Needless to say this second flood was an inconvenience but not a problem as all of the damage had been done.

About 12 months after this *flooding* incident we again experienced very heavy rains. The local paper reported the worst flooding in Pearl Beach in 100 years - my property was not affected.

In January, 1991 I received a copy of Gosford Council's Flood Report. My property was mentioned in this (copy attached). Although the Council does seem to concede that a blockage in the easement was instrumental in causing the flooding and subsequent damage, they seem to apportion as much blame to the paling fence and garden shed and suggest *modification of fence construction to a flood compatible standard.* I find this ludicrous. Certainly the fence, the shed, the garage, the front gates, the pavers and the road were impediments to the water's flow. I find it self evident (although somewhat zany) to conclude, that had these objects not been there they would not have been damaged. Contrarily, had the easement not been blocked all the aforementioned objects would have been quite safe, as the water would have followed its course instead of deviating from it.

The point I am trying to emphasise is that the property is not flood prone in the common sense. Rainwater and surface water run-off from the surrounding hills and properties are not, and have never been, an issue. Not only were the houses on either side of mine unaffected by flooding, but the property which adjoins my property at the back and through which the easement runs was also unaffected - apart from the damage at the easement. The water which flooded my property and caused so much damage was not site or local surface water run-off. It was blown out of a blocked easement through the weakest spot which was the inspection cover (buried under a few feet of soil). Had the inspection cover been located one metre to the right the property next door would have been flooded not mine.

Originally, Pearl Beach had no drainage. It was a holiday community with tank water, pan toilets, and rubble drains for dispersement of water on the property. Septic tanks did

not come in until town water was connected. Roof water was run-off and saved in the water-tank. Household water wastage was minimised by the fact that tank-water had to be conserved. Drainage problems were non-existent.

Drainage easements were put in many years later. Their path was apparently dictated by the location of existing inhabited properties and available vacant blocks. As a consequence the easement which affected my property runs across the property adjoining mine at the back (which was vacant until about five years ago), and down the side of the property to the right of mine (which was also vacant until about five years ago). This, of course, necessitates a dog-leg bend in the easement. This is obviously were rubbish would be expected to accumulate and for this reason an inspection hole was placed near this juncture. What I do not understand is why this inspection-hole is located some feet underground. Could it not be extended so that it is easily accessible from the surface and inspected regularly (whatever is practicable - say every two years).

9th March, 1992

65 Cornelian Rd
Pearl Beach
2256
28/11/91

Gutteridge Haskins & Davey Pty Ltd.
21 Rankens Court
Wyong 2259.
Branch Manager

Dear Sir,

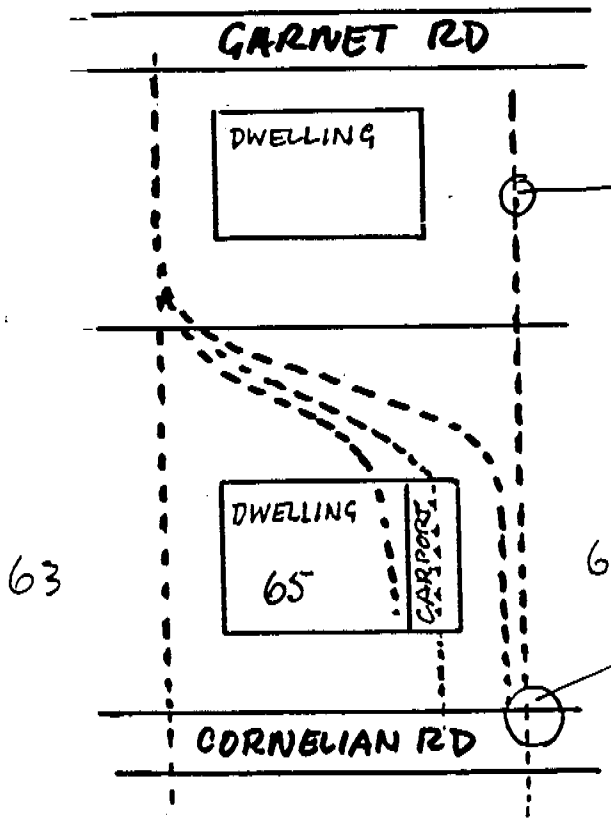
Having had this property for over 14 years I can only say the worst floods happened over the last three years, but your records should show exact dates when they did occur.

The flood level on my property reached the first step in the front of the house. After replacing the base of my carport with a road base mix, gravel and wood chips twice it was completely washed away and gauged huge crevices which I couldn't drive the car on. I have now had to cement the base which is almost level with the first step. Find enclosed sketch.

I hope this problem can be solved so that it doesn't happen again.

Yours faithfully
B. Docker

B. DOCKAR.
65 CORNELIAN RD
PEARL BEACH



THIS LINE OF FLOODING KEPT FLOWING FOR TWO WEEKS AFTER RAIN.

THIS IS THE LOWEST POINT IN CORNELIAN RD WHICH HAS NO PROPER FALL INTO DRAINS THUS FLOODS BACK INTO MY PROPERTY AND NO. 67.

ALL DOTTED LINES SHOW THE COURSE OF FLOOD WATER.

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name Janes
Address 66 Cornelan Rd
Telephone 413684

Interviewer David Barnigan
Date 12/11/91
Interview No

1. How long have you owned this property? 14 Yrs

How long have you been a resident in this area? 14 Yrs

2. Have there been large floods in this area? ☑ Yes ☐ No

3. Did the highest flood enter the house? ☐ Yes ☑ No

Can you show us where the highest flood came to? ☐ Yes ☐ No
(If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)

How did you know about this flood level?
- Resident was here at time ☐
- Past house owners told resident ☐
- Neighbours told resident ☐

What was the approximate year and month of this highest flood?
~1980 - before Beryl drainage improved

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	☐ Yes	☐ No
April 1988	☐ Yes	☐ No
July 1988	☐ Yes	☐ No
October 1988	☐ Yes	☐ No
January 1989	☐ Yes	☐ No
April 1989	☐ Yes	☐ No
February 1990	☐ Yes	☐ No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? ☐ Yes ☐ No
If "Yes" response, what was the year and month?

(If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

7.1 Any photographs shown flooding? ☑ Yes ☐ No

7.2 A diary in which you record flood information? ☐ Yes ☑ No

If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? ☐ Yes ☐ No

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name STEPHEN FLICK ..... Interviewer .....
Address 67 CORNELIAN RD ..... Date .....
PEARL BEACH ..... Interview No .....
Telephone 02 6346543 .....

1. How long have you owned this property? [15] Yrs

How long have you been a PART TIME resident in this area? (HOLIDAY HOUSE) [15] Yrs

2. Have there been large floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [✓] Yes [ ] No

4. Can you show us where the highest flood came to? [✓] Yes [ ] No
(If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
How did you know about this flood level?
Resident was here at time [✓]
Past house owners told resident [ ]
Neighbours told resident [ ]

What was the approximate year and month of this highest flood? JANUARY 89
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[ ] Yes	[ ] No
April 1988	[ ] Yes	[ ] No
July 1988	[ ] Yes	[ ] No
October 1988	[ ] Yes	[ ] No
January 1989	[✓] Yes	[ ] No
April 1989	[✓] Yes	[ ] No
February 1990	[✓] Yes	[ ] No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [ ] Yes [✓] No
If "Yes" response, what was the year and month?
.....
(If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

7.1 Any photographs shown flooding? [ ] Yes [✓] No

7.2 A diary in which you record flood information? [ ] Yes [✓] No

If "Yes", can we borrow the items for a short period?

In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

The Following 1 document(s) is/are an exact copy.

The original document(s) is/are either:

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FLICK S J

I

GUTTER RCONSTRUCT, RO-BERYL BVD.

Dear Sir,

With the current state of storm water situation here, during period it carries stormwater across

The problem seems to be caused by previously well developed gutters in Beryl Boulevard becoming blocked with sand, weed growth. Water now flows directly towards my property rather than continues directly towards my property rather than redirecting the flow into the existing drains.

I request that the gutters on both sides of Beryl Boulevard reconstructed, especially outreach beach and Carrington that ground water flows directly to the drain nearby.

I have sketched the location of the work needed so that problem is properly understood by your staff.

Thank you for your attention to this matter.

Yours sincerely,

ATTENTION HAS BEEN GIVEN
COMPLETED: 2/4/90
BY: P Goldsack

GARDEN

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name TAYLOR ..... Interviewer .....
Address 85 DIMOND ROAD ..... Date .....
PEARL BEACH 2256 ..... Interview No .....
Telephone 043 41 8329 .....

1. How long have you owned this property? [14] Yrs

   How long have you been a resident in this area? [17] Yrs

2. Have there been large floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [✓] Yes [ ] No

4. Can you show us where the highest flood came to? [✓] Yes [ ] No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level?
   - Resident was here at time [✓]
   - Past house owners told resident [ ]
   - Neighbours told resident [ ]

What was the approximate year and month of this highest flood? FEB 1990

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[✓] Yes	[ ] No
April 1988	[✓] Yes	[ ] No
July 1988	[✓] Yes	[ ] No
October 1988	[✓] Yes	[ ] No
January 1989	[✓] Yes	[ ] No
April 1989	[✓] Yes	[ ] No
February 1990	[✓] Yes	[ ] No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [✓] Yes [ ] No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? [✓] Yes [ ] No

   7.2 A diary in which you record flood information? [ ] Yes [✓] No

   If "Yes", can we borrow the items for a short period?

   In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

92 Diamond Road,
PEARL BEACH. 2256.

24 February, 1992.

Mr. John R. Lawrence,
Gutteridge, Haskins & Davey Pty. Ltd.,
P.O. Box 39,
RAILWAY SQUARE. 2000.

Dear John,

Thank you for your advice over the 'phone (20 Feb.) concerning overflows from the stormwater pit located, alongside our house, in the easement which passes through our property. I have postponed our plan to spend $3,000 on a floodway of pavers until Gosford Council considers the recommendations in your report.

As I explained during your site inspection on 19 November last year, flooding of our land is associated principally with overflows from "our" stormwater pit, and all of them can be attributed to the way in which the pit has been designed and constructed. Overflows from pits located further upstream on the pipeline, though damaging, have (so far) had a lesser impact on our land.

Flow into our pit is through a 1200mm pipe, entering at an angle of about 60°, which transfers its flow into two 900mm pipes set in the opposite wall of the pit. The two smaller pipes are separated by a section of the wall 400mm wide.

It is that bifurcation of the flow and the manner in which it is contrived that creates two sources of overflows. First, and more frequently, under high-flow conditions, by creating a hydraulic jump throwing large volumes of water out through the grating located in the middle section of the pit. Secondly, under virtually any condition of flow, by trapping and holding large pieces of bush-land "trash" that can accumulate and create blockages varying from a partial to a complete blockage.

Though water ejected from the pit by turbulence has caused damage to our drive-way, our constant concern is for the major consequences of even partial blockages. It was on 16 January 1988 (almost two years after taking up permanent residence and 8½ years after purchasing the land) that we first experienced the aftermath of such an event; it occurred during the night when fierce thunder-storms precipitated 180mm of torrential rain. When morning dawned we found our driveway, on the southern side, and the garden on the northern side of the house devastated by torrents of water that had surged from the blocked pipeline. It was apparent that a blockage in our pit had caused a build-up of hydraulic pressure which eventually pushed the heavy concrete covers on the pit apart and lifted the covers on the upstream pit as well. Thus the flow was discharged from two points in the pipeline with disastrous effects on our property. Restoration was expensive and took many months to complete.

The blockage was caused by a huge accumulation of palm leaves and branches, lengths of sawn timber, chunks of concrete, a long length of (surprisingly!) 250mm diameter concrete pipe and a variety of sticks, stones and other debris. The large and varied quantity of accumulated rubbish was graphic evidence of the lack of any periodic inspection and cleaning by Gosford Council.

Realising that access for inspection and cleaning was crucial I persuaded Council officers to leave the heavy covers apart and provide the aluminium grating that now covers the centre section of the lid. It has proved to be a

../2

boon on many occasions since.

One in particular was a "near miss" during late afternoon on 21 January 1991 when a fierce frontal wind struck the northern suburbs of Sydney, continued to Pearl Beach and on to the coast again further north. The wind was accompanied by a brief but torrential thunderstorm with 26mm of rain falling in 15 minutes. Our pit was quickly choked with leaves and branches of cabbage tree palms and then rapidly filled with smaller trash. An overflow was averted when the rain ceased and, after the flow had abated, I was able to enter the pit and remove a trailer-load of trash. Thus the pipe was clear when a second, fiercer, storm struck a few days later.

It is clear that the cause of blockages in the pit is the section of the wall that separates the two smaller pipes within the pit. This section will invariably catch and hold long pieces of trash that enter the pit from upstream portions of the pipeline. The principal offenders are the dead branches and attached leaves of "Cabbage Tree" palms growing in abundance beside the open creek and culvert that directs stormwater into the upper sections of the pipeline. To reach our pit this material must travel "lengthwise" down the pipeline but, under the influence of the swirling flow within the pit, they are turned side-on, then caught against the dividing section and held tightly by the flow.

A build-up can be removed when the flow is low-to-moderate, but the force exerted by faster flows makes it virtually impossible to remove blockages and dangerous even to try. So far, I've been able to remove accumulations of material before the next storm sends more down to add to the size of the build-up. But prevention is more important than cure, and depends on removal of potential obstructions at the source of the pipeline.

Even without blockages, and always during medium-to-high flows the dividing section of the wall creates a wave directed back above the flow; and when the inflow pipe is close to full the wave becomes a hydraulic jump throwing large volumes of water out through the grating. By this time the pit is noisy with the turbulence within, created not only by the resistance of the dividing section, but also by swirling caused by the tangential entry of the flow from the large pipe, typically moving with a velocity of some eight metres per second, equivalent to a flow of half a megalitre a minute.

Turning now to flooding caused by blockages in upstream pits located on the pipeline, our experience is limited to a major overflow during the afternoon of 6 January 1989. Torrential rain fell in a series of intense thunderstorms through the day; in one period at the rate of 25mm in 20 minutes and in another at the rate of 50mm in 20 minutes. Total rainfall during daylight hours was 150mm.

About midday a complete blockage had developed in a buried pit in 59 Cornelian Road though it was manifested in a voluminous overflow in the adjacent upstream pir in a neighbouring yard. At the height of the storm the outflow poured down the driveway of 57 Cornelian Road and spreading northwards, flowed into four allotments on the eastern side. Our western neighbour's land - 56 Cornelian Road - shed its share of the flow onto our land which thus became the recipient of some 25 percent of the total overflow. Much of it was concentrated in a corner of our garden where it scoured out a hole big enough to accommodate a ten-tonne truck!

When the buried pit was eventually located and opened it was found to be jammed tight with the sort of debris that we had found in our pit a year before - further evidence of the laissez-faire attitude to drainage maintenance in earlier years, and a classic example of the old aphorism "out of sight out of mind"!

../3

At about the same time Gosford Council had begun to modify various inspection pits by incorporating hinged gratings in new, lightweight covers. But the 'underground' pit wasn't modified and, after cleaning, it was buried again under 1½ metres of soil, where it lies to-day. So, unless council officers crawl down the pipe from the upper pit to clear it out occasionally the underground pit will, sooner or later, block again.

From our experience since 1986 John, I am convinced that the whole of the system that I've been discussing has - inherently - sufficient capacity to drain very high precipitation rates even from storms deemed to have a one in a hundred years return. It is my opinion that re-engineering the system, either to enlarge it or to undertake major reconstruction of parts of it, doesn't seem to be necessary at this time. Instead, because the system doesn't function at maximum capacity over extended periods, future improvements should be directed to ensuring that it does by keeping it free from blockages. Thus relatively inexpensive improvements can be made to ensure that vital sections of the pipeline are protected from foreign material, are easy to access and are regularly patrolled.

Here are some improvements that I would like to suggest though it is likely that you've already considered most of them.

FIRST, improvements to "our" inspection pit to increase the volume of the pit and diminish the effects of turbulence and jump-discharges.

(a) Raise the height of the pit by at least one course of masonry.

(b) Replace the existing lid with a lightweight one incorporating a specially designed drop-in grating, positioned so as to be clear of jump-discharges while providing adequate access for entry and removal of blockages.

(c) Provide a moulded fibreglass, streamlined fairing to be dynabolted on to the concrete face of the pit wall between the two 900mm pipes.

SECOND, improvements to other inspection pits to facilitate inspection, access and cleaning.

(a) Each pit should be brought to ground level and provided with lightweight concrete covers incorporating a hinged grating.

(b) Inspections should be made regularly, especially after heavy rainfall.

THIRD, road collection points.

Each should be kept clear of rubbish, weeds etc. and regularly inspected at the same time as the pits.

FOURTH, improvements to the upstream source of the drain to control the entry of large pieces of bushland trash.

(a) All Cabbage Tree palms growing on the easement should be regularly pruned and, together with all ground level trash, collected and taken away.

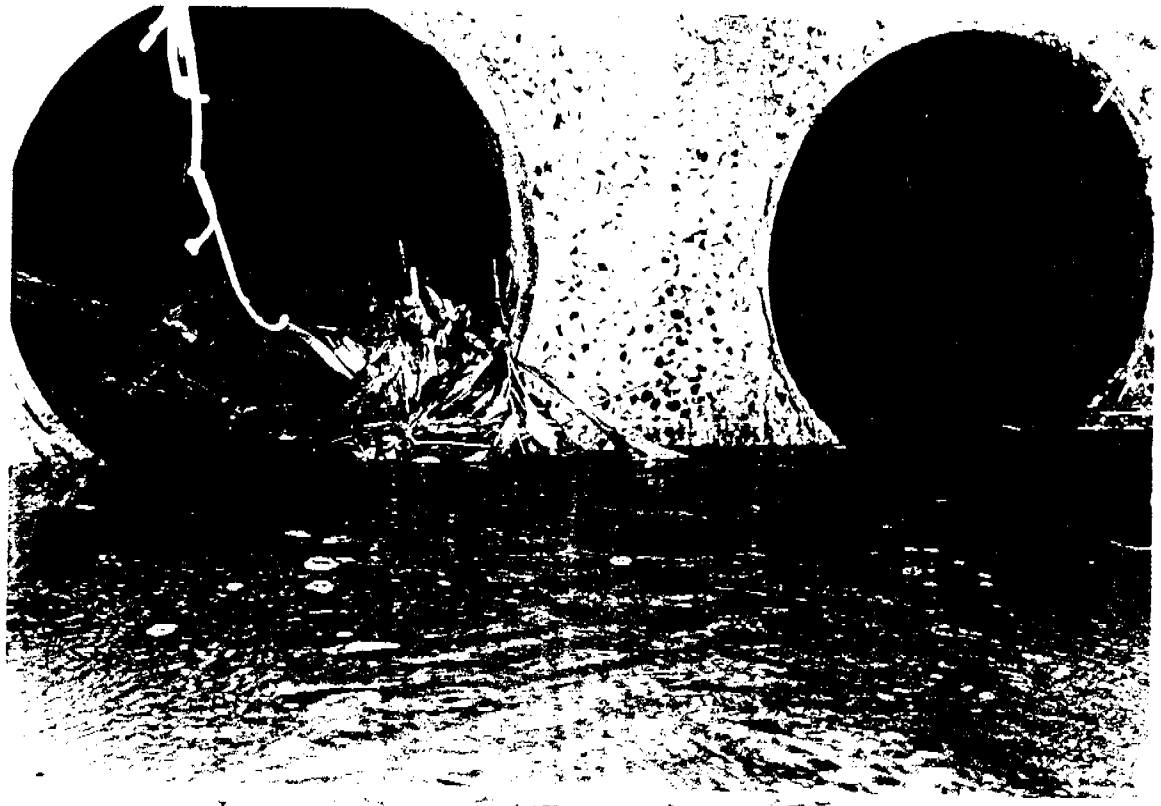
(b) Extend the concrete culvert and cover it with lightweight steel mesh covers.

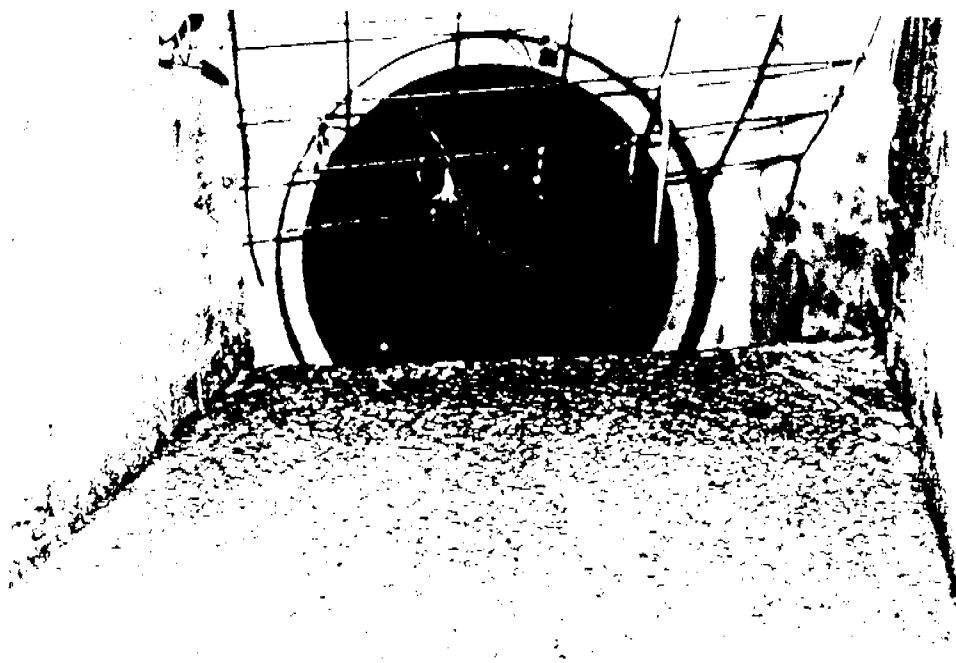
(c) Provide an effective trash screen over the inlet to the first section of pipe.

I trust these comments will be of some help to you John and look forward to hearing from you again.

Yours truly,

Jim Oliff B.Sc., ARACI.





RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name RALPH + JAN TESTER. Interviewer .....
Address 45 DIAMOND ROAD Date .....
PEARL BEACH Interview No .....
Telephone 043-432227

1. How long have you owned this property? 3½ Yrs

   How long have you been a resident in this area? 3½ Yrs

2. Have there been large floods in this area? ☑ Yes ☐ No

3. Did the highest flood enter the house? ☑ Yes ☐ No

4. Can you show us where the highest flood came to? ☐ Yes ☐ No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level?
   - Resident was here at time ☑
   - Past house owners told resident ☐
   - Neighbours told resident ☐

What was the approximate year and month of this highest flood?
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	☐ Yes	☐ No
30th April 1988	☑ Yes	☐ No
July 1988	☐ Yes	☐ No
October 1988	☐ Yes	☐ No
6th January 1989	☑ Yes	☐ No
April 1989	☐ Yes	☐ No
4th February 1990	☑ Yes	☐ No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? ☐ Yes ☐ No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? ☑ Yes ☐ No

   7.2 A diary in which you record flood information? ☐ Yes ☐ No

   If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? ☑ Yes ☐ No

95 DIAMOND

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TESTER R H

City Manager
Gosford City Council
49 Mann Street
Gosford NSW 2250

95 Diamond Road
PEARL BEACH 2256
January 23rd, 1989

ENGINEERS DEPARTMENT

DRAINAGE DIAMOND H95

Dear Sir,

I have to inform you in the most strongest terms that we have been flooded out through the entire home for the second time in eight months on Friday January 6th, 1989, the previous time being Saturday April 30th, 1988.

From our investigation with residents in the area who were also flooded, we were amazed to find that the main drainage pipe commencing at the foot of the mountain has never been completed to trap water from the mountain and water from the National Park, which the Council recently diverted under the Pearl Beach Mountain Road to the main water coarse drainage pipe. From photos taken in the said area, copies attached, the drains leading from the foot of the mountain to the main drain are non-existent, thus allowing any water off the mountain to spread in all directions and more through residents homes in a bid to reach the drainage lagoon area leading to the ocean.

We think it is appalling that a Council can engineer such a pathetic drainage system at the expense of a number of residents, knowing full well that when heavy rains hit the area very little water will be channelled into the main drainage pipe, and it is with this knowledge that we are holding the Council fully responsible for the damage to our carpets, furniture etc.

We would also mention that one open natural water course at the mountain foot leads directly into the path of a home recently built in Garnet Road.

Further more upon inspection of the drains in Beryl Boulevard we find that all are completely silted up and any water from the N.W. side of the mountain would also find itself to the lowest point of Garnet Road travelling through peoples' homes and property.

After speaking to residents that have lived in the area for some 40 years, one being Mrs.R.Butler of 102 Diamond Road, we were told that this flooding has only been since the Council directed the National Park water under the Pearl Beach Mountain Road, which has added tons of water to the all inadequate pipe which is situated midway between Onyx Street and Beryl Boulevard.

We have been told by residents of Diamond Road who were home when the storm hit that around 4,30pm a wall of water some 6" deep came through the centre of Pearl Beach in line with the main drainage pipe, which would be the lowest point to the lagoon.

My 85 year old Mother was at home at the time of the storm and was terrified when a wall of water came cascading down both sides of our home, and on one side all gravel and sand was washed away leaving the sewer pipes suspended in the air.

My wife who has not good health and requires Blood Pressure and nerve tablets was near to collapsing when we arrived home at 8pm that night. I had been held up at Sydney Central due to the 4.55pm Newcastle train leaving 1½hours late. Upon arriving home we again were greeted by all that I had worked for was again destroyed, let alone the heart break of moving our "Chiswell" Teak furniture, which is now showing signs of cracking and splitting, to the kitchen area. This had to be done so that

could be sucked from the carpets before they could be pulled up and thrown out.

This is the second time in eight months that we have been through this trauma and have now been advised by our insurance co., GRE, that they will not now cover us for water damage. We are completely at a loss to understand that a Council can be so incompentant in the way the drainage system has been left, and we would gladly accompany you to an inspection of the area which caused the flooding of our home.

We feel the Council has no right to bring such grief and suffering to people in this way and we demand that work in the area be commenced immediatly to rectify the drainage problem at the foot of the mountain. Bearing in mind our rates have increased about 50%.

We have already built a brick side fence, costing $1,380, to keep out water from next door, which Council made the owners raise their level of land. Yet Council told my wife Friday 13th January, 1989 it was illegal to drain water onto someone elses property. To protect our home we now have to go to the expense of building a brick fence across the front of the house and down the other side. This we have been told will cost us around $3,000 plus extra drains, a quote which we have yet to receive. All this extra cost is money we just don't have and will have to take out another loan to cover it. The fence will spoil the appearance of our home, But at this point in time we must do all we can to protect our home from the Councils' wrong doing.

We wish also to advise that on Sunday January 8th, 1989, after the storm we contacted the Council and asked for assistance with cleaning the silt off the road and scraping the shoulders of the road outside our home to prevent the street drain blocking, this they did with a frontend loader they had in the area, and at the same time my neighbour and myself spoke to an overseer of the Council to whom we requested some gravel to cover the sewer pipes but without success, however in our conversation with him about the flooding he did agree the problem lies up on the mountain road where Council has widened a bend. A pipe runs under the road then just washes down to the foot of the mountain into the National Park to where drainage is almost non existent and/or not completed. Unfortunately we didn't get his name.

We are also engaging an independant engineer to instruct us in the height and type of fencing around our home and we have also requested a report from them concerning the source of the drainage at the foot of the mountain. And upon receipt of such report we will again contact you, meantime would you kindly acknowledge receipt of this letter.

Yours faithfully

.....R.H.Tester

.....J.I.Tester

ENGINEERS ACTION STAMP

REFERRED	DATE	ACTION	INIT.	COMPLETED
Mr Brandon	3/1			

THE FOLLOWING DOCUMENT (S) HAS/HAVE BEEN SCANNED AT THE BEST POSSIBLE RESOLUTION.

ORIGINAL PRINT QUALITY IS POOR.

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name ..... Interviewer .....
Address ..... Date 13-2-92
..... Interview No .....
Telephone .....

1. How long have you owned this property? [16] Yrs

   How long have you been a resident in this area? [1] Yrs

2. Have there been large floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [ ] Yes [✓] No

4. Can you show us where the highest flood came to? [ ] Yes [✓] No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level?
   - Resident was here at time [✓]
   - Past house owners told resident [✓]
   - Neighbours told resident [✓]

What was the approximate year and month of this highest flood?
..... early 1991, early 88 .....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[ ] Yes	[✓] No
April 1988	[✓] Yes	[ ] No
July 1988	[ ] Yes	[✓] No
October 1988	[ ] Yes	[✓] No
January 1989	[ ] Yes	[✓] No
April 1989	[✓] Yes	[ ] No
February 1990	[ ] Yes	[✓] No

If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [ ] Yes [✓] No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? [ ] Yes [✓] No

   7.2 A diary in which you record flood information? [ ] Yes [✓] No

   If "Yes", can we borrow the items for a short period?

   In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name John & Beverly MCNAMARA. Interviewer .....
Address ..97...DIAMOND..RD..... Date .....
...PEARL...BEACH..... Interview No .....
Telephone .....
Postal Address: 87 Grandview Rd, New Lambton Hts 2305 049 (526609)

1. How long have you owned this property? 21 Yrs

   How long have you been a resident in this area? Holidays only 20 Yrs

2. Have there been large floods in this area? ✓ Yes ☐ No

3. Did the highest flood enter the house? ✓ Yes ☐ No

4. Can you show us where the highest flood came to? ✓ Yes ☐ No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level? Resident was here at time ✓
   Past house owners told resident ☐
   Neighbours told resident ☐

(A) What was the approximate year and month of this highest flood?
.....JANUARY...1989.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

We were not at Pearl Beach when the interviewer called. We've attached a separate sheet of paper detailing (A) (B) (C)

January 1988	✓ Yes	☐ No
April 1988	✓ Yes	☐ No
July 1988	☐ Yes	☐ No
October 1988	☐ Yes	☐ No
(A) * January 1989	✓ Yes	☐ No
April 1989	✓ Yes	☐ No
February 1990	✓ Yes	☐ No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

(B) 6. Have you any recollections of floods, besides the dates given above? ✓ Yes ☐ No
   If "Yes" response, what was the year and month?
   .....CYCLONE...1974.....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

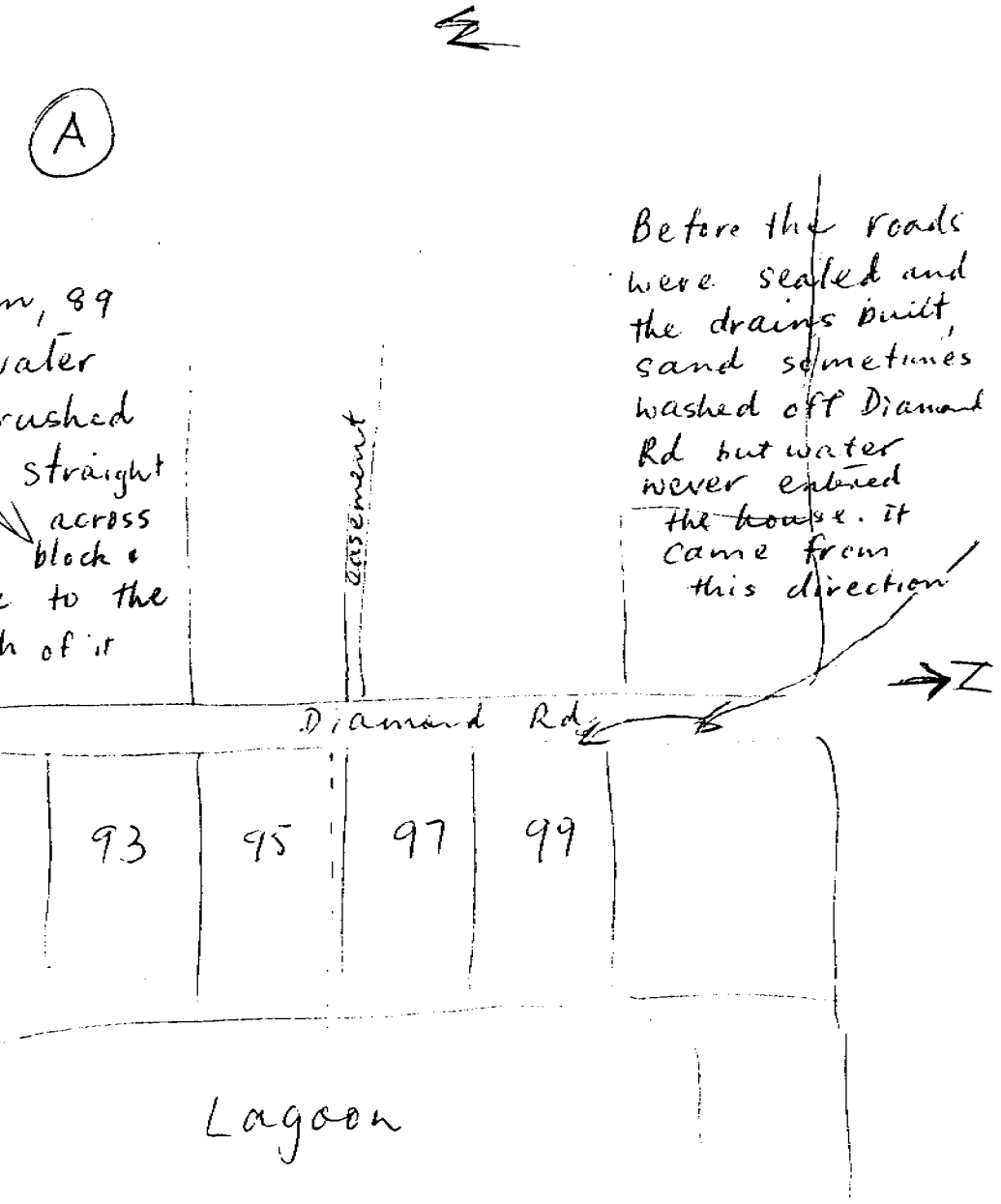
7. We are also looking for additional data. Do you have ....

(C) 7.1 Any photographs shown flooding? ☐ Yes ☐ No

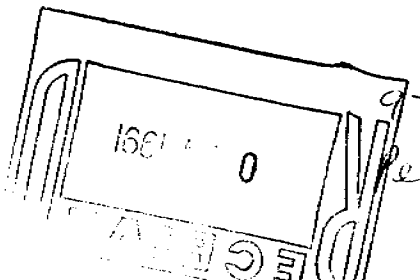
7.2 A diary in which you record flood information? ☐ Yes ☐ No

If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? ✓ Yes ☐ No



RE: 97 Diamond Rd
Pearl Beach



(A) The flood came from an unexpected direction (see map), also (B)

Although it had rained all day, when the really heavy rain commenced the area flooded within ½ an hour. The water entered the house through the garage and flooded the ground floor to a depth of 5 cm.

In the past the water had never entered our house or come from this direction. We feel that many problems began with the sewerage work and the houses built (& consequent clearing) in Jade Place.

We gave all our photographs of the flood to Mr & Mrs R Tester, 95 Diamond Rd

(B) During the cyclone of 1974, the lagoon rose higher than previously and instead of flooding the last 6 metres of our block, as sometimes occurs, it came almost to the house, but did not enter.

(C) Our photographs, commencing when Diamond Rd first started flooding, and showing the levels at 97 and 97. were all given to Mr & Mrs R. Tester. These were of the January 1989 flood. This was witnessed by several of my family and a police officer (friend visiting) Const. Stephen Potter from Wyong Police.

Yours faithfully
JD & BA McNamara

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name KING JOHN & HELEN ..... Interviewer .....
Address 7 GARNET RD ..... Date .....
PEARL BEACH ..... Interview No .....
Telephone 41 5780 ..... 02/451 2839

1. How long have you owned this property? [8] Yrs

   How long have you been a resident in this area? [ ] Yrs

2. Have there been large floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [ ] Yes [✓] No

4. Can you show us where the highest flood came to? [✓] Yes [ ] No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level?
   - Resident was here at time [✓]
   - Past house owners told resident [ ]
   - Neighbours told resident [✓]

What was the approximate year and month of this highest flood?
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[✓] Yes	[ ] No
April 1988	[✓] Yes	[ ] No
July 1988	[✓] Yes	[ ] No
October 1988	[✓] Yes	[ ] No
January 1989	[✓] Yes	[ ] No
April 1989	[✓] Yes	[ ] No
February 1990	[✓] Yes	[ ] No

Description on back of 3 photographs supplied with this interview sheet.

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [ ] Yes [ ] No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? [✓] Yes [ ] No

   7.2 A diary in which you record flood information? [ ] Yes [ ] No

   If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

THE FOLLOWING 3 DOCUMENT (S) HAS/HAVE BEEN SCANNED AT THE BEST POSSIBLE RESOLUTION.

ORIGINAL PRINT QUALITY IS POOR.

Data Imaging Solutions Corporation
43 Young Street WEST GOSFORD NSW 2250
T: (02) 43250811 F: (02) 43250814 E: ddataima@bigpond.net.au

[illegible] Garnet [illegible]

DRAINAGE GARNET H7

PB
02 31

07.01.89
[illegible]

3360.00.00
KING J E
I

7 Garnet Rd
Pearl Beach
7th January [illegible].

Dear Sir,

This is the fourth letter I have written to the Council Relating to Stormwater troubles around Garnet Rd & particularly to our property No 7 [illegible] has again Demolished our Asphalt Drive through [illegible] Easement Inspection hole (Inside our property) blown open again & thus undermining the Drive Way.

The Inspection Hole at No 12 Garnet Rd (opposite us) Blew up this time & has Done Considerably Damage also.

I think this easement empties out in the lagoon in Diamond Road, & My thought is the Easement is full of Silt at that end or is Blocked somewhere else, but a thorough Inspection of this piped Easement has to Carried out Immediately.

Referring to the Unpiped Easement at the Rear of our property, we have Complained & Rang [illegible] Depot to get Experts out here to Inspect. [illegible] [illegible] Nothing has been Done to Rectify these [illegible] problems, & the Residents of Garnet Rd & Surrounding Areas are Sick & tired of the attitude of the Gosford Council.

We have 3 Serious Areas to be Inspected & fixed up.

ENGINEERS' ACTION STAMP

REFERRED	DATE	ACTION	INIT.	COMPLETED
Mr Bunderlin [illegible]				

The Easement Drain behind our house to the piped Easement then our property is Completely Useless. Since Pearl Beach Drive has been altered the Amount of Water Coming Down has trebled & Bringing all the Road Base Down also & filling the Drain therefore the Water Runs everywhere.
With the heavy Volume of Water the sides of Easement just behind our property have been Demolished or Eaten Away So the water is not going into the Piped Easement & therefore flooding all areas Around.
The Water Knocked down a fence & has eaten into the Sewer line in the Adjacent Property to ours.
We Require Expert advise & Urgent attention & Rectification Immediately to this problem.
The stormwater Coming off Beryl Blvde which is dumped [illegible] a [illegible] Easement & this Connects with our Easement, the Water is too large & our Easement ~~[illegible]~~ pipes Cannot take this volume & also the Water from the Mountain & thats where the troubles start.
The Stormwater off Beryl Blvde should be taken Straight Down that Street & not put Into other Easements which ~~[illegible]~~ Cannot take the Volume.

3) The Drainage in CAlbert Rd is again Inadequate as in heavy Rain the water collects in the [illegible] of the Road just outside our property & was the Easement completely full the Water in the Street cannot get away & therefore Banks up & then travells into properties further Down the Street.

This causing troubles in project Easement Running across Beryl Bvd into CAlbert [illegible] the water just floods all the street & [illegible] on the lower side of CAlbert Rd.

This Water should be piped Down Beryl Bvd with the Water that Connects into our Easement. We in CAlbert Rd are collecting all the troubles from other areas especially Beryl Bvd & we consider Inspection & Installation of Piped easement in Beryl Bvd will ease the troubles in CAlbert Rd.

I'm sure you will Receive more Consideration [illegible] [illegible] inspection [illegible] [illegible] to alleviate all this water problem.

Referring to my Drive & Inspection Easement Cement Slab, I would appreciate fixing up in very near future so I can get my car into our property.

Yours faithfully

[illegible signature]

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name J. R. Wheeler ..... Interviewer .....
Address 12 GARNET ROAD ..... Date .....
Pearl Beach ..... Interview No .....
Telephone .....

1. How long have you owned this property? [8] Yrs

   How long have you been a resident in this area? [8] Yrs

2. Have there been ~~large~~ floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [ ] Yes [✓] No

4. Can you show us where the highest flood came to? [ ] Yes [ ] No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level? Resident was here at time [ ]
   Past house owners told resident [ ]
   Neighbours told resident [ ]

What was the approximate year and month of this highest flood?
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

* Garnet Road in front of our house was flooded to a depth of roughly 3½ feet. Water did not enter our property. Clogged water easements caused the overflow - it is essential for Council to check all easements regularly for blockage. The easement system needs further development to cope with water coming off the mountain in times of heavy rain

January 1988	[ ] Yes	[ ] No
April 1988	[ ] Yes	[ ] No
July 1988	[ ] Yes	[ ] No
October 1988	[ ] Yes	[ ] No
January 1989	[ ] Yes	[ ] No
April 1989	[ ] Yes	[ ] No
February 1990	[ ] Yes	[ ] No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [ ] Yes [ ] No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

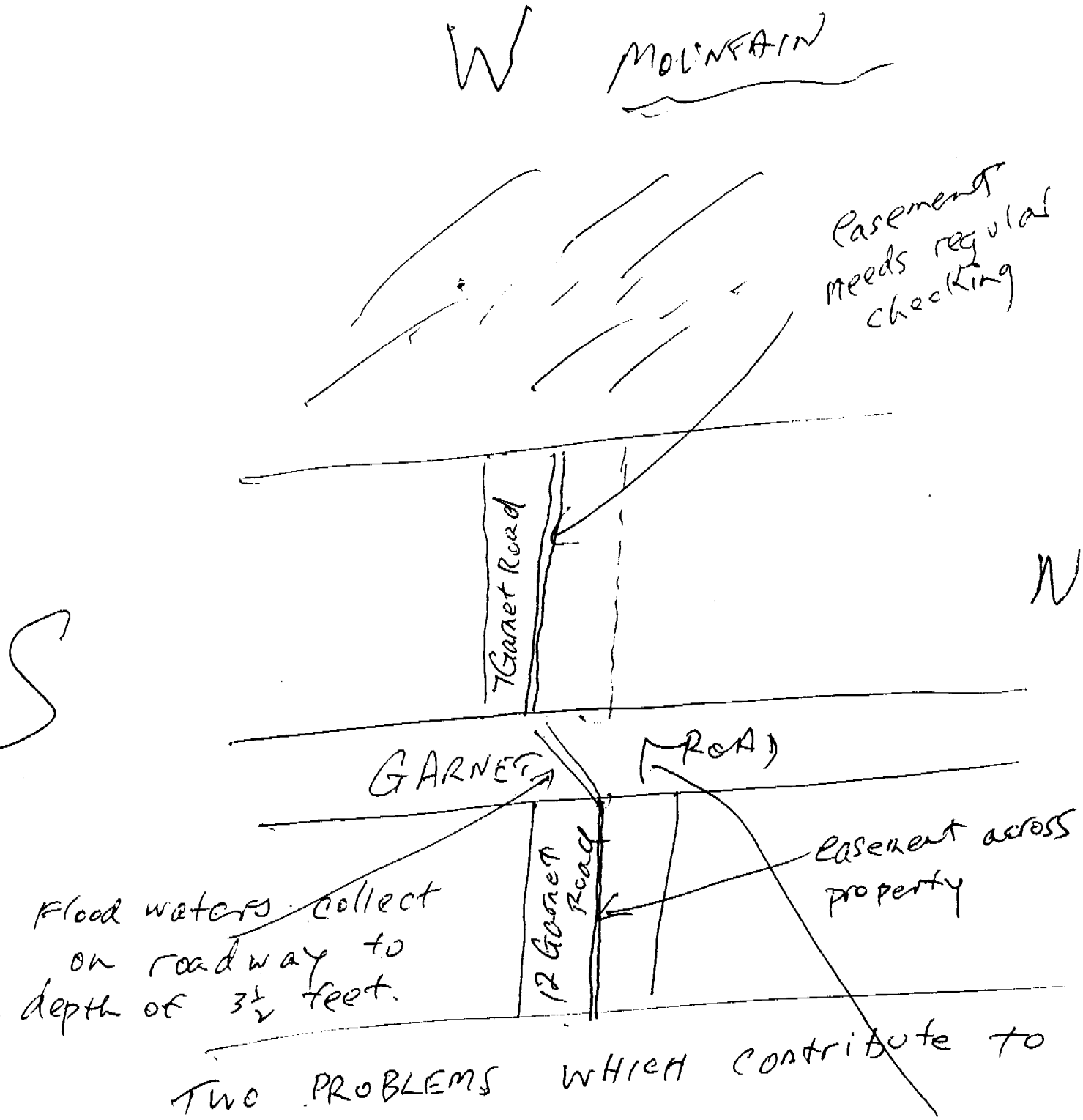
   7.1 Any photographs shown flooding? [ ] Yes [ ] No

   7.2 A diary in which you record flood information? [ ] Yes [ ] No

   If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

(over)



TWO PROBLEMS WHICH contribute to the flooding :-

(1) RUBBISH COLLECTING IN THE EASEMENT

(2) INSUFFICIENT DEVELOPMENT OF THE DRAINAGE SYSTEM IN MOUNTAIN AREA.

E

The Following 1 document(s) is/are an exact copy.

The original document(s) is/are either:

✓ - A photocopy of turned corners.
- A photocopy of over lapped pages.
- Contains dark lines/patches from photocopying.
- Damaged or unrepairable.
- Other: _____

Data Imaging Solutions Corporation
43 Young Street WEST GOSFORD NSW 2250
T: (02) 43250811 F: (02) 43250814 E: ddataima@bigpond.net.au

To be registered Les Kirwan

12 Garnet Road 12 GARNET

Pearl Beach

Friday, 6th January.

DRAINAGE GARNET RD PEARL BCH

L Kirwan
0260

The Engineer
Gosford City Council, 06-01-89
DEPOT
3360-00-00
WHEELER J R

Dear Sir

To-day's heavy rain has caused flash flooding in Garnet Road Pearl Beach. Water three foot deep, banked up across the road as the easement on our property was unable to cope with the volume of the flood. Properties at no 16 and 18 were badly affected

Whilst we (at 12 Garnet Rd) had no water entry, a soil cave-in above the easement on the N.E. extremity, caused by the volume of water, indicates that the water easement needs urgent checking for blockage.

It is clear that there is an urgent need to look at the whole problem of drainage in this part of Pearl Beach as the roadway has been under water for some time.

I would appreciate it if Council would check the easement [illegible]

Also: 2A/27 Sutherland Crescent, Darling Point 2027

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name DR. JANET McCREDIE
Address 16 GARNET ROAD
PEARL BEACH
Telephone (043) 427716

Interviewer Self
Date 3.3.92
Interview No

1. How long have you owned this property? 16 Yrs

   How long have you been a resident in this area? 16 Yrs

2. Have there been large floods in this area? ☑ Yes ☐ No

3. Did the highest flood enter the house? ☐ Yes ☑ No BUT IT ENTERED THE GARAGE

4. Can you show us where the highest flood came to? ☑ Yes ☐ No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet) FRONT DOORSTEP
   How did you know about this flood level?

	No	Yes
Resident was there at time	☐	☑
Past house owners told resident	☑	☐
Neighbours told resident	☐	☑

What was the approximate year and month of this highest flood?
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	☐ Yes	☐ No
Sat 30th April 1988	☑ Yes	☐ No
July 1988	☐ Yes	☐ No
18-25 October 1988	☑ Yes	☐ No
January 1989	☑ Yes	☐ No
April 1989	☐ Yes	☐ No
February 1990	☑ Yes	☐ No

If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? ☐ Yes ☑ No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? ☑ Yes ☐ No

   7.2 A diary in which you record flood information? ☐ Yes ☑ No

   If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? ☑ Yes ☐ No

2A/27 Sutherland Crescent,
Darling Point
N.S.W. 2027
AUSTRALIA
Telephone (02) 328 7879

3 March 1992

Attention Mr J Lawrence
Gutteridge Haskins & Davey Pty Ltd
39 Regent St
RAILWAY SQUARE 2000

Dear Sir

Thank you for your letter of January, 1992, ref: 214/024071/00, with the questionnaire which I return herewith.

Although my house has never had flood water inside it, floods have threatened to enter three times in the past three or four years, and I am anxious to help with your investigation. I have ~~included~~ some photographs of the damage to the foundations of my house. It took one tonne of road metal to fill the hole. The fences, having been knocked over three times, have been only partially re-erected as there seems little point in placing a paling fence across the route which the floods take - namely, from south-west to north-east across my land.

You will probably find that the Gosford Council has a file of letters from me and I will not repeat the contents here. However, it does seem to me that during the more than fourteen years I have had the house in Pearl Beach there has been a change in the drainage of the area. The change is compounded of about four factors:

1 ROADS Many of the streets have now been tarred. The road down the mountain into Pearl Beach has been re-tarred and re-cambered and it seems that the drainage towards the inner side of the road is collected and drained beneath the road where water spouts down the hillsides with no arrangement for its catchment.

2 POLE-HOUSE TECHNOLOGY Much of the steeply sloping land which formed the arena of Pearl Beach and was clad by thick bush and rocks when I first came there has now been stripped The absorbent bush has been replaced by concrete driveways and roofs which collectively eliminate the previous

natural absorption and provoke water slides and flash flooding to the level properties below.

3 BLOCKED STREET DRAINS Following the second flood the Council discovered that a major junction drain had been blocked by wooden planks, an ironing board and other general rubbish. This factor obviously exacerbated the street drainage problem in our area of Pearl Beach where, at the height of the rain, the street drains were disgorging water into Garnet Street instead of draining water from the street. The Council assures us that this has been rectified.

4 SEWERAGE INSTALLATION Immediately preceding the first flood, if I have the details right, the sewerage pipes were put into Pearl Beach. This caused a lot of shifting of soil and sand which was not properly settled before the flood occurred. Loose sand was evident across properties and roadways in the wake of the flood, and if one looked into the street drain pipes at that time they were half filled with sand so that the volume remaining to carry away the water was reduced by about half. The Council have probably rectified this, but it should be checked.

These four factors set the stage for local flooding when the abnormally heavy rains occurred on the three occasions.

In addition to the excavation of my foundations on all three occasions, the contents of other peoples septic tanks overflowed and was deposited on my garden. The grass, which had been in moderately good condition, died off and became infested with foreign weeds. Between two of the floods I invested in a Buffalo turf lawn. This was barely established when another flood tore up a lot of it and rolled up the strips against the back fence. By this time I was near to despair and actually thought about selling the house. However, a flood-prone property would not fetch a fair price, and I decided to keep it in the hope that measures could be taken to prevent further flooding.

I would appreciate any opinions, information or advice which your investigation provides. I would really appreciate being sent a copy of your report if that is allowed.

Yours faithfully

Janet McCredie

Janet McCredie

RESIDENTS INTERVIEW SHEET - GOSFORD

Resident's name CONWAY Interviewer .....
Address 18 GARNET ST Date .....
~~DAILY~~ PEARL BEACH Interview No .....
Telephone 42 4234

1. How long have you owned this property? [5] Yrs

   How long have you been a resident in this area? [5] Yrs

2. Have there been large floods in this area? [✓] Yes [ ] No

3. Did the highest flood enter the house? [✓] Yes [ ] No

4. Can you show us where the highest flood came to? [✓] Yes [ ] No
   (If "yes" Interviewer to complete sketch showing flood levels on supplementary sheet)
   How did you know about this flood level?
   4th January 1990

   Resident was here at time [✓]
   Past house owners told resident [ ]
   Neighbours told resident [ ]

What was the approximate year and month of this highest flood?
.....

5. We think floods may have occurred about the following dates. Do you have any recollection of these floods?

January 1988	[ ] Yes	[ ] No
April 1988	[ ] Yes	[ ] No
July 1988	[ ] Yes	[ ] No
October 1988	[ ] Yes	[ ] No
January 1989	[ ] Yes	[ ] No
April 1989	[ ] Yes	[ ] No
February 1990	[ ] Yes	[ ] No

(If "Yes", Interviewer to complete sketch showing flood levels on supplementary sheet)

6. Have you any recollections of floods, besides the dates given above? [✓] Yes [ ] No
   If "Yes" response, what was the year and month?
   .....
   (If "Yes", Interviewer to complete sketches on supplementary sheet)

7. We are also looking for additional data. Do you have ....

   7.1 Any photographs shown flooding? [ ] Yes [✓] No

   7.2 A diary in which you record flood information? [ ] Yes [✓] No
   4th January 1990

   If "Yes", can we borrow the items for a short period?

8. In the future we will need to come back to survey the flood levels indicated, May we enter your property at that time to undertake the survey? [✓] Yes [ ] No

APPENDIX B

RAINFALL INTENSITY–FREQUENCY–DURATION DATA

RAINFALL INTENSITY (mm/hr) FOR WOY WOY.

MINUTES	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
6	87	112	141	158	181	210	232
7	83	106	134	150	171	199	220
8	78	100	127	142	163	189	210
9	75	96	122	136	156	181	200
10	72	92	116	131	149	174	192
11	69	88	112	126	144	167	185
12	66	85	108	121	139	162	179
13	64	82	104	117	134	156	173
14	62	79	101	113	130	152	168
15	60	77	98	110	126	147	163
16	58	75	95	107	123	143	158
17	57	73	93	104	119	139	154
18	55	71	90	101	116	136	150
19	54	69	88	99	113	132	147
20	52	67	86	97	111	129	143
21	51	66	84	94	108	126	140
22	50	64	82	92	106	124	137
23	49	63	80	90	104	121	134
24	48	61	79	88	102	119	132
25	47	60	77	87	100	116	129
26	46	59	75	85	98	114	127
27	45	58	74	83	96	112	124
28	44	57	73	82	94	110	122
29	43	56	71	81	93	108	120
30	43	55	70	79	91	106	118
31	42	54	69	78	89	105	116
32	41	53	68	77	88	103	114
33	40	52	67	75	87	101	113
34	40	51	66	74	85	100	111
35	39	50	65	73	84	98	109
36	39	50	64	72	83	97	108
37	38	49	63	71	82	96	106
38	37	48	62	70	81	94	105
39	37	48	61	69	79	93	103
40	36	47	60	68	78	92	102
41	36	46	60	67	77	91	101
42	35	46	59	66	76	90	100
43	35	45	58	66	75	88	98
44	35	44	57	65	75	87	97
45	34	44	57	64	74	86	96
46	34	43	56	63	73	85	95
47	33	43	55	62	72	84	94
48	33	42	55	62	71	83	93
49	32	42	54	61	70	83	92
50	32	41	53	60	70	82	91
51	32	41	53	60	69	81	90
52	31	40	52	59	68	80	89
53	31	40	52	58	67	79	88
54	31	40	51	58	67	78	87
55	30	39	51	57	66	78	86
56	30	39	50	57	65	77	85
57	30	38	50	56	65	76	85
58	30	38	49	56	64	75	84
59	29	38	49	55	64	75	83
60	29	37	48	55	63	74	82

APPENDIX C

COST ESTIMATES

PEARL BEACH - DRAINAGE IMPROVEMENTS
COST ESTIMATE

PRIORITY	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
1	Stabilise channel upstream of 8/1		item		5000
1	Provide trash rack upstream of node 8/1		item		1000
1	Construct new drainage at end of Jade Pl				
	(a) Break out existing kerbing and pavement		item		2000
	(b) Supply and lay 375 dia RCPs incl. excavation and backfill	60	m	105	6300
	(c) Construct grated inlet pits	4	no	1200	4800
	(d) connect new drainage to pits 10/1 &10/2		item		1000
	(e) Relace inlets on pits 10/1 & 10/2 with 600x600 gratings		item		1000
	(f) restore road pvt and kerbing		item		5000
1	Construct new pipeline from Pearl Beach Drive to Jade Place				
	(a) Supply and lay 300 dia RCP incl. excavation and backfill	80	m	90	7200
	(b) Construct pits	2	no.	600	1200
	(c) Connect to existing drainage		item		1000
1	Construct new pipeline from Jade Place to Onyx Road				
	(a) Supply and lay 300 dia RCP incl. excavation and backfill	70	m	90	6300
	(b) Construct pits	2	no.	600	1200
	(c) Connect to existing drainage		item	1000	1000
	(d) Pavement demolition and reconstruction		item	1000	1000
	(e) Property restoration		item	1000	1000
	(f) Headwall 300 dia		item	500	500

PEARL BEACH - DRAINAGE IMPROVEMENTS
COST ESTIMATE

PRIORITY	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
2	Pipe open channel in line 2 (2/3A-2/4)				
	(a) Supply and lay 525 dia RCP incl. excavation and backfill	50	m	145	7250
	(b) Break out existing headwalls at 2/3A & 2/4		item		500
	(c) Construct grated inlet pits	2	no	820	1640
2	Povide drainage for undrained lowpoint south of node 8/1				
	(a) Supply and lay 375 dia RCP incl excavation and backfill	40	m	105	4200
	(b) 375 dia headwall	1	no	300	300
	(c) Grated inlet pit	1	no	600	1000
2	Raise outlet invert at pit 6/6 to match incoming invert level		item		1000
2	Replace pit 6/8 cover with 600x600 grating		item		500
2	Modify fence at node 6/9 to allow clear floodway		item		200

PEARL BEACH - DRAINAGE IMPROVEMENTS
COST ESTIMATE

PROIRITY	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
3	Resurface Beryl Bvd to provide 2 way 3% crossfall				
	(a) Edge profiling	800	m2	5	4000
	(b) Supply and lay AC10	300	t	125	37500
3	Provide new drainage from node 1/1 to lagoon				
	(a) Supply and lay 2400w x 450 h RCBC incl excavation, backfill and base slab	90	m	1040	93600
	(b) Special Inlet Pits	3	no	2000	6000
	(c)Outlet headwall	1	no	5000	5000
	(d) restore road etc		item		5000

PEARL BEACH - DRAINAGE IMPROVEMENTS
COST ESTIMATE

PRIORITY	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
4	Construct new pipeline from 8/1 to 6/15 (20 yr ARI capacity - 1 x 900 dia RCP)				
	(a) Supply and lay 900 dia RCP incl. excavation and backfill	300	m	300	90000
	(c) Construct pits	10	no	820	8200
	(d) Inlet & outlet headwalls		item		2000
	(e)Road demolition & reconstruction		item		10000
					110200
4	Construct new pipeline from 8/1 to 6/15 (100 yr ARI capacity - 2 x 900 dia RCP)				
	(a) Supply and lay 2*900 dia RCP incl. excavation and backfill	300	m	600	180000
	(c) Construct pits	20	no	820	16400
	(d) Inlet & outlet headwalls		item		4000
	(e)Road demolition & reconstruction		item		20000
					220400
4	Construct new drainage in Diamond St to node 6/15				
	(a) Supply and lay 600 dia RCP incl. excavation and backfill	70	m	158	11060
	(b) Construct grated inlet pits	3	no	820	2460
	(c) Headwall 600 dia	1	no	480	480
	(d) Construct 300 deep table drain		item		100
					14100
4	Construct new drainage from node 3/2 lowpoint to existing pit 6/11				
	(a) Supply and lay 600 dia RCP incl. excavation and backfill	70	m	158	11060
	(b) Construct grated inlet pit	1	no	820	820
	(c) Connection to existing pit		item		200
					12080

APPENDIX D

RatHGL MODEL RESULTS

TABLE D.1
DESIGN FLOW ESTIMATES - CATCHMENT A
Improvements = Minor Works + Beryl Boulevarde

U/S Pit	D/S Pit	No. of Conduits	Pipe Length (m)	Dia (mm)	Inlet Capacity (m3/s)	20 Year ARI (m3/s)						50 Year ARI (m3/s)						100 Year ARI (m3/s)					
						Existing Flows			Improved Flows			Existing Flows			Improved Flows			Existing Flows			Improved Flows		
						Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total
CATCHMENT A																							
1/1	1/2	1	10	375	0.42	0.04	0.94	0.98	1.85	0.00	1.85	0.04	1.18	1.22	1.85	0.57	2.42	0.04	1.36	1.40	1.85	0.98	2.83
1/2	1/3	1	25	375	0.28	0.21	0.79	1.01	1.88	0.00	1.88	0.21	1.04	1.25	1.88	0.56	2.44	0.21	1.21	1.43	1.88	0.97	2.85
1/3	1/4	1	57	375		0.25	0.00	0.25	1.88	0.00	1.88	0.25	0.00	0.25	1.88	0.00	1.88	0.26	0.00	0.26	1.88	0.00	1.88
1/4								1.02			1.88			1.26			2.44			1.43			2.85
2/1	2/2	1	15	375	0.26	0.18	0.27	0.45	0.18	0.56	0.74	0.16	0.40	0.56	0.18	0.76	0.94	0.14	0.49	0.63	0.18	0.92	1.09
2/2	2/3	1	26	450	0.48	0.48	0.00	0.48	0.21	0.00	0.21	0.60	0.00	0.60	0.22	0.00	0.22	0.64	0.04	0.68	0.22	0.00	0.22
3/1	3/2	1	9	375	0.22	0.06	1.54	1.61	0.07	0.83	0.89	0.07	2.60	2.67	0.07	1.79	1.85	0.06	3.41	3.47	0.07	2.50	2.57
3/2	2/3	1	32.5	375	0.41	0.08	1.57	1.65	0.16	0.78	0.94	0.08	2.71	2.63	0.16	1.75	1.91	0.08	3.44	3.52	0.16	2.45	2.61
2/3	2/3A	1	93	525	0.19	0.55	0.03	0.57	0.38	0.00	0.38	0.55	0.14	0.69	0.39	0.00	0.39	0.55	0.18	0.73	0.39	0.00	0.39
2/3A								0.57			0.38			0.69			0.39			0.73			0.39
2/4	2/5	1	5.5	525		0.26	0.29	0.56	0.26	0.11	0.37	0.23	0.43	0.66	0.23	0.15	0.38	0.23	0.47	0.70	0.23	0.14	0.38
2/5	2/6	1	19.5	525	0.18	0.38	2.71	3.09	0.38	0.45	0.83	0.40	4.00	4.40	0.40	0.56	0.96	0.40	4.99	5.40	0.40	0.63	1.04
5/1	2/6	1	9	375	0.24	0.10	3.18	3.28	0.10	0.49	0.59	0.10	4.92	5.02	0.10	0.66	0.76	0.10	6.17	6.27	0.10	1.76	1.86
4/1	4/2	1	11.5	375	0.29	0.18	0.31	0.49	0.18	0.87	1.05	0.18	0.43	0.61	0.18	1.20	1.38	0.18	0.52	0.70	0.18	1.43	1.61
4/2	4/3	1	11	450	0.21	0.38	0.15	0.53	0.22	0.00	0.22	0.38	0.27	0.65	0.22	0.00	0.22	0.38	0.36	0.74	0.23	0.00	0.23
4/3	4/4	1	28	450	0.12	0.50	0.04	0.54	0.23	0.00	0.23	0.50	0.17	0.67	0.24	0.00	0.24	0.50	0.26	0.76	0.25	0.00	0.25
4/4	4/5	1	16	525	0.18	0.46	0.08	0.55	0.24	0.00	0.24	0.47	0.21	0.68	0.25	0.00	0.25	0.46	0.31	0.77	0.26	0.00	0.26
4/5	4/6	1	5	525	0.3	0.37	0.11	0.48	0.26	0.00	0.26	0.37	0.11	0.48	0.27	0.00	0.27	0.37	0.12	0.49	0.28	0.00	0.28
4/6	4/7	1	37	600	0	0.37	0.11	0.48	0.26	0.00	0.26	0.37	0.11	0.48	0.27	0.00	0.27	0.37	0.12	0.49	0.28	0.00	0.28
2/6	2/7	1	37	600	0	0.46	0.00	0.46	0.46	0.00	0.46	0.46	0.02	0.48	0.48	0.00	0.48	0.46	0.02	0.48	0.48	0.00	0.48
2/7								3.56			2.30			4.39			3.72			5.84			3.90
	6/2	1	12.5	450		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
7/1	6/2	1	13	450	0.21	0.08	0.00	0.08	0.08	0.00	0.08	0.11	0.00	0.11	0.11	0.00	0.11	0.12	0.00	0.12	0.12	0.00	0.12
6/2	6/3	1	22	450		0.12	0.00	0.12	0.12	0.00	0.12	0.14	0.00	0.14	0.14	0.00	0.14	0.16	0.00	0.16	0.16	0.00	0.16
6/3	6/4	1	48	450	0.18	0.13	0.00	0.13	0.13	0.00	0.13	0.16	0.00	0.16	0.16	0.00	0.16	0.18	0.00	0.18	0.18	0.00	0.18
6/4	6/5	1	17	450		0.13	0.00	0.13	0.13	0.00	0.13	0.16	0.00	0.16	0.16	0.00	0.16	0.18	0.00	0.18	0.18	0.00	0.18
8/1	6/5	1	28.5	900	1.06	1.00	1.28	2.28	1.63	0.65	2.28	1.00	1.85	2.85	1.63	1.22	2.85	1.00	2.26	3.26	1.63	1.63	3.26
6/5	6/6	1	21	900		1.08	1.28	2.36	1.71	0.65	2.37	1.11	1.85	2.96	1.73	1.26	2.96	1.11	2.26	3.37	1.73	1.63	3.36
6/6	6/7	1	8.5	900	0.05	1.13	1.41	2.54	1.74	0.80	2.54	1.15	2.02	3.17	1.77	1.41	3.17	1.15	2.47	3.61	1.77	1.86	3.63
9/1	9/2	1	23	375	0.48	0.11	0.29	0.40	0.11	0.29	0.40	0.11	0.39	0.50	0.11	0.39	0.50	0.11	0.46	0.57	0.11	0.46	0.57
9/2	6/7	-	-	-			0.42	0.42		0.14	0.14	0.00	0.52	0.52	0.00	0.14	0.14		0.59	0.59		0.14	0.14
6/7	6/8	1	10	750	0.8	0.64	2.28	2.92	0.93	1.78	2.71	0.64	3.00	3.64	0.93	2.42	3.35	0.62	3.53	4.15	0.93	2.89	3.82
6/8	6/9	1	45.5	750	0.63	1.25	1.72	2.97	1.53	1.23	2.75	1.25	2.44	3.69	1.52	1.88	3.40	1.25	2.95	4.20	1.53	2.35	3.88
6/9	6/10	1	50	750		1.24	1.70	2.94	1.56	1.19	2.75	1.24	2.42	3.66	1.56	1.84	3.40	1.24	2.93	4.18	1.56	2.32	3.88
6/10	6/11	1	11	900	0.84	2.07	0.92	2.98	2.38	0.39	2.77	2.07	1.64	3.71	2.38	1.05	3.43	2.07	2.18	4.24	2.39	1.55	3.93
6/11	6/12	1	50	900	0.52	2.07	0.00	2.07	2.38	0.01	2.39	2.07	0.00	2.07	2.38	0.01	2.39	2.07	0.01	2.08	2.39	0.01	2.40
6/12	6/13	1	21.5	900	0.05	2.04	0.01	2.05	2.33	0.03	2.35	2.04	0.01	2.05	2.33	0.00	2.33	2.04	0.01	2.05	2.33	0.05	2.38
6/13	6/14	2	26	675	0.05	1.32	0.72	2.04	2.29	0.05	2.36	1.32	0.72	2.04	2.29	0.06	2.35	1.32	0.73	2.05	2.29	0.08	2.37
6/14	6/15	2	17	675	0.48	1.81	1.43	3.24	2.98	0.00	2.98	1.81	2.23	4.04	2.77	0.93	3.70	1.81	2.86	4.67	3.27	1.02	4.29
6/15				1.2*0.55BC				1.80			2.98			1.80			2.77			1.80			3.27

Note: Improved Flows allow for "Efficiency Improvement" Measures and Beryl Boulevarde re-surfacing and improvements to Line 1

TABLE D.2

DESIGN FLOW ESTIMATES - CATCHMENT A

Improvements = Minor Works + Beryl Boulevarde + Line 6 Augmentation (20 Yr ARI)

U/S Pit	D/S Pit	No. of Conduits	Pipe Length (m)	Dia (mm)	Inlet Capacity (m3/s)	20 Year ARI (m3/s)						50 Year ARI (m3/s)						100 Year ARI (m3/s)					
						Existing Flows			Improved Flows			Existing Flows			Improved Flows			Existing Flows			Improved Flows		
						Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total
CATCHMENT A																							
1/1	1/2	1	10	375	0.42	0.04	0.94	0.98	1.85	0.00	1.85	0.04	1.18	1.22	1.85	0.57	2.42	0.04	1.36	1.40	1.85	0.98	2.83
1/2	1/3	1	25	375	0.28	0.21	0.79	1.01	1.88	0.00	1.88	0.21	1.04	1.25	1.88	0.56	2.44	0.21	1.21	1.43	1.88	0.97	2.85
1/3	1/4	1	57	375		0.25	0.00	0.25	1.88	0.00	1.88	0.25	0.00	0.25	1.88	0.00	1.88	0.26	0.00	0.26	1.88	0.00	1.88
1/4								1.02			1.88			1.26			2.44			1.43			2.85
2/1	2/2	1	15	375	0.26	0.18	0.27	0.45	0.18	0.56	0.74	0.16	0.40	0.56	0.18	0.76	0.94	0.14	0.49	0.63	0.18	0.92	1.09
2/2	2/3	1	26	450	0.48	0.48	0.00	0.48	0.21	0.00	0.21	0.60	0.00	0.60	0.22	0.00	0.22	0.64	0.04	0.68	0.22	0.00	0.22
3/1	3/2	1	9	375	0.22	0.06	1.54	1.61	0.07	0.44	0.50	0.07	2.60	2.67	0.07	1.40	1.47	0.06	3.41	3.47	0.07	2.11	2.18
3/2	2/3	1	32.5	375	0.41	0.08	1.57	1.65	0.16	0.39	0.55	0.08	2.71	2.63	0.16	1.36	1.52	0.08	3.44	3.52	0.16	2.06	2.22
2/3	2/3A	1	93	525	0.19	0.55	0.03	0.57	0.38	0.00	0.38	0.55	0.14	0.69	0.39	0.00	0.39	0.55	0.18	0.73	0.39	0.00	0.39
2/3A								0.57			0.38			0.69			0.39			0.73			0.39
2/4	2/5	1	5.5	525		0.26	0.29	0.56	0.26	0.11	0.37	0.23	0.43	0.66	0.23	0.15	0.38	0.23	0.47	0.70	0.23	0.14	0.36
2/5	2/6	1	19.5	525	0.18	0.38	2.71	3.09	0.38	0.45	0.83	0.40	4.00	4.40	0.40	0.56	0.96	0.40	4.99	5.40	0.40	0.63	1.04
5/1	2/6	1	9	375	0.24	0.10	3.18	3.28	0.10	0.49	0.59	0.10	4.92	5.02	0.10	0.66	0.76	0.10	6.17	6.27	0.10	1.76	1.86
4/1	4/2	1	11.5	375	0.29	0.18	0.31	0.49	0.18	0.87	1.05	0.18	0.43	0.61	0.18	1.20	1.38	0.18	0.52	0.70	0.18	1.43	1.61
4/2	4/3	1	11	450	0.21	0.38	0.15	0.53	0.22	0.00	0.22	0.38	0.27	0.65	0.22	0.00	0.22	0.38	0.36	0.74	0.23	0.00	0.23
4/3	4/4	1	28	450	0.12	0.50	0.04	0.54	0.23	0.00	0.23	0.50	0.17	0.67	0.24	0.00	0.24	0.50	0.26	0.76	0.25	0.00	0.25
4/4	4/5	1	16	525	0.18	0.46	0.08	0.55	0.24	0.00	0.24	0.47	0.21	0.68	0.25	0.00	0.25	0.46	0.31	0.77	0.26	0.00	0.26
4/5	4/6	1	5	525	0.3	0.37	0.11	0.48	0.26	0.00	0.26	0.37	0.11	0.48	0.27	0.00	0.27	0.37	0.12	0.49	0.28	0.00	0.28
4/6	4/7	1	37	600	0	0.37	0.11	0.48	0.26	0.00	0.26	0.37	0.11	0.48	0.27	0.00	0.27	0.37	0.12	0.49	0.28	0.00	0.28
2/6	2/7	1	37	600	0	0.46	0.00	0.46	0.46	0.00	0.46	0.46	0.02	0.48	0.48	0.00	0.48	0.46	0.02	0.48	0.48	0.00	0.48
2/7								3.56			2.30			4.39			3.51			5.84			3.59
	6/2	1	12.5	450		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
7/1	6/2	1	13	450	0.21	0.08	0.00	0.08	0.08	0.00	0.08	0.11	0.00	0.11	0.11	0.00	0.11	0.12	0.00	0.12	0.12	0.00	0.12
6/2	6/3	1	22	450		0.12	0.00	0.12	0.12	0.00	0.12	0.14	0.00	0.14	0.14	0.00	0.14	0.16	0.00	0.16	0.16	0.00	0.16
6/3	6/4	1	48	450	0.18	0.13	0.00	0.13	0.13	0.00	0.13	0.16	0.00	0.16	0.16	0.00	0.16	0.18	0.00	0.18	0.18	0.00	0.18
6/4	6/5	1	17	450		0.13	0.00	0.13	0.13	0.00	0.13	0.16	0.00	0.16	0.16	0.00	0.16	0.18	0.00	0.18	0.18	0.00	0.18
8/1	6/5	1	28.5	900	1.06	1.00	1.28	2.28	2.28	0.00	2.28	1.00	1.85	2.85	2.28	0.57	2.85	1.00	2.26	3.26	2.28	0.98	3.26
6/5	6/6	1	21	900		1.08	1.28	2.36	2.37	0.00	2.37	1.11	1.85	2.96	2.37	0.59	2.96	1.11	2.26	3.37	2.37	0.99	3.36
6/6	6/7	1	8.5	900	0.05	1.13	1.41	2.54	2.54	0.00	2.54	1.15	2.02	3.17	2.54	0.63	3.17	1.15	2.47	3.61	2.54	1.09	3.63
9/1	9/2	1	23	375	0.48	0.11	0.29	0.40	0.11	0.29	0.40	0.11	0.39	0.50	0.11	0.39	0.50	0.11	0.46	0.57	0.11	0.46	0.57
9/2	6/7	-	-	-			0.42	0.42		0.14	0.14	0.00	0.52	0.52	0.00	0.14	0.14		0.59	0.59		0.14	0.14
6/7	6/8	1	10	750	0.8	0.64	2.28	2.92	2.71	0.00	2.71	0.64	3.00	3.64	2.71	0.64	3.35	0.62	3.53	4.15	2.71	1.11	3.82
6/8	6/9	1	45.5	750	0.63	1.25	1.72	2.97	2.75	0.00	2.75	1.25	2.44	3.69	2.75	0.65	3.40	1.25	2.95	4.20	2.75	1.13	3.88
6/9	6/10	1	50	750		1.24	1.70	2.94	2.75	0.00	2.75	1.24	2.42	3.66	2.75	0.65	3.40	1.24	2.93	4.18	2.75	1.13	3.88
6/10	6/11	1	11	900	0.84	2.07	0.92	2.98	2.77	0.00	2.77	2.07	1.64	3.71	2.77	0.66	3.43	2.07	2.18	4.24	2.77	1.16	3.93
6/11	6/12	1	50	900	0.52	2.07	0.00	2.07	2.78	0.00	2.78	2.07	0.00	2.07	2.78	0.00	2.78	2.07	0.01	2.08	2.78	0.00	2.78
6/12	6/13	1	21.5	900	0.05	2.04	0.01	2.05	2.78	0.00	2.78	2.04	0.01	2.05	2.78	0.00	2.78	2.04	0.01	2.05	2.78	0.00	2.78
6/13	6/14	2	26	675	0.05	1.32	0.72	2.04	2.78	0.00	2.78	1.32	0.72	2.04	2.78	0.00	2.78	1.32	0.73	2.05	2.78	0.00	2.78
6/14	6/15	2	17	675	0.48	1.81	1.43	3.24	2.98	0.00	2.98	1.81	2.23	4.04	3.48	0.22	3.70	1.81	2.86	4.67	3.48	0.81	4.29
6/15				1.2*0.55BC				1.80			2.96			1.80			3.48			1.80			3.48

Note: Improved Flows allow for "Efficiency Improvement" Measures and Beryl Boulevarde re-surfacing and improvements to Line 1 & Upgrading of Line 6 to 20 yr ARI capacity

TABLE D.3

DESIGN ESTIMATES - CATCHMENT A

Improvements = Minor Works + Beryl Boulevarde + Line 6 Augmentation (100 Yr ARI)

U/S Pit	D/S Pit	No. of Conduits	Pipe Length (m)	Dia (mm)	Inlet Capacity (m3/s)	20 Year ARI (m3/s)						50 Year ARI (m3/s)						100 Year ARI (m3/s)					
						Existing Flows			Improved Flows			Existing Flows			Improved Flows			Existing Flows			Improved Flows		
						Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total	Pipe	Overland	Total
CATCHMENT A																							
1/1	1/2	1	10	375	0.42	0.04	0.94	0.98	1.85	0.00	1.85	0.04	1.18	1.22	1.85	0.57	2.42	0.04	1.36	1.40	1.85	0.98	2.83
1/2	1/3	1	25	375	0.28	0.21	0.79	1.01	1.88	0.00	1.88	0.21	1.04	1.25	1.88	0.56	2.44	0.21	1.21	1.43	1.88	0.97	2.85
1/3	1/4	1	57	375		0.25	0.00	0.25	1.88	0.00	1.88	0.25	0.00	0.25	1.88	0.00	1.88	0.26	0.00	0.26	1.88	0.00	1.88
1/4								1.02			1.88			1.26			2.44			1.43			2.85
2/1	2/2	1	15	375	0.26	0.18	0.27	0.45	0.18	0.56	0.74	0.16	0.40	0.56	0.18	0.76	0.94	0.14	0.49	0.63	0.18	0.92	1.09
2/2	2/3	1	26	450	0.48	0.48	0.00	0.48	0.21	0.00	0.21	0.60	0.00	0.60	0.22	0.00	0.22	0.64	0.04	0.68	0.22	0.00	0.22
3/1	3/2	1	9	375	0.22	0.06	1.54	1.61	0.07	0.44	0.50	0.07	2.60	2.67	0.07	0.74	0.80	0.06	3.41	3.47	0.07	0.95	1.02
3/2	2/3	1	32.5	375	0.41	0.08	1.57	1.65	0.16	0.39	0.55	0.08	2.71	2.63	0.16	0.70	0.86	0.08	3.44	3.52	0.16	0.90	1.06
2/3	2/3A	1	93	525	0.19	0.55	0.03	0.57	0.38	0.00	0.38	0.55	0.14	0.69	0.39	0.00	0.39	0.55	0.18	0.73	0.39	0.00	0.39
2/3A								0.57			0.38			0.69			0.39			0.73			0.39
2/4	2/5	1	5.5	525		0.26	0.29	0.56	0.26	0.11	0.37	0.23	0.43	0.66	0.23	0.15	0.38	0.23	0.47	0.70	0.23	0.14	0.38
2/5	2/6	1	19.5	525	0.18	0.38	2.71	3.09	0.38	0.45	0.83	0.40	4.00	4.40	0.40	0.56	0.96	0.40	4.99	5.40	0.40	0.63	1.04
5/1	2/6	1	9	375	0.24	0.10	3.18	3.28	0.10	0.49	0.59	0.10	4.92	5.02	0.10	0.66	0.76	0.10	6.17	6.27	0.10	1.76	1.86
4/1	4/2	1	11.5	375	0.29	0.18	0.31	0.49	0.18	0.87	1.05	0.18	0.43	0.61	0.18	1.20	1.38	0.18	0.52	0.70	0.18	1.43	1.61
4/2	4/3	1	11	450	0.21	0.38	0.15	0.53	0.22	0.00	0.22	0.38	0.27	0.65	0.22	0.00	0.22	0.38	0.36	0.74	0.23	0.00	0.23
4/3	4/4	1	28	450	0.12	0.50	0.04	0.54	0.23	0.00	0.23	0.50	0.17	0.67	0.24	0.00	0.24	0.50	0.26	0.76	0.25	0.00	0.25
4/4	4/5	1	16	525	0.18	0.46	0.08	0.55	0.24	0.00	0.24	0.47	0.21	0.68	0.25	0.00	0.25	0.46	0.31	0.77	0.26	0.00	0.26
4/5	4/6	1	5	525	0.3	0.37	0.11	0.48	0.26	0.00	0.26	0.37	0.11	0.48	0.27	0.00	0.27	0.37	0.12	0.49	0.28	0.00	0.28
4/6	4/7	1	37	600	0	0.37	0.11	0.48	0.26	0.00	0.26	0.37	0.11	0.48	0.27	0.00	0.27	0.37	0.12	0.49	0.28	0.00	0.28
2/6	2/7	1	37	600	0	0.46	0.00	0.46	0.46	0.00	0.46	0.46	0.02	0.48	0.48	0.00	0.48	0.46	0.02	0.48	0.48	0.00	0.48
2/7								3.56			2.30			4.39			2.79			5.84			2.78
	6/2	1	12.5	450		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
7/1	6/2	1	13	450	0.21	0.08	0.00	0.08	0.08	0.00	0.08	0.11	0.00	0.11	0.11	0.00	0.11	0.12	0.00	0.12	0.12	0.00	0.12
6/2	6/3	1	22	450		0.12	0.00	0.12	0.12	0.00	0.12	0.14	0.00	0.14	0.14	0.00	0.14	0.16	0.00	0.16	0.16	0.00	0.16
6/3	6/4	1	48	450	0.18	0.13	0.00	0.13	0.13	0.00	0.13	0.16	0.00	0.16	0.16	0.00	0.16	0.18	0.00	0.18	0.18	0.00	0.18
6/4	6/5	1	17	450		0.13	0.00	0.13	0.13	0.00	0.13	0.16	0.00	0.16	0.16	0.00	0.16	0.18	0.00	0.18	0.18	0.00	0.18
8/1	6/5	1	28.5	900	1.06	1.00	1.28	2.28	2.28	0.00	2.28	1.00	1.85	2.85	2.85	0.00	2.85	1.00	2.26	3.26	3.26	0.00	3.26
6/5	6/6	1	21	900		1.08	1.28	2.36	2.37	0.00	2.37	1.11	1.85	2.96	2.96	0.00	2.96	1.11	2.26	3.37	3.36	0.00	3.36
6/6	6/7	1	8.5	900	0.05	1.13	1.41	2.54	2.54	0.00	2.54	1.15	2.02	3.17	3.17	0.00	3.17	1.15	2.47	3.61	3.63	0.00	3.63
9/1	9/2	1	23	375	0.48	0.11	0.29	0.40	0.11	0.29	0.40	0.11	0.39	0.50	0.11	0.39	0.50	0.11	0.46	0.57	0.11	0.46	0.57
9/2	6/7	-	-	-			0.42	0.42		0.14	0.14		0.52	0.52		0.14	0.14		0.59	0.59		0.14	0.14
6/7	6/8	1	10	750	0.8	0.64	2.28	2.92	2.71	0.00	2.71	0.64	3.00	3.64	0.93	2.42	3.35	0.62	3.53	4.15	3.82	0.00	3.82
6/8	6/9	1	45.5	750	0.63	1.25	1.72	2.97	2.75	0.00	2.75	1.25	2.44	3.69	1.52	1.88	3.40	1.25	2.95	4.20	3.88	0.00	3.88
6/9	6/10	1	50	750		1.24	1.70	2.94	2.75	0.00	2.75	1.24	2.42	3.66	1.56	1.84	3.40	1.24	2.93	4.18	3.88	0.00	3.88
6/10	6/11	1	11	900	0.84	2.07	0.92	2.98	2.77	0.00	2.77	2.07	1.64	3.71	3.43	0.00	3.43	2.07	2.18	4.24	3.93	0.00	3.93
6/11	6/12	1	50	900	0.52	2.07	0.00	2.07	2.78	0.00	2.78	2.07	0.00	2.07	3.43	0.00	3.43	2.07	0.01	2.08	3.93	0.00	3.93
6/12	6/13	1	21.5	900	0.05	2.04	0.01	2.05	2.78	0.00	2.78	2.04	0.01	2.05	3.43	0.00	3.43	2.04	0.01	2.05	3.93	0.00	3.93
6/13	6/14	2	26	675	0.05	1.32	0.72	2.04	2.78	0.00	2.78	1.32	0.72	2.04	3.43	0.00	3.43	1.32	0.73	2.05	3.93	0.00	3.93
6/14	6/15	2	17	675	0.48	1.81	1.43	3.24	2.98	0.00	2.98	1.81	2.23	4.04	3.70	0.00	3.70	1.81	2.86	4.67	4.29	0.00	4.29
6/15				1.2*0.55BC				1.80			2.98			1.80			3.70			1.80			4.29

Note: Improved Flows allow for "Efficiency Improvement" Measures and Beryl Boulevarde re-surfacing and improvements to Line 1 & Upgrading of Line 6 to 100 yr ARI capacity

TABLE D.4
DESIGN FLOW ESTIMATES - CATCHMENT B

U/S Pit	D/S Pit	No. of Conduits	Pipe Length (m)	Dia (mm)	Inlet Capacity (m3/s)	20 Year ARI (m3/s)						50 Year ARI (m3/s)						100 Year ARI (m3/s)					
						Existing			Improved			Existing			Improved			Existing			Improved		
						Pipe flow	Overland flow	Total	Pipe flow	Overland flow	Total	Pipe flow	Overland flow	Total	Pipe flow	Overland flow	Total	Pipe flow	Overland flow	Total	Pipe flow	Overland flow	Total
CATCHMENT B																							
10/1	10/2	1	5.5	375	0.10	0.10	0.25	0.35	0.35	0.00	0.35	0.10	0.33	0.43	0.43	0.00	0.43	0.10	0.39	0.49	0.49	0.00	0.49
10/2	10/3	1	42	375	0.10	0.20	0.18	0.38	0.38	0.00	0.38	0.20	0.27	0.47	0.47	0.00	0.47	0.20	0.34	0.54	0.54	0.00	0.54
10/3	10/4	1	46	375	0.00	0.20	0.00	0.20	0.38	0.00	0.38	0.20	0.00	0.20	0.47	0.00	0.47	0.20	0.00	0.20	0.54	0.00	0.54
10/4	10/5	1	54	375	0.10	0.19	0.17	0.36	0.38	0.17	0.54	0.19	0.21	0.40	0.47	0.21	0.68	0.19	0.23	0.42	0.54	0.23	0.76
11/1	10/5	1	22	600	0.42	0.27	0.58	0.85	0.27	0.40	0.67	0.27	0.81	1.08	0.27	0.54	0.81	0.27	0.98	1.26	0.27	0.64	0.94
12/1	10/5	1	9.5	450	0.08	0.08	0.65	0.73	0.08	0.47	0.55	0.08	0.91	0.99	0.08	0.64	0.72	0.08	1.12	1.19	0.08	0.88	0.96
10/5	10/6	1	5	600	0.00	0.44	0.00	0.44	0.44	0.00	0.44	0.44	0.00	0.44	0.47	0.00	0.47	0.44	0.00	0.44	0.54	0.00	0.54
10/6	10/7	1	98	600	0.52	0.94	0.47	1.41	0.94	0.47	1.41	0.94	0.78	1.72	0.94	0.78	1.72	0.94	0.99	1.93	0.94	0.99	1.93
10/7	10/8	1	10	600	0.14	0.87	0.59	1.47	0.87	0.59	1.47	0.87	0.92	1.79	0.87	0.92	1.79	0.87	1.15	2.03	0.87	1.15	2.03
10/8	10/9	1	45	600	0.2	0.74	0.14	0.88	0.74	0.14	0.88	0.74	0.14	0.88	0.74	0.14	0.88	0.74	0.15	0.89	0.74	0.15	0.89
10/9								0.73			0.73			0.73			0.73			0.73			0.73
13/1	13/2	1	10	450	0.47	0.26	1.26	1.52	0.26	1.26	1.52	0.26	1.80	2.06	0.26	1.80	2.06	0.26	2.18	2.43	0.26	2.18	2.43
13/2	13/3	1	59.5	525	0.15	0.41	1.32	1.72	0.41	1.32	1.72	0.41	1.85	2.26	0.41	1.85	2.26	0.41	2.23	2.64	0.41	2.23	2.64
13/3								1.67			1.67			2.19			2.19			2.59			2.59

Note: Improved Flows allow for additional inlets in Jade Place

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE AREAS IMPERV HA	CUMULATIVE AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/1												
20	.004	7.00	172.97	.009	.004	.000	6/2	.000	NONE	.01	.01	.004
100	.006	7.00	222.87	.009	.006	.000	6/2	.000	NONE	.01	.01	.006
POINT NO 7/1												
20	.082	7.00	172.97	.171	.082	.000	6/2	.000	NONE	.00	.32	.082
100	.121	7.00	222.87	.195	.120	.000	6/2	.000	NONE	.00	.32	.121
POINT NO 6/2												
20	.116	7.11	172.02	.243	.116	.000	6/3	.000	NONE	.08	.40	.030
100	.164	7.22	220.49	.267	.163	.001	6/3	.000	NONE	.08	.40	.039
POINT NO 6/3												
20	.132	7.23	170.97	.279	.133	.000	6/4	.000	NONE	.12	.44	.017
100	.182	7.58	216.63	.303	.182	.001	6/4	.000	NONE	.12	.44	.022
POINT NO 6/4												
20	.131	7.50	168.73	.279	.131	.000	6/5	.000	6/6	.12	.44	.000
100	.176	8.38	208.88	.303	.175	.000	6/5	.001	6/6	.12	.44	.000
POINT NO 8/1												
20	2.280	21.00	109.78	7.475	1.000	.000	6/5	1.280	6/6	2.50	12.30	2.280
100	3.263	21.00	142.86	8.221	1.000	.000	6/5	2.263	6/6	2.50	12.30	3.263
POINT NO 6/5												
20	1.081	21.16	109.40	7.754	1.084	.000	6/6	.000	NONE	2.62	12.74	.000
100	1.112	21.30	141.93	8.524	1.109	.003	6/6	.000	NONE	2.62	12.74	.000

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE AREAS IMPERV HA	CUMULATIVE AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/6												
20	2.541	21.33	108.98	8.394	1.132	1.410	6/7	.000	NONE	3.00	13.68	.194
100	3.614	21.51	141.31	9.208	1.151	2.463	6/7	.000	NONE	3.00	13.68	.268
POINT NO 9/1												
20	.398	11.00	145.58	.985	.110	.288	9/2	.000	NONE	.33	1.62	.398
100	.566	11.00	188.28	1.083	.110	.456	9/2	.000	NONE	.33	1.62	.566
POINT NO 9/2												
20	.422	11.13	144.90	1.048	.010	.412	6/7	.000	NONE	.40	1.69	.025
100	.591	11.38	185.73	1.146	.010	.581	6/7	.000	NONE	.40	1.69	.033
POINT NO 6/7												
20	2.922	21.40	108.81	9.667	.643	2.279	6/8	.000	NONE	3.65	15.62	.068
100	4.145	21.59	141.07	10.579	.643	3.502	6/8	.000	NONE	3.65	15.62	.088
POINT NO 6/8												
20	2.965	21.49	108.61	9.829	1.245	1.721	6/9	.000	NONE	3.83	15.80	.049
100	4.199	21.70	140.72	10.741	1.245	2.954	6/9	.000	NONE	3.83	15.80	.063
POINT NO 6/9												
20	2.941	21.87	107.72	9.829	1.243	1.698	6/10	.000	NONE	3.83	15.80	.000
100	4.175	21.97	139.93	10.741	1.243	2.932	6/10	.000	NONE	3.83	15.80	.000
POINT NO 6/10												
20	2.981	22.28	106.77	10.053	2.065	.000	6/11	.916	3/1	3.96	16.13	.066
100	4.241	22.27	139.07	10.980	2.065	.000	6/11	2.176	3/1	3.96	16.13	.092

RATHGL OUTPUT
PEARL BEACH - CATCHMENT A
20 and 100 Year ARI - Existing
File: Pearl 11.out

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/11												
20	2.072	22.34	106.63	10.084	2.065	.000	6/12	.007	3/2	4.00	16.16	.009
100	2.075	22.32	138.90	11.011	2.065	.000	6/12	.010	3/2	4.00	16.16	.012
POINT NO 6/12												
20	2.047	22.76	105.70	10.084	2.039	.007	6/13	.000	NONE	4.00	16.16	.000
100	2.054	22.58	138.17	11.011	2.046	.007	6/13	.000	NONE	4.00	16.16	.000
POINT NO 6/13												
20	2.039	22.94	105.31	10.084	1.324	.715	6/14	.000	NONE	4.00	16.16	.000
100	2.049	22.69	137.85	11.011	1.324	.725	6/14	.000	NONE	4.00	16.16	.000
POINT NO 2/1												
20	.447	11.00	145.58	1.106	.175	.272	2/2	.000	NONE	.40	1.80	.447
100	.634	11.00	188.28	1.213	.144	.490	2/2	.000	NONE	.40	1.80	.634
POINT NO 2/2												
20	.482	11.08	145.14	1.196	.481	.000	2/3	.001	3/1	.50	1.90	.036
100	.678	11.16	187.22	1.303	.642	.000	2/3	.036	3/1	.50	1.90	.047
POINT NO 3/1												
20	1.605	11.00	145.58	.877	.064	1.541	3/2	.000	NONE	.50	1.30	.354
100	3.473	11.00	188.28	.937	.064	3.409	3/2	.000	NONE	.50	1.30	.490
POINT NO 3/2												
20	1.646	11.08	145.14	.967	.080	.000	2/3	1.567	6/14	.60	1.40	.036
100	3.515	11.15	187.27	1.027	.080	.000	2/3	3.435	6/14	.60	1.40	.047

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/14												
20	3.241	23.16	104.84	10.356	1.812	.000	6/15	1.429	2/5	4.16	16.56	.079
100	4.666	22.93	137.20	11.301	1.812	.000	6/15	2.855	2/5	4.16	16.56	.111
POINT NO 6/15												
20	1.807	23.30	104.53	10.356	1.800	.000	D2	.006	5/1	4.16	16.56	.000
100	1.804	23.13	136.63	11.301	1.800	.000	D2	.004	5/1	4.16	16.56	.000
POINT NO 2/3												
20	.570	11.23	144.38	2.194	.546	.025	2/3A	.000	NONE	1.14	3.33	.014
100	.727	11.30	186.27	2.347	.546	.181	2/3A	.000	NONE	1.14	3.31	.019
POINT NO 2/3A												
20	.562	11.64	142.24	2.194	.008	.553	2/4	.000	NONE	1.14	3.33	.000
100	.718	11.63	184.14	2.348	.008	.710	2/4	.000	NONE	1.14	3.31	.000
POINT NO 2/4												
20	.551	12.22	139.45	2.194	.258	.293	2/5	.000	NONE	1.14	3.33	.000
100	.702	12.30	180.06	2.348	.234	.469	2/5	.000	NONE	1.14	3.31	.000
POINT NO 4/1												
20	.491	11.00	145.58	1.213	.181	.310	4/2	.000	NONE	.40	2.00	.491
100	.698	11.00	188.28	1.335	.181	.517	4/2	.000	NONE	.40	2.00	.698
POINT NO 4/2												
20	.525	11.13	144.91	1.303	.379	.146	4/3	.000	NONE	.50	2.10	.036

100	.742	11.12	187.49	1.425	.379	.363	4/3	.000	NONE	.50	2.10	.047

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 4/3												
20	.538	11.19	144.59	1.339	.496	.041	4/4	.000	NONE	.54	2.14	.014
100	.759	11.19	186.98	1.461	.496	.262	4/4	.000	NONE	.54	2.14	.019
POINT NO 4/4												
20	.546	11.34	143.78	1.366	.464	.000	4/5	.081	2/5	.57	2.17	.011
100	.769	11.34	186.00	1.488	.464	.000	4/5	.305	2/5	.57	2.17	.014
POINT NO 2/5												
20	3.086	11.00	145.58	3.293	.381	.000	2/6	2.705	5/1	1.88	4.88	.504
100	5.395	12.37	179.60	3.678	.404	.000	2/6	4.991	5/1	1.88	5.14	.664
POINT NO 5/1												
20	3.281	7.00	172.97	.117	.099	.000	2/6	3.182	2/7	.13	.13	.056
100	6.273	7.00	222.87	.117	.099	.000	2/6	6.174	2/7	.13	.13	.072
POINT NO 2/6												
20	.462	11.16	144.72	3.410	.463	.000	2/7	.000	NONE	2.01	5.01	.000
100	.481	12.56	178.52	3.795	.461	.020	2/7	.000	NONE	2.01	5.27	.000
POINT NO 2/7												
20	3.089	11.47	143.12	3.410	.458	2.631	D2	.000	NONE	2.01	5.01	.000
100	5.361	12.93	176.37	3.795	.455	4.905	D2	.000	NONE	2.01	5.27	.000
POINT NO D2												
20	4.290	12.90	136.31	11.125	1.789	2.500	D3	.000	NONE	6.16	16.62	.000
100	6.141	13.97	170.81	12.354	1.398	4.744	D3	.000	NONE	6.16	17.33	.000

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 4/5												
20	.480	11.48	143.09	1.411	.372	.000	4/6	.108	4/7	.62	2.22	.018
100	.485	11.47	185.19	1.533	.372	.000	4/6	.113	4/7	.62	2.22	.023
POINT NO 4/6												
20	.371	11.53	142.80	1.411	.370	.001	4/7	.000	NONE	.62	2.22	.000
100	.371	11.52	184.87	1.533	.370	.001	4/7	.000	NONE	.62	2.22	.000
POINT NO 4/7												
20	.474	11.84	141.26	1.411	.365	.109	D3	.000	NONE	.62	2.22	.000
100	.477	11.99	181.92	1.533	.365	.112	D3	.000	NONE	.62	2.22	.000
POINT NO D3												
20	4.742	12.82	136.69	12.490	2.138	2.604	D4	.000	NONE	6.78	18.76	.000
100	6.584	13.49	173.32	13.675	1.669	4.915	D4	.000	NONE	6.78	19.21	.000
POINT NO 1/1												
20	.981	11.00	145.58	2.426	.042	.939	1/2	.000	NONE	.80	4.00	.981
100	1.396	11.00	188.28	2.670	.039	1.358	1/2	.000	NONE	.80	4.00	1.396
POINT NO 1/2												
20	1.007	11.09	145.09	2.498	.214	.000	1/3	.793	1/4	.88	4.08	.029
100	1.425	11.17	187.16	2.742	.212	.000	1/3	1.213	1/4	.88	4.08	.037
POINT NO 1/3												

20	.247	11.38	143.58	2.588	.247	.001	1/4	.000	NONE	.98	4.18	.036
100	.257	11.38	185.74	2.832	.256	.001	1/4	.000	NONE	.98	4.18	.046

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 1/4												
20	1.015	11.86	141.19	2.588	.241	.774	D4	.000	NONE	.98	4.18	.000
100	1.431	11.99	181.87	2.832	.250	1.181	D4	.000	NONE	.98	4.18	.000
POINT NO D4												
20	5.735	11.94	140.78	14.664	5.735	.000	NONE	.000	NONE	7.76	22.16	.000
100	7.947	12.16	180.86	15.818	7.947	.000	NONE	.000	NONE	7.76	22.26	.000

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/1										
20	.004	7.00	172.97	.009	.004	.000	6/2	.000	NONE	.01
100	.006	7.00	222.87	.009	.006	.000	6/2	.000	NONE	.01
POINT NO 7/1										
20	.082	7.00	172.97	.171	.082	.000	6/2	.000	NONE	.32
100	.121	7.00	222.87	.195	.120	.000	6/2	.000	NONE	.32
POINT NO 6/2										
20	.116	7.11	172.02	.243	.116	.000	6/3	.000	NONE	.40
100	.164	7.22	220.49	.267	.163	.001	6/3	.000	NONE	.40
POINT NO 6/3										
20	.132	7.23	170.97	.279	.132	.000	6/4	.000	NONE	.44
100	.182	7.58	216.63	.303	.182	.001	6/4	.000	NONE	.44
POINT NO 6/4										
20	.131	7.50	168.73	.279	.131	.000	6/5	.000	6/6	.44
100	.176	8.38	208.88	.303	.175	.000	6/5	.001	6/6	.44
POINT NO 8/1										
20	2.280	21.00	109.78	7.475	1.000	.000	6/5	1.280	6/6	12.30
100	3.263	21.00	142.86	8.221	1.000	.000	6/5	2.263	6/6	12.30
POINT NO 6/5										
20	1.081	21.16	109.40	7.754	1.081	.000	6/6	.000	NONE	12.74
100	1.112	21.30	141.93	8.524	1.109	.003	6/6	.000	NONE	12.74

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/6										
20	2.541	21.33	108.98	8.394	1.132	1.410	6/7	.000	NONE	13.68
100	3.614	21.51	141.31	9.208	1.151	2.463	6/7	.000	NONE	13.68
POINT NO 9/1										
20	.398	11.00	145.58	.985	.110	.288	9/2	.000	NONE	1.62
100	.566	11.00	188.28	1.083	.110	.456	9/2	.000	NONE	1.62
POINT NO 9/2										
20	.422	11.13	144.90	1.048	.010	.412	6/7	.000	NONE	1.69

100	.591	11.38	185.73	1.146	.010	.581	6/7	.000 NONE	1.69

POINT NO 6/7

20	2.922	21.40	108.81	9.667	.643	2.279	6/8	.000 NONE	15.62
100	4.145	21.59	141.07	10.579	.643	3.502	6/8	.000 NONE	15.62

POINT NO 6/8

20	2.965	21.49	108.61	9.829	1.245	1.721	6/9	.000 NONE	15.80
100	4.199	21.70	140.72	10.741	1.245	2.954	6/9	.000 NONE	15.80

POINT NO 6/9

20	2.941	21.87	107.72	9.829	1.243	1.698	6/10	.000 NONE	15.80
100	4.175	21.97	139.93	10.741	1.243	2.932	6/10	.000 NONE	15.80

POINT NO 6/10

20	2.981	22.28	106.77	10.053	2.065	.000	6/11	.916 3/1	16.13
100	4.241	22.27	139.07	10.980	2.065	.000	6/11	2.176 3/1	16.13

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/11										
20	2.072	22.34	106.63	10.084	2.065	.000	6/12	.007	3/2	16.16
100	2.075	22.32	138.90	11.011	2.065	.000	6/12	.010	3/2	16.16
POINT NO 6/12										
20	2.047	22.76	105.70	10.084	2.039	.007	6/13	.000	NONE	16.16
100	2.054	22.58	138.17	11.011	2.046	.007	6/13	.000	NONE	16.16
POINT NO 6/13										
20	2.039	22.94	105.31	10.084	1.324	.715	6/14	.000	NONE	16.16
100	2.049	22.69	137.85	11.011	1.324	.725	6/14	.000	NONE	16.16
POINT NO 2/1										
20	.447	11.00	145.58	1.106	.175	.272	2/2	.000	NONE	1.80
100	.634	11.00	188.28	1.213	.144	.490	2/2	.000	NONE	1.80
POINT NO 2/2										
20	.482	11.08	145.14	1.196	.481	.000	2/3	.001	3/1	1.90
100	.678	11.16	187.22	1.303	.642	.000	2/3	.036	3/1	1.90
POINT NO 3/1										
20	1.605	11.00	145.58	.877	.064	1.541	3/2	.000	NONE	1.30
100	3.473	11.00	188.28	.937	.064	3.409	3/2	.000	NONE	1.30
POINT NO 3/2										
20	1.646	11.08	145.14	.967	.080	.000	2/3	1.567	6/14	1.40
100	3.515	11.15	187.27	1.027	.080	.000	2/3	3.435	6/14	1.40

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/14										
20	3.241	23.16	104.84	10.356	1.812	.000	6/15	1.429	2/5	16.56
100	4.666	22.93	137.20	11.301	1.812	.000	6/15	2.855	2/5	16.56
POINT NO 6/15										
20	1.807	23.30	104.53	10.356	1.800	.000	D2	.006	5/1	16.56
100	1.804	23.13	136.63	11.301	1.800	.000	D2	.004	5/1	16.56
POINT NO 2/3										

20	.570	11.35	143.72	2.199	.546	.024	2/3A	.000	NONE	3.34
100	.727	11.69	183.76	2.367	.546	.181	2/3A	.000	NONE	3.34

POINT NO 2/3A

20	.561	11.77	141.62	2.199	.008	.553	2/4	.000	NONE	3.34
100	.718	12.02	181.70	2.367	.008	.710	2/4	.000	NONE	3.34

POINT NO 2/4

20	.551	12.34	138.86	2.199	.258	.293	2/5	.000	NONE	3.34
100	.703	12.69	177.77	2.367	.234	.469	2/5	.000	NONE	3.34

POINT NO 4/1

20	.491	11.00	145.58	1.213	.181	.310	4/2	.000	NONE	2.00
100	.698	11.00	188.28	1.335	.181	.517	4/2	.000	NONE	2.00

POINT NO 4/2

20	.525	11.13	144.91	1.303	.379	.146	4/3	.000	NONE	2.10
100	.742	11.12	187.49	1.425	.379	.363	4/3	.000	NONE	2.10

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 4/3										
20	.538	11.19	144.59	1.339	.496	.041	4/4	.000	NONE	2.14
100	.759	11.19	186.98	1.461	.496	.262	4/4	.000	NONE	2.14
POINT NO 4/4										
20	.546	11.34	143.78	1.366	.464	.000	4/5	.081	2/5	2.17
100	.769	11.34	186.00	1.488	.464	.000	4/5	.305	2/5	2.17
POINT NO 2/5										
20	2.998	12.39	138.64	3.446	.381	.000	2/6	2.617	5/1	5.17
100	5.337	12.76	177.33	3.697	.404	.000	2/6	4.933	5/1	5.17
POINT NO 5/1										
20	3.332	7.00	172.97	.117	.099	.000	2/6	3.233	2/7	.13
100	6.279	7.00	222.87	.117	.099	.000	2/6	6.179	2/7	.13
POINT NO 2/6										
20	.458	12.55	137.89	3.563	.458	.000	2/7	.000	NONE	5.30
100	.480	12.95	176.29	3.814	.461	.019	2/7	.000	NONE	5.30
POINT NO 2/7										
20	3.004	12.86	136.50	3.563	.458	2.546	D2	.000	NONE	5.30
100	5.305	13.32	174.21	3.814	.455	4.849	D2	.000	NONE	5.30
POINT NO D2										
20	4.098	23.34	104.45	13.919	1.789	2.308	D3	.000	NONE	21.87
100	5.950	23.22	136.40	15.115	1.398	4.553	D3	.000	NONE	21.87

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 4/5										
20	.480	11.48	143.09	1.411	.372	.000	4/6	.108	4/7	2.22
100	.485	11.47	185.19	1.533	.372	.000	4/6	.113	4/7	2.22
POINT NO 4/6										
20	.371	11.53	142.80	1.411	.370	.001	4/7	.000	NONE	2.22
100	.371	11.52	184.87	1.533	.370	.001	4/7	.000	NONE	2.22
POINT NO 4/7										

20	.474	11.84	141.26	1.411	.365	.109	D3	.000	NONE	2.22
100	.477	11.99	181.92	1.533	.365	.112	D3	.000	NONE	2.22

POINT NO D3

20	4.444	23.38	104.36	15.330	2.138	2.306	D4	.000	NONE	24.09
100	6.297	23.30	136.17	16.648	1.669	4.628	D4	.000	NONE	24.09

POINT NO 1/1

20	.981	11.00	145.58	2.426	.042	.939	1/2	.000	NONE	4.00
100	1.396	11.00	188.28	2.670	.039	1.358	1/2	.000	NONE	4.00

POINT NO 1/2

20	1.007	11.09	145.09	2.498	.214	.000	1/3	.793	1/4	4.08
100	1.425	11.17	187.16	2.742	.212	.000	1/3	1.213	1/4	4.08

POINT NO 1/3

20	.247	11.38	143.58	2.588	.247	.001	1/4	.000	NONE	4.18
100	.257	11.38	185.74	2.832	.256	.001	1/4	.000	NONE	4.18

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 1/4										
20	1.015	11.86	141.19	2.588	.241	.774	D4	.000	NONE	4.18
100	1.431	11.99	181.87	2.832	.250	1.181	D4	.000	NONE	4.18
POINT NO D4										
20	5.190	23.42	104.27	17.918	5.190	.000	NONE	.000	NONE	28.27
100	7.356	23.38	135.95	19.480	7.356	.000	NONE	.000	NONE	28.27

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	6/1	7/1	6/2	6/3	6/4	8/1	6/5	6/6
DN	-	6/2	6/2	6/3	6/4	6/5	6/5	6/6	6/7
PT	-	99	99	99	99	99	99	99	99
DHGL	M	16.400	16.400	15.319	11.270	11.221	11.221	11.010	10.499
DO	M	.450	.450	.450	.450	.450	.900	.900	.900
QO	M3/S	.004	.082	.116	.133	.131	1.000	1.084	1.132
VEL	M/S	.027	.517	.731	.835	.823	1.572	1.704	1.779
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0000	.0007	.0013	.0017	.0017	.0025	.0030	.0032
LEN	M	12.50	13.00	22.00	48.00	17.00	28.50	21.00	8.50
HGLP	M	16.550	16.700	16.350	15.230	11.249	12.460	11.073	10.526
KU	-	1.70	5.00	.70	2.50	.60	2.00	1.00	3.00
KW	-	1.70	5.00	.70	2.50	.60	2.00	1.00	3.00
UHGL	M	16.550	16.768	16.369	15.319	11.270	12.712	11.221	11.010
UWSL	M	16.550	16.768	16.369	15.319	11.270	12.712	11.221	11.010
MWSL	M	18.000	16.900	16.800	15.978	12.272	12.789	12.100	11.301
IF	M3/S	.004	.082	.030	.017	.000	1.000	.000	.050
IC	M3/S	.500	.150	.100	.200	.000	1.000	.000	.050
FC	-					$	#	$	#

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	9/1	9/2	6/7	6/8	6/9	6/10	6/11	6/12
DN	-	9/2	6/7	6/8	6/9	6/10	6/11	6/12	6/13
PT	-	99	99	99	99	99	99	99	99
DHGL	M	12.390	10.499	10.256	9.390	7.488	6.868	5.705	5.218
DO	M	.375	.100	.750	.750	.750	.900	.900	.900
QO	M3/S	.110	.010	.643	1.245	1.243	2.065	2.065	2.039
VEL	M/S	.996	1.253	1.455	2.817	2.813	3.246	3.245	3.205
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0031	.0263	.0027	.0101	.0101	.0107	.0107	.0105
LEN	M	23.00	72.00	10.00	45.50	50.00	11.00	50.00	21.50

HGLP	M	14.370	12.390	10.283	9.851	8.180	7.220	6.600	5.443
KU	-	5.00	.00	2.00	1.00	3.00	.50	.50	.50
KW	-	5.00	.00	2.00	1.00	3.00	.50	.50	.50
UHGL	M	14.623	12.390	10.499	10.256	9.390	7.488	6.868	5.705
UWSL	M	14.623	12.390	10.499	10.256	9.390	7.488	6.868	5.705
MWSL	M	14.883	12.392	10.500	10.400	9.394	7.720	7.620	5.854
IF	M3/S	.110	-.100	-.494	.600	.008	.840	.009	.000
IC	M3/S	.110	.000	.800	.600	.050	.840	.500	.050
FC	-	#	@*	@*	#	*	#		

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	17	18	19	20	21	22	23	24
PN	-	6/13	2/1	2/2	3/1	3/2	6/14	6/15	2/3
DN	-	6/14	2/2	2/3	3/2	2/3	6/15	D2	2/3A
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.155	10.486	7.102	7.209	7.102	3.880	3.400	5.302
DO	M	.675	.375	.450	.375	.375	.917	2.100	.525
QO	M3/S	1.324	.175	.481	.064	.080	1.812	1.800	.546
VEL	M/S	1.849	1.584	3.025	.580	.723	1.373	.520	2.520
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0050	.0077	.0220	.0011	.0016	.0024	.0001	.0126
LEN	M	26.00	15.00	26.00	9.00	32.50	17.00	5.00	50.00
HGLP	M	4.695	10.615	10.160	7.218	7.155	4.030	3.500	6.455
KU	-	3.00	.00	.70	.00	2.00	.50	.00	2.00
KW	-	3.00	5.00	.70	5.00	2.00	.50	.00	2.00
UHGL	M	5.218	10.615	10.486	7.218	7.209	4.078	3.500	7.102
UWSL	M	5.218	11.255	10.486	7.304	7.209	4.078	3.500	7.102
MWSL	M	5.221	11.252	10.771	7.301	7.206	4.418	3.900	7.106
IF	M3/S	-.708	.175	.308	.064	.016	.500	.000	-.010
IC	M3/S	.050	.300	.500	.220	.400	.500	.000	.200
FC	-	@*	*		*	*	#	$	@*

ITEM	DIM	RESULT							
RN	-	25	26	27	28	29	30	31	32
PN	-	2/3A	2/4	4/1	4/2	4/3	4/4	2/5	5/1
DN	-	2/4	2/5	4/2	4/3	4/4	4/5	2/6	2/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.459	4.313	7.815	6.564	4.914	4.346	4.114	4.114
DO	M	.100	.525	.375	.450	.450	.525	.525	.375
QO	M3/S	.008	.258	.181	.379	.496	.464	.381	.099
VEL	M/S	1.080	1.191	1.638	2.382	3.122	2.144	1.758	.900
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0196	.0029	.0082	.0137	.0235	.0092	.0062	.0025
LEN	M	43.00	5.50	11.50	11.00	28.00	16.00	19.50	9.00
HGLP	M	5.302	4.329	7.909	6.980	5.571	4.492	4.235	4.136
KU	-	.00	1.80	.00	.50	2.00	1.80	.50	.00
KW	-	.00	1.80	5.00	.50	2.00	1.80	.50	5.00
UHGL	M	5.302	4.459	7.909	7.125	6.564	4.914	4.313	4.136
UWSL	M	5.302	4.459	8.593	7.125	6.564	4.914	4.313	4.343
MWSL	M	5.300	4.455	8.597	8.395	6.956	4.919	4.397	4.340
IF	M3/S	-.529	.249	.181	.200	.120	-.030	.170	.099
IC	M3/S	10.000	.500	.300	.200	.120	.200	.170	.200
FC	-	@*	*	*	#	#	@*	#	*

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	33	34	35	36	37	38	39	40
PN	-	2/6	2/7	D2	4/5	4/6	4/7	D3	1/1
DN	-	2/7	D2	D3	4/6	4/7	D3	D4	1/2
PT	-	99	99	99	99	99	99	99	99
DHGL	M	3.420	3.300	3.200	4.015	3.420	3.200	3.133	5.165
DO	M	.600	2.100	2.100	.525	.600	2.100	2.100	.375
QO	M3/S	.463	.458	1.789	.372	.370	.365	2.138	.042
VEL	M/S	1.639	.132	.517	1.719	1.310	.105	.617	.384
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0046	.0000	.0001	.0059	.0029	.0000	.0001	.0005
LEN	M	37.00	5.00	5.00	5.00	37.00	5.00	5.00	10.00
HGLP	M	3.840	3.400	3.300	4.044	3.840	3.400	3.200	5.170

KU	-	2.00	.00	.00	2.00	2.00	.00	.00	.00
KW	-	2.00	.00	.00	2.00	2.00	.00	.00	5.00
UHGL	M	4.114	3.400	3.300	4.346	4.015	3.400	3.200	5.170
UWSL	M	4.114	3.400	3.300	4.346	4.015	3.400	3.200	5.207
MWSL	M	4.110	3.500	3.450	4.349	4.110	3.500	3.400	5.205
IF	M3/S	.000	.000	.000	-.090	.000	.000	.000	.042
IC	M3/S	.000	.000	.000	.450	.000	.000	.000	.400
FC	-	$*	$	$	@*	$	$	$	*

ITEM	DIM	RESULT			
RN	-	41	42	43	44
PN	-	1/2	1/3	1/4	D4
DN	-	1/3	1/4	D4	D4
PT	-	99	99	99	0
DHGL	M	4.498	3.480	3.133	.000
DO	M	.375	.450	2.100	2.100
QO	M3/S	.214	.247	.241	5.735
VEL	M/S	1.935	1.551	.070	.000
KP	-	.00	.00	.00	.00
SF	M/M	.0114	.0058	.0000	.0000
LEN	M	25.00	57.00	10.00	.00
HGLP	M	4.783	4.290	3.400	.000
KU	-	2.00	1.70	.00	.00
KW	-	2.00	1.70	.00	.00
UHGL	M	5.165	4.498	3.400	3.133
UWSL	M	5.165	4.498	3.400	3.133
MWSL	M	5.170	5.070	3.500	3.133
IF	M3/S	.172	.036	.000	.000
IC	M3/S	.280	.600	.000	.000
FC	-	*		$	$*

END OF SUMMARY RETURN PERIOD 20 YEARS

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	6/1	7/1	6/2	6/3	6/4	8/1	6/5	6/6
DN	-	6/2	6/2	6/3	6/4	6/5	6/5	6/6	6/7
PT	-	99	99	99	99	99	99	99	99
DHGL	M	16.400	16.400	15.396	11.336	11.249	11.249	11.028	10.499
DO	M	.450	.450	.450	.450	.450	.900	.900	.900
QO	M3/S	.006	.120	.163	.182	.175	1.000	1.109	1.151
VEL	M/S	.035	.757	1.024	1.142	1.098	1.572	1.744	1.810
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0000	.0014	.0026	.0032	.0030	.0025	.0031	.0034
LEN	M	12.50	13.00	22.00	48.00	17.00	28.50	21.00	8.50
HGLP	M	16.550	16.700	16.350	15.230	11.299	12.460	11.094	10.527
KU	-	1.70	5.00	.70	2.50	.60	2.00	1.00	3.00
KW	-	1.70	5.00	.70	2.50	.60	2.00	1.00	3.00
UHGL	M	16.550	16.846	16.387	15.396	11.336	12.712	11.249	11.028
UWSL	M	16.550	16.846	16.387	15.396	11.336	12.712	11.249	11.028
MWSL	M	18.000	16.900	16.800	15.978	12.272	12.789	12.100	11.301
IF	M3/S	.006	.121	.039	.022	.000	1.000	.000	.050
IC	M3/S	.500	.150	.100	.200	.000	1.000	.000	.050
FC	-					$	#	$	#

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	9/1	9/2	6/7	6/8	6/9	6/10	6/11	6/12
DN	-	9/2	6/7	6/8	6/9	6/10	6/11	6/12	6/13
PT	-	99	99	99	99	99	99	99	99
DHGL	M	12.390	10.499	10.256	9.390	7.488	6.868	5.708	5.218
DO	M	.375	.100	.750	.750	.750	.900	.900	.900
QO	M3/S	.110	.010	.643	1.245	1.243	2.065	2.065	2.046
VEL	M/S	.996	1.253	1.455	2.817	2.813	3.246	3.245	3.217
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0031	.0263	.0027	.0101	.0101	.0107	.0107	.0105
LEN	M	23.00	72.00	10.00	45.50	50.00	11.00	50.00	21.50
HGLP	M	14.370	12.390	10.283	9.851	8.180	7.220	6.600	5.444
KU	-	5.00	.00	2.00	1.00	3.00	.50	.50	.50
KW	-	5.00	.00	2.00	1.00	3.00	.50	.50	.50
UHGL	M	14.623	12.390	10.499	10.256	9.390	7.488	6.868	5.708
UWSL	M	14.623	12.390	10.499	10.256	9.390	7.488	6.868	5.708
MWSL	M	14.883	12.392	10.500	10.400	9.394	7.720	7.620	5.854

IF	M3/S	.110	-.099	-.514	.600	.005	.840	.012	.000
IC	M3/S	.110	.000	.800	.600	.050	.840	.500	.050
FC	-	#	@*	@*	#	*	#		

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	17	18	19	20	21	22	23	24
PN	-	6/13	2/1	2/2	3/1	3/2	6/14	6/15	2/3
DN	-	6/14	2/2	2/3	3/2	2/3	6/15	D2	2/3A
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.155	10.741	7.102	7.209	7.102	3.880	3.400	5.298
DO	M	.675	.375	.450	.375	.375	.917	2.100	.525
QO	M3/S	1.324	.144	.642	.064	.080	1.812	1.800	.546
VEL	M/S	1.849	1.306	4.035	.580	.723	1.373	.520	2.520
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0050	.0052	.0391	.0011	.0016	.0024	.0001	.0126
LEN	M	26.00	15.00	26.00	9.00	32.50	17.00	5.00	50.00
HGLP	M	4.695	10.819	10.160	7.218	7.155	4.030	3.500	6.455
KU	-	3.00	.00	.70	.00	2.00	.50	.00	2.00
KW	-	3.00	5.00	.70	5.00	2.00	.50	.00	2.00
UHGL	M	5.218	10.819	10.741	7.218	7.209	4.078	3.500	7.102
UWSL	M	5.218	11.254	10.741	7.304	7.209	4.078	3.500	7.102
MWSL	M	5.221	11.252	10.771	7.301	7.206	4.418	3.900	7.106
IF	M3/S	-.718	.144	.500	.064	.016	.500	.000	-.162
IC	M3/S	.050	.300	.500	.220	.400	.500	.000	.200
FC	-	@*	*	#	*	*	#	$	@*

ITEM	DIM	RESULT							
RN	-	25	26	27	28	29	30	31	32
PN	-	2/3A	2/4	4/1	4/2	4/3	4/4	2/5	5/1
DN	-	2/4	2/5	4/2	4/3	4/4	4/5	2/6	2/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.455	4.335	7.815	6.564	4.914	4.346	4.111	4.111
DO	M	.100	.525	.375	.450	.450	.525	.525	.375
QO	M3/S	.008	.234	.181	.379	.496	.464	.404	.099
VEL	M/S	1.080	1.080	1.638	2.382	3.122	2.144	1.866	.900
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0196	.0024	.0082	.0137	.0235	.0092	.0070	.0025
LEN	M	43.00	5.50	11.50	11.00	28.00	16.00	19.50	9.00
HGLP	M	5.298	4.348	7.909	6.980	5.571	4.492	4.246	4.133
KU	-	.00	1.80	.00	.50	2.00	1.80	.50	.00
KW	-	.00	1.80	5.00	.50	2.00	1.80	.50	5.00
UHGL	M	5.298	4.455	7.909	7.125	6.564	4.914	4.335	4.133
UWSL	M	5.298	4.455	8.593	7.125	6.564	4.914	4.335	4.340
MWSL	M	5.300	4.455	8.597	8.395	6.956	4.919	4.397	4.340
IF	M3/S	-.531	.226	.181	.200	.120	-.030	.170	.099
IC	M3/S	10.000	.500	.300	.200	.120	.200	.170	.200
FC	-	@*	*	*	#	#	@*	#	*

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	33	34	35	36	37	38	39	40
PN	-	2/6	2/7	D2	4/5	4/6	4/7	D3	1/1
DN	-	2/7	D2	D3	4/6	4/7	D3	D4	1/2
PT	-	99	99	99	99	99	99	99	99
DHGL	M	3.420	3.300	3.200	4.015	3.420	3.200	3.133	5.172
DO	M	.600	2.100	2.100	.525	.600	2.100	2.100	.375
QO	M3/S	.461	.455	1.398	.372	.370	.365	1.669	.039
VEL	M/S	1.629	.131	.403	1.719	1.310	.105	.482	.349
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0045	.0000	.0001	.0059	.0029	.0000	.0001	.0004
LEN	M	37.00	5.00	5.00	5.00	37.00	5.00	5.00	10.00
HGLP	M	3.840	3.400	3.300	4.044	3.840	3.400	3.200	5.176
KU	-	2.00	.00	.00	2.00	2.00	.00	.00	.00
KW	-	2.00	.00	.00	2.00	2.00	.00	.00	5.00
UHGL	M	4.111	3.400	3.300	4.346	4.015	3.400	3.200	5.176
UWSL	M	4.111	3.400	3.300	4.346	4.015	3.400	3.200	5.207
MWSL	M	4.110	3.500	3.450	4.349	4.110	3.500	3.400	5.205
IF	M3/S	-.020	.000	.000	-.090	.000	.000	.000	.039

IC	M3/S	.000	.000	.000	.450	.000	.000	.000	.400
FC	-	@*	$	$	@*	$	$	$	*

ITEM	DIM	RESULT			
RN	-	41	42	43	44
PN	-	1/2	1/3	1/4	D4
DN	-	1/3	1/4	D4	D4
PT	-	99	99	99	0
DHGL	M	4.514	3.480	3.133	.000
DO	M	.375	.450	2.100	2.100
QO	M3/S	.212	.256	.250	7.947
VEL	M/S	1.922	1.610	.072	.000
KP	-	.00	.00	.00	.00
SF	M/M	.0112	.0063	.0000	.0000
LEN	M	25.00	57.00	10.00	.00
HGLP	M	4.796	4.290	3.400	.000
KU	-	2.00	1.70	.00	.00
KW	-	2.00	1.70	.00	.00
UHGL	M	5.172	4.514	3.400	3.133
UWSL	M	5.172	4.514	3.400	3.133
MWSL	M	5.170	5.070	3.500	3.133
IF	M3/S	.174	.046	.000	.000
IC	M3/S	.280	.600	.000	.000
FC	-	*		$	$*

END OF SUMMARY RETURN PERIOD 100 YEARS

ITEM	MEANING
RN	REACH NUMBER
PN	PIT NAME
DN	DOWNSTREAM PIT NAME
PT	PIT TYPE
DHGL	DOWNSTREAM TAKE-OFF HGL
DO	PIPE DIAMETER
QO	PIPE FLOW
VEL	PIPE VELOCITY
KP	INTER-NODAL LOSS COEFFICIENT
SF	PIPE FRICTION SLOPE
LEN	PIPE LENGTH
HGLP	PIT DOWNSTREAM HGL
KU	PIT PRESSURE CHANGE COEFFICIENT
KW	PIT WATER SURFACE COEFFICIENT
UHGL	PIT UPSTREAM HGL
UWSL	PIT WATER SURFACE LEVEL
MWSL	PIT WATER SURFACE LEVEL LIMIT
IF	PIT INLET FLOW
IC	PIT INLET CAPACITY
FC	REACH FAILURE (LIMIT) CODE

LIMIT CODES		
	*	HYDRAULIC LIMITING
	#	INLET LIMITING
	@	INLET SURCHARGE
	$	ZERO INLET CAPACITY

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE AREAS IMPERV HA	CUMULATIVE AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/1												
20	.004	7.00	172.97	.009	.004	.000	6/2	.000	NONE	.01	.01	.004
100	.006	7.00	222.87	.009	.006	.000	6/2	.000	NONE	.01	.01	.006
POINT NO 7/1												
20	.082	7.00	172.97	.171	.082	.000	6/2	.000	NONE	.00	.32	.082
100	.121	7.00	222.87	.195	.120	.000	6/2	.000	NONE	.00	.32	.121
POINT NO 6/2												
20	.116	7.11	172.02	.243	.116	.000	6/3	.000	9/1	.08	.40	.030
100	.164	7.22	220.49	.267	.163	.000	6/3	.001	9/1	.08	.40	.039
POINT NO 9/1												
20	.398	11.00	145.58	.985	.110	.000	9/2	.288	2/1	.33	1.62	.398
100	.567	11.00	188.28	1.083	.110	.000	9/2	.457	2/1	.33	1.62	.566
POINT NO 2/1												
20	.736	11.00	145.58	1.106	.175	.000	2/2	.561	4/1	.40	1.80	.447
100	1.091	11.00	188.28	1.213	.175	.000	2/2	.916	4/1	.40	1.80	.634
POINT NO 4/1												
20	1.051	11.00	145.58	1.213	.181	.000	4/2	.870	1/1	.40	2.00	.491
100	1.614	11.00	188.28	1.335	.181	.000	4/2	1.434	1/1	.40	2.00	.698
POINT NO 1/1												
20	1.851	11.00	145.58	2.426	.042	1.809	1/2	.000	NONE	.80	4.00	.981
100	2.830	11.00	188.28	2.670	.039	2.791	1/2	.000	NONE	.80	4.00	1.396

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE AREAS IMPERV HA	CUMULATIVE AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 1/2												
20	1.874	11.09	145.09	2.498	.214	.000	1/3	1.660	1/4	.88	4.08	.029
100	2.851	11.17	187.16	2.742	.212	.000	1/3	2.638	1/4	.88	4.08	.037
POINT NO 1/3												
20	.247	11.38	143.58	2.588	.247	.001	1/4	.000	NONE	.98	4.18	.036
100	.257	11.38	185.74	2.832	.256	.001	1/4	.000	NONE	.98	4.18	.046
POINT NO 1/4												
20	1.859	11.86	141.19	2.588	.241	1.618	D4	.000	NONE	.98	4.18	.000
100	2.815	11.99	181.87	2.832	.250	2.566	D4	.000	NONE	.98	4.18	.000
POINT NO 6/3												
20	.132	7.23	170.97	.279	.133	.000	6/4	.000	NONE	.12	.44	.017
100	.182	7.58	216.63	.303	.181	.001	6/4	.000	NONE	.12	.44	.022
POINT NO 6/4												
20	.131	7.50	168.73	.279	.131	.000	6/5	.000	6/6	.12	.44	.000
100	.175	8.38	208.88	.303	.174	.000	6/5	.001	6/6	.12	.44	.000
POINT NO 8/1												
20	2.280	21.00	109.78	7.475	1.626	.000	6/5	.653	6/6	2.50	12.30	2.280
100	3.263	21.00	142.86	8.221	1.626	.000	6/5	1.637	6/6	2.50	12.30	3.263
POINT NO 6/5												
20	1.705	21.16	109.40	7.754	1.710	.000	6/6	.000	NONE	2.62	12.74	.000
100	1.738	21.19	142.29	8.524	1.730	.008	6/6	.000	NONE	2.62	12.74	.000

RATHGL OUTPUT
PEARL BEACH - CATCHMENT A
20, 100 Year ARI - Improved (Min + Beryl)
File: Pearl 12.out

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE AREAS IMPERV HA	CUMULATIVE AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/6												
20	2.544	21.27	109.12	8.394	1.744	.800	6/7	.000	NONE	3.00	13.68	.194
100	3.629	21.32	141.89	9.208	1.770	1.859	6/7	.000	NONE	3.00	13.68	.269
POINT NO 9/2												
20	.135	11.13	144.90	1.048	.010	.125	6/7	.000	NONE	.40	1.69	.025
100	.141	11.38	185.73	1.146	.010	.131	6/7	.000	NONE	.40	1.69	.033
POINT NO 6/7												
20	2.710	21.35	108.95	9.667	.928	1.781	6/8	.000	NONE	3.65	15.62	.068
100	3.821	21.37	141.73	10.579	.928	2.892	6/8	.000	NONE	3.65	15.62	.089
POINT NO 6/8												
20	2.754	21.43	108.75	9.829	1.525	1.229	6/9	.000	NONE	3.83	15.80	.049
100	3.878	21.45	141.49	10.741	1.525	2.353	6/9	.000	NONE	3.83	15.80	.064
POINT NO 6/9												
20	2.731	21.81	107.86	9.829	1.562	1.169	6/10	.000	NONE	3.83	15.80	.000
100	3.860	21.67	140.83	10.741	1.562	2.298	6/10	.000	NONE	3.83	15.80	.000
POINT NO 6/10												
20	2.773	22.23	106.90	10.053	2.380	.000	6/11	.394	3/1	3.96	16.13	.066
100	3.934	21.90	140.13	10.980	2.387	.000	6/11	1.547	3/1	3.96	16.13	.093
POINT NO 6/11												
20	2.386	22.29	106.76	10.084	2.375	.000	6/12	.011	3/2	4.00	16.17	.009
100	2.397	21.95	139.98	11.011	2.390	.000	6/12	.007	3/2	4.00	16.17	.012

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE AREAS IMPERV HA	CUMULATIVE AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/12												
20	2.354	22.70	105.83	10.084	2.326	.029	6/13	.000	NONE	4.00	16.17	.000
100	2.378	22.17	139.33	11.011	2.326	.053	6/13	.000	NONE	4.00	16.17	.000
POINT NO 6/13												
20	2.346	22.88	105.43	10.084	2.292	.054	6/14	.000	NONE	4.00	16.17	.000
100	2.374	22.27	139.05	11.011	2.292	.082	6/14	.000	NONE	4.00	16.17	.000
POINT NO 2/2												
20	.211	11.08	145.14	1.196	.212	.000	2/3	.000	3/1	.50	1.90	.036
100	.221	11.16	187.22	1.303	.220	.000	2/3	.001	3/1	.50	1.90	.047
POINT NO 3/1												
20	.891	11.00	145.58	.877	.066	.825	3/2	.000	NONE	.50	1.30	.354
100	2.569	11.00	188.28	.937	.065	2.504	3/2	.000	NONE	.50	1.30	.490
POINT NO 3/2												
20	.939	11.08	145.14	.967	.161	.000	2/3	.778	6/14	.60	1.40	.036
100	2.612	11.15	187.27	1.027	.159	.000	2/3	2.452	6/14	.60	1.40	.047
POINT NO 6/14												
20	2.977	23.10	104.96	10.356	2.772	.205	6/15	.000	NONE	4.16	16.57	.079
100	4.294	22.41	138.66	11.301	2.772	1.522	6/15	.000	NONE	4.16	16.57	.112
POINT NO 6/15												
20	2.968	23.24	104.66	10.356	2.754	.215	D2	.000	NONE	4.16	16.57	.000

100	4.283	22.54	138.28	11.301	2.754	1.529	D2	.000	NONE	4.16	16.57	.000

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 2/3												
20	.382	11.23	144.38	2.194	.384	.000	2/3A	.000	NONE	1.14	3.33	.014
100	.393	11.48	185.09	2.365	.391	.002	2/3A	.000	NONE	1.14	3.34	.019
POINT NO 2/3A												
20	.377	11.64	142.24	2.194	.008	.368	2/4	.000	NONE	1.14	3.33	.000
100	.387	11.95	182.13	2.365	.008	.378	2/4	.000	NONE	1.14	3.34	.000
POINT NO 2/4												
20	.369	12.22	139.45	2.194	.258	.111	2/5	.000	NONE	1.14	3.33	.000
100	.378	12.62	178.17	2.365	.234	.144	2/5	.000	NONE	1.14	3.34	.000
POINT NO 4/2												
20	.216	11.13	144.91	1.303	.217	.000	4/3	.000	NONE	.50	2.10	.036
100	.227	11.12	187.49	1.425	.226	.001	4/3	.000	NONE	.50	2.10	.047
POINT NO 4/3												
20	.230	11.19	144.59	1.339	.231	.000	4/4	.000	NONE	.54	2.14	.014
100	.245	11.25	186.60	1.461	.244	.001	4/4	.000	NONE	.54	2.14	.019
POINT NO 4/4												
20	.240	11.34	143.78	1.366	.240	.000	4/5	.000	2/5	.57	2.17	.011
100	.256	11.57	184.51	1.488	.255	.000	4/5	.001	2/5	.57	2.17	.014
POINT NO 2/5												
20	.830	11.00	145.58	3.293	.381	.000	2/6	.449	5/1	1.88	4.88	.504
100	1.035	12.69	177.73	3.695	.404	.000	2/6	.631	5/1	1.88	5.17	.657

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 5/1												
20	.590	7.00	172.97	.117	.099	.000	2/6	.491	2/7	.13	.13	.056
100	.864	7.00	222.87	.117	.099	.000	2/6	.764	2/7	.13	.13	.072
POINT NO 2/6												
20	.462	11.16	144.72	3.410	.463	.000	2/7	.000	NONE	2.01	5.01	.000
100	.480	12.88	176.68	3.812	.460	.020	2/7	.000	NONE	2.01	5.30	.000
POINT NO 2/7												
20	.862	11.47	143.12	3.410	.458	.404	D2	.000	NONE	2.01	5.01	.000
100	1.073	13.25	174.59	3.812	.455	.618	D2	.000	NONE	2.01	5.30	.000
POINT NO D2												
20	3.693	12.90	136.31	11.141	3.015	.678	D3	.000	NONE	6.16	16.65	.000
100	5.114	13.38	173.93	12.336	2.582	2.532	D3	.000	NONE	6.16	17.30	.000
POINT NO 4/5												
20	.257	11.48	143.09	1.411	.257	.000	4/6	.000	4/7	.62	2.22	.018
100	.276	11.81	183.00	1.533	.275	.000	4/6	.001	4/7	.62	2.22	.023
POINT NO 4/6												
20	.256	11.53	142.80	1.411	.256	.000	4/7	.000	NONE	.62	2.22	.000
100	.274	11.88	182.56	1.533	.273	.001	4/7	.000	NONE	.62	2.22	.000
POINT NO 4/7												

20	.253	11.84	141.26	1.411	.253	.000	D3	.000	NONE	.62	2.22	.000
100	.269	12.50	178.85	1.533	.267	.003	D3	.000	NONE	.62	2.22	.000

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO D3												
20	3.931	12.82	136.69	12.505	3.237	.694	D4	.000	NONE	6.78	18.79	.000
100	5.361	13.42	173.69	13.852	2.833	2.528	D4	.000	NONE	6.78	19.50	.000
POINT NO D4												
20	5.741	11.94	140.78	14.679	5.741	.000	NONE	.000	NONE	7.76	22.19	.000
100	8.032	12.67	177.89	16.256	8.032	.000	NONE	.000	NONE	7.76	22.97	.000

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/1										
20	.004	7.00	172.97	.009	.004	.000	6/2	.000	NONE	.01
100	.006	7.00	222.87	.009	.006	.000	6/2	.000	NONE	.01
POINT NO 7/1										
20	.082	7.00	172.97	.171	.082	.000	6/2	.000	NONE	.32
100	.121	7.00	222.87	.195	.120	.000	6/2	.000	NONE	.32
POINT NO 6/2										
20	.116	7.11	172.02	.243	.116	.000	6/3	.000	9/1	.40
100	.164	7.22	220.49	.267	.163	.000	6/3	.001	9/1	.40
POINT NO 9/1										
20	.398	11.00	145.58	.985	.110	.000	9/2	.288	2/1	1.62
100	.567	11.00	188.28	1.083	.110	.000	9/2	.457	2/1	1.62
POINT NO 2/1										
20	.736	11.00	145.58	1.106	.175	.000	2/2	.561	4/1	1.80
100	1.091	11.00	188.28	1.213	.175	.000	2/2	.916	4/1	1.80
POINT NO 4/1										
20	1.051	11.00	145.58	1.213	.181	.000	4/2	.870	1/1	2.00
100	1.614	11.00	188.28	1.335	.181	.000	4/2	1.434	1/1	2.00
POINT NO 1/1										
20	1.851	11.00	145.58	2.426	.042	1.809	1/2	.000	NONE	4.00
100	2.830	11.00	188.28	2.670	.039	2.791	1/2	.000	NONE	4.00

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 1/2										
20	1.874	11.09	145.09	2.498	.214	.000	1/3	1.660	1/4	4.08
100	2.851	11.17	187.16	2.742	.212	.000	1/3	2.638	1/4	4.08
POINT NO 1/3										
20	.247	11.38	143.58	2.588	.247	.001	1/4	.000	NONE	4.18
100	.257	11.38	185.74	2.832	.256	.001	1/4	.000	NONE	4.18
POINT NO 1/4										
20	1.859	11.86	141.19	2.588	.241	1.618	D4	.000	NONE	4.18

100	2.815	11.99	181.87	2.832	.250	2.566 D4		.000 NONE	4.18

POINT NO 6/3

20	.132	7.23	170.97	.279	.132	.000 6/4		.000 NONE	.44
100	.182	7.58	216.63	.303	.181	.001 6/4		.000 NONE	.44

POINT NO 6/4

20	.131	7.50	168.73	.279	.131	.000 6/5		.000 6/6	.44
100	.175	8.38	208.88	.303	.174	.000 6/5		.001 6/6	.44

POINT NO 8/1

20	2.280	21.00	109.78	7.475	1.626	.000 6/5		.653 6/6	12.30
100	3.263	21.00	142.86	8.221	1.626	.000 6/5		1.637 6/6	12.30

POINT NO 6/5

20	1.705	21.16	109.40	7.754	1.705	.000 6/6		.000 NONE	12.74
100	1.738	21.19	142.29	8.524	1.730	.008 6/6		.000 NONE	12.74

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/6										
20	2.544	21.27	109.12	8.394	1.744	.800	6/7	.000	NONE	13.68
100	3.629	21.32	141.89	9.208	1.770	1.859	6/7	.000	NONE	13.68
POINT NO 9/2										
20	.135	11.13	144.90	1.048	.010	.125	6/7	.000	NONE	1.69
100	.141	11.38	185.73	1.146	.010	.131	6/7	.000	NONE	1.69
POINT NO 6/7										
20	2.710	21.35	108.95	9.667	.928	1.781	6/8	.000	NONE	15.62
100	3.821	21.37	141.73	10.579	.928	2.892	6/8	.000	NONE	15.62
POINT NO 6/8										
20	2.754	21.43	108.75	9.829	1.525	1.229	6/9	.000	NONE	15.80
100	3.878	21.45	141.49	10.741	1.525	2.353	6/9	.000	NONE	15.80
POINT NO 6/9										
20	2.731	21.81	107.86	9.829	1.562	1.169	6/10	.000	NONE	15.80
100	3.860	21.67	140.83	10.741	1.562	2.298	6/10	.000	NONE	15.80
POINT NO 6/10										
20	2.773	22.23	106.90	10.053	2.380	.000	6/11	.394	3/1	16.13
100	3.934	21.90	140.13	10.980	2.387	.000	6/11	1.547	3/1	16.13
POINT NO 6/11										
20	2.386	22.29	106.76	10.084	2.375	.000	6/12	.011	3/2	16.17
100	2.397	21.95	139.98	11.011	2.390	.000	6/12	.007	3/2	16.17

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/12										
20	2.354	22.70	105.83	10.084	2.326	.029	6/13	.000	NONE	16.17
100	2.378	22.17	139.33	11.011	2.326	.053	6/13	.000	NONE	16.17
POINT NO 6/13										
20	2.346	22.88	105.43	10.084	2.292	.054	6/14	.000	NONE	16.17
100	2.374	22.27	139.05	11.011	2.292	.082	6/14	.000	NONE	16.17

POINT NO 2/2

20	.211	11.08	145.14	1.196	.211	.000	2/3	.000 3/1	1.90
100	.221	11.16	187.22	1.303	.220	.000	2/3	.001 3/1	1.90

POINT NO 3/1

20	.891	11.00	145.58	.877	.066	.825	3/2	.000 NONE	1.30
100	2.569	11.00	188.28	.937	.065	2.504	3/2	.000 NONE	1.30

POINT NO 3/2

20	.939	11.08	145.14	.967	.161	.000	2/3	.778 6/14	1.40
100	2.612	11.15	187.27	1.027	.159	.000	2/3	2.452 6/14	1.40

POINT NO 6/14

20	2.977	23.10	104.96	10.356	2.772	.205	6/15	.000 NONE	16.57
100	4.294	22.41	138.66	11.301	2.772	1.522	6/15	.000 NONE	16.57

POINT NO 6/15

20	2.968	23.24	104.66	10.356	2.754	.215	D2	.000 NONE	16.57
100	4.283	22.54	138.28	11.301	2.754	1.529	D2	.000 NONE	16.57

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 2/3										
20	.383	11.35	143.72	2.199	.383	.000	2/3A	.000	NONE	3.34
100	.393	11.52	184.84	2.367	.391	.002	2/3A	.000	NONE	3.34
POINT NO 2/3A										
20	.377	11.77	141.62	2.199	.008	.369	2/4	.000	NONE	3.34
100	.387	11.99	181.89	2.367	.008	.379	2/4	.000	NONE	3.34
POINT NO 2/4										
20	.370	12.34	138.86	2.199	.258	.112	2/5	.000	NONE	3.34
100	.379	12.65	177.95	2.367	.234	.144	2/5	.000	NONE	3.34
POINT NO 4/2										
20	.216	11.13	144.91	1.303	.216	.000	4/3	.000	NONE	2.10
100	.227	11.12	187.49	1.425	.226	.001	4/3	.000	NONE	2.10
POINT NO 4/3										
20	.230	11.19	144.59	1.339	.230	.000	4/4	.000	NONE	2.14
100	.245	11.25	186.60	1.461	.244	.001	4/4	.000	NONE	2.14
POINT NO 4/4										
20	.240	11.34	143.78	1.366	.240	.000	4/5	.000	2/5	2.17
100	.256	11.57	184.51	1.488	.255	.000	4/5	.001	2/5	2.17
POINT NO 2/5										
20	.849	12.39	138.64	3.446	.381	.000	2/6	.469	5/1	5.17
100	1.035	12.73	177.51	3.697	.404	.000	2/6	.631	5/1	5.17

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 5/1										
20	.641	7.00	172.97	.117	.099	.000	2/6	.542	2/7	.13
100	.864	7.00	222.87	.117	.099	.000	2/6	.765	2/7	.13
POINT NO 2/6										
20	.458	12.55	137.89	3.563	.458	.000	2/7	.000	NONE	5.30
100	.480	12.92	176.46	3.814	.460	.020	2/7	.000	NONE	5.30
POINT NO 2/7										

20	.881	12.86	136.50	3.563	.458	.422	D2	.000	NONE	5.30
100	1.073	13.29	174.38	3.814	.455	.618	D2	.000	NONE	5.30

POINT NO D2

20	3.641	23.28	104.57	13.919	3.015	.625	D3	.000	NONE	21.87
100	5.125	22.63	138.04	15.115	2.582	2.543	D3	.000	NONE	21.87

POINT NO 4/5

20	.257	11.48	143.09	1.411	.257	.000	4/6	.000	4/7	2.22
100	.276	11.81	183.00	1.533	.275	.000	4/6	.001	4/7	2.22

POINT NO 4/6

20	.256	11.53	142.80	1.411	.256	.000	4/7	.000	NONE	2.22
100	.274	11.88	182.56	1.533	.273	.001	4/7	.000	NONE	2.22

POINT NO 4/7

20	.253	11.84	141.26	1.411	.253	.000	D3	.000	NONE	2.22
100	.269	12.50	178.85	1.533	.267	.003	D3	.000	NONE	2.22

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA

POINT NO D3

20	3.825	23.32	104.48	15.330	3.237	.588	D4	.000	NONE	24.09
100	5.324	22.71	137.81	16.648	2.833	2.491	D4	.000	NONE	24.09

POINT NO D4

20	5.196	23.37	104.39	17.918	5.196	.000	NONE	.000	NONE	28.27
100	7.444	22.79	137.57	19.480	7.444	.000	NONE	.000	NONE	28.27

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	6/1	7/1	6/2	9/1	2/1	4/1	1/1	1/2
DN	-	6/2	6/2	6/3	9/2	2/2	4/2	1/2	1/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	16.400	16.400	15.319	12.389	10.223	7.815	5.165	4.498
DO	M	.450	.450	.450	.375	.375	.375	.375	.375
QO	M3/S	.004	.082	.116	.110	.175	.181	.042	.214
VEL	M/S	.027	.517	.731	.996	1.586	1.638	.384	1.935
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0000	.0007	.0013	.0031	.0077	.0082	.0005	.0114
LEN	M	12.50	13.00	22.00	23.00	15.00	11.50	10.00	25.00
HGLP	M	16.550	16.700	16.350	14.370	10.615	7.909	5.170	4.783
KU	-	1.70	5.00	.70	5.00	.00	.00	.00	2.00
KW	-	1.70	5.00	.70	5.00	5.00	5.00	5.00	2.00
UHGL	M	16.550	16.768	16.369	14.623	10.615	7.909	5.170	5.165
UWSL	M	16.550	16.768	16.369	14.623	11.256	8.593	5.207	5.165
MWSL	M	18.000	16.900	16.800	14.883	11.252	8.597	5.205	5.170
IF	M3/S	.004	.082	.030	.110	.175	.181	.042	.172
IC	M3/S	.500	.150	.100	.110	.300	.300	.400	.280
FC	-				#	*	*	*	*

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	1/3	1/4	6/3	6/4	8/1	6/5	6/6	9/2
DN	-	1/4	D4	6/4	6/5	6/5	6/6	6/7	6/7
PT	-	99	99	99	99	99	99	99	99
DHGL	M	3.480	3.133	11.398	11.348	11.348	10.752	10.495	10.495
DO	M	.450	2.100	.450	.450	.900	.900	.900	.100
QO	M3/S	.247	.241	.133	.131	1.626	1.710	1.744	.010
VEL	M/S	1.551	.070	.835	.823	2.556	2.689	2.742	1.254
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0058	.0000	.0017	.0017	.0067	.0074	.0077	.0263
LEN	M	57.00	10.00	48.00	17.00	28.50	21.00	8.50	72.00

HGLP	M	4.290	3.400	15.230	11.377	12.460	10.980	10.560	12.389
KU	-	1.70	.00	2.50	.60	1.00	1.00	.50	.00
KW	-	1.70	.00	2.50	.60	1.00	1.00	.50	.00
UHGL	M	4.498	3.400	15.319	11.398	12.793	11.348	10.752	12.389
UWSL	M	4.498	3.400	15.319	11.398	12.793	11.348	10.752	12.389
MWSL	M	5.070	3.500	15.978	12.272	12.789	12.100	11.301	12.392
IF	M3/S	.036	.000	.017	.000	1.626	.000	.050	-.100
IC	M3/S	.600	.000	.200	.000	10.000	.000	.050	.000
FC	-		$		$	*	$	#	@*

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	17	18	19	20	21	22	23	24
PN	-	6/7	6/8	6/9	6/10	6/11	6/12	6/13	2/2
DN	-	6/8	6/9	6/10	6/11	6/12	6/13	6/14	2/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	9.988	8.691	7.577	6.955	5.850	5.218	4.155	6.775
DO	M	.750	.750	.750	.900	.900	.900	.675	.450
QO	M3/S	.928	1.525	1.562	2.380	2.375	2.326	2.292	.212
VEL	M/S	2.101	3.451	3.535	3.741	3.734	3.656	3.202	1.332
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0057	.0152	.0159	.0142	.0142	.0136	.0149	.0043
LEN	M	10.00	45.50	50.00	11.00	50.00	21.50	26.00	26.00
HGLP	M	10.045	9.381	8.373	7.220	6.600	5.510	4.695	10.160
KU	-	2.00	1.00	.50	.50	.50	.50	1.00	.70
KW	-	2.00	1.00	.50	.50	.50	.50	1.00	.70
UHGL	M	10.495	9.988	8.691	7.577	6.955	5.850	5.218	10.223
UWSL	M	10.495	9.988	8.691	7.577	6.955	5.850	5.218	10.223
MWSL	M	10.500	10.400	9.394	7.720	7.620	5.854	5.221	10.771
IF	M3/S	-.821	.600	.050	.840	.009	-.029	-.025	.036
IC	M3/S	.800	.600	.050	.840	.500	.050	.050	.500
FC	-	@*	#	#	#		@*	@*	

ITEM	DIM	RESULT							
RN	-	25	26	27	28	29	30	31	32
PN	-	3/1	3/2	6/14	6/15	2/3	2/3A	2/4	4/2
DN	-	3/2	2/3	6/15	D2	2/3A	2/4	2/5	4/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	7.203	6.775	3.880	3.400	5.302	4.459	4.313	5.760
DO	M	.375	.375	.917	2.100	.525	.100	.525	.450
QO	M3/S	.066	.161	2.772	2.754	.384	.008	.258	.217
VEL	M/S	.596	1.458	2.100	.795	1.773	1.080	1.191	1.365
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0011	.0065	.0056	.0002	.0063	.0196	.0029	.0045
LEN	M	9.00	32.50	17.00	5.00	50.00	43.00	5.50	11.00
HGLP	M	7.213	6.987	4.030	3.500	6.455	5.302	4.329	6.980
KU	-	.00	2.00	.50	.00	2.00	.00	1.80	.50
KW	-	5.00	2.00	.50	.00	2.00	.00	1.80	.50
UHGL	M	7.213	7.203	4.142	3.500	6.775	5.302	4.459	7.027
UWSL	M	7.304	7.203	4.142	3.500	6.775	5.302	4.459	7.027
MWSL	M	7.301	7.206	4.418	3.900	7.106	5.300	4.455	8.395
IF	M3/S	.066	.095	.500	.000	.014	-.368	.249	.036
IC	M3/S	.220	.400	.500	.000	.200	10.000	.500	.200
FC	-	*	*	#	$		@*	*	

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	33	34	35	36	37	38	39	40
PN	-	4/3	4/4	2/5	5/1	2/6	2/7	D2	4/5
DN	-	4/4	4/5	2/6	2/6	2/7	D2	D3	4/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.288	4.082	4.114	4.114	3.420	3.300	3.200	3.924
DO	M	.450	.525	.525	.375	.600	2.100	2.100	.525
QO	M3/S	.231	.240	.381	.099	.463	.458	3.015	.257
VEL	M/S	1.453	1.111	1.758	.900	1.639	.132	.871	1.187
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0051	.0025	.0062	.0025	.0046	.0000	.0003	.0028
LEN	M	28.00	16.00	19.50	9.00	37.00	5.00	5.00	5.00
HGLP	M	5.390	4.175	4.235	4.136	3.840	3.400	3.300	3.938

KU	-	2.00	1.80	.50	.00	2.00	.00	.00	2.00
KW	-	2.00	1.80	.50	5.00	2.00	.00	.00	2.00
UHGL	M	5.605	4.288	4.313	4.136	4.114	3.400	3.300	4.082
UWSL	M	5.605	4.288	4.313	4.343	4.114	3.400	3.300	4.082
MWSL	M	6.956	4.919	4.397	4.340	4.110	3.500	3.450	4.349
IF	M3/S	.014	.011	.170	.099	.000	.000	.000	.018
IC	M3/S	.120	.200	.170	.200	.000	.000	.000	.450
FC	-			#	*	$*	$	$	

ITEM	DIM	RESULT			
RN	-	41	42	43	44
PN	-	4/6	4/7	D3	D4
DN	-	4/7	D3	D4	D4
PT	-	99	99	99	0
DHGL	M	3.420	3.200	3.133	.000
DO	M	.600	2.100	2.100	2.100
QO	M3/S	.256	.253	3.237	5.741
VEL	M/S	.907	.073	.934	.000
KP	-	.00	.00	.00	.00
SF	M/M	.0014	.0000	.0003	.0000
LEN	M	37.00	5.00	5.00	.00
HGLP	M	3.840	3.400	3.200	.000
KU	-	2.00	.00	.00	.00
KW	-	2.00	.00	.00	.00
UHGL	M	3.924	3.400	3.200	3.133
UWSL	M	3.924	3.400	3.200	3.133
MWSL	M	4.110	3.500	3.400	3.133
IF	M3/S	.000	.000	.000	.000
IC	M3/S	.000	.000	.000	.000
FC	-	$	$	$	$*

END OF SUMMARY RETURN PERIOD 20 YEARS

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	6/1	7/1	6/2	9/1	2/1	4/1	1/1	1/2
DN	-	6/2	6/2	6/3	9/2	2/2	4/2	1/2	1/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	16.400	16.400	15.395	12.391	10.229	7.815	5.172	4.514
DO	M	.450	.450	.450	.375	.375	.375	.375	.375
QO	M3/S	.006	.120	.163	.110	.175	.181	.039	.212
VEL	M/S	.035	.757	1.024	.996	1.586	1.638	.349	1.922
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0000	.0014	.0026	.0031	.0077	.0082	.0004	.0112
LEN	M	12.50	13.00	22.00	23.00	15.00	11.50	10.00	25.00
HGLP	M	16.550	16.700	16.350	14.370	10.615	7.909	5.176	4.796
KU	-	1.70	5.00	.70	5.00	.00	.00	.00	2.00
KW	-	1.70	5.00	.70	5.00	5.00	5.00	5.00	2.00
UHGL	M	16.550	16.846	16.387	14.623	10.615	7.909	5.176	5.172
UWSL	M	16.550	16.846	16.387	14.623	11.256	8.593	5.207	5.172
MWSL	M	18.000	16.900	16.800	14.883	11.252	8.597	5.205	5.170
IF	M3/S	.006	.121	.039	.110	.175	.181	.039	.174
IC	M3/S	.500	.150	.100	.110	.300	.300	.400	.280
FC	-				#	*	*	*	*

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	1/3	1/4	6/3	6/4	8/1	6/5	6/6	9/2
DN	-	1/4	D4	6/4	6/5	6/5	6/6	6/7	6/7
PT	-	99	99	99	99	99	99	99	99
DHGL	M	3.480	3.133	11.443	11.357	11.357	10.762	10.497	10.497
DO	M	.450	2.100	.450	.450	.900	.900	.900	.100
QO	M3/S	.256	.250	.181	.174	1.626	1.730	1.770	.010
VEL	M/S	1.610	.072	1.139	1.094	2.556	2.719	2.782	1.254
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0063	.0000	.0032	.0029	.0067	.0075	.0079	.0263
LEN	M	57.00	10.00	48.00	17.00	28.50	21.00	8.50	72.00
HGLP	M	4.290	3.400	15.230	11.407	12.460	10.980	10.564	12.391
KU	-	1.70	.00	2.50	.60	1.00	1.00	.50	.00
KW	-	1.70	.00	2.50	.60	1.00	1.00	.50	.00
UHGL	M	4.514	3.400	15.395	11.443	12.793	11.357	10.762	12.391
UWSL	M	4.514	3.400	15.395	11.443	12.793	11.357	10.762	12.391
MWSL	M	5.070	3.500	15.978	12.272	12.789	12.100	11.301	12.392

IF	M3/S	.046	.000	.022	.000	1.626	.000	.050	-.099
IC	M3/S	.600	.000	.200	.000	10.000	.000	.050	.000
FC	-		$		$	*	$	#	@*

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	17	18	19	20	21	22	23	24
PN	-	6/7	6/8	6/9	6/10	6/11	6/12	6/13	2/2
DN	-	6/8	6/9	6/10	6/11	6/12	6/13	6/14	2/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	9.990	8.693	7.579	6.960	5.850	5.218	4.155	6.788
DO	M	.750	.750	.750	.900	.900	.900	.675	.450
QO	M3/S	.928	1.525	1.562	2.387	2.390	2.326	2.292	.220
VEL	M/S	2.101	3.451	3.535	3.752	3.756	3.656	3.202	1.386
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0057	.0152	.0159	.0143	.0143	.0136	.0149	.0047
LEN	M	10.00	45.50	50.00	11.00	50.00	21.50	26.00	26.00
HGLP	M	10.047	9.384	8.375	7.220	6.600	5.510	4.695	10.160
KU	-	2.00	1.00	.50	.50	.50	.50	1.00	.70
KW	-	2.00	1.00	.50	.50	.50	.50	1.00	.70
UHGL	M	10.497	9.990	8.693	7.579	6.960	5.850	5.218	10.229
UWSL	M	10.497	9.990	8.693	7.579	6.960	5.850	5.218	10.229
MWSL	M	10.500	10.400	9.394	7.720	7.620	5.854	5.221	10.771
IF	M3/S	-.847	.600	.050	.840	.012	-.053	-.029	.047
IC	M3/S	.800	.600	.050	.840	.500	.050	.050	.500
FC	-	@*	#	#	#		@*	@*	

ITEM	DIM	RESULT							
RN	-	25	26	27	28	29	30	31	32
PN	-	3/1	3/2	6/14	6/15	2/3	2/3A	2/4	4/2
DN	-	3/2	2/3	6/15	D2	2/3A	2/4	2/5	4/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	7.208	6.788	3.880	3.400	5.298	4.455	4.335	5.760
DO	M	.375	.375	.917	2.100	.525	.100	.525	.450
QO	M3/S	.065	.159	2.772	2.754	.391	.008	.234	.226
VEL	M/S	.586	1.443	2.100	.795	1.808	1.080	1.083	1.424
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0011	.0064	.0056	.0002	.0065	.0196	.0024	.0049
LEN	M	9.00	32.50	17.00	5.00	50.00	43.00	5.50	11.00
HGLP	M	7.217	6.995	4.030	3.500	6.455	5.298	4.348	6.980
KU	-	.00	2.00	.50	.00	2.00	.00	1.80	.50
KW	-	5.00	2.00	.50	.00	2.00	.00	1.80	.50
UHGL	M	7.217	7.208	4.142	3.500	6.788	5.298	4.455	7.032
UWSL	M	7.305	7.208	4.142	3.500	6.788	5.298	4.455	7.032
MWSL	M	7.301	7.206	4.418	3.900	7.106	5.300	4.455	8.395
IF	M3/S	.065	.095	.500	.000	.019	-.377	.226	.047
IC	M3/S	.220	.400	.500	.000	.200	10.000	.500	.200
FC	-	*	*	#	$		@*	*	

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	33	34	35	36	37	38	39	40
PN	-	4/3	4/4	2/5	5/1	2/6	2/7	D2	4/5
DN	-	4/4	4/5	2/6	2/6	2/7	D2	D3	4/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.302	4.115	4.110	4.110	3.420	3.300	3.200	3.935
DO	M	.450	.525	.525	.375	.600	2.100	2.100	.525
QO	M3/S	.244	.255	.404	.099	.460	.455	2.582	.275
VEL	M/S	1.533	1.177	1.866	.900	1.628	.131	.746	1.268
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0057	.0028	.0070	.0025	.0045	.0000	.0002	.0032
LEN	M	28.00	16.00	19.50	9.00	37.00	5.00	5.00	5.00
HGLP	M	5.390	4.175	4.246	4.133	3.840	3.400	3.300	3.951
KU	-	2.00	1.80	.50	.00	2.00	.00	.00	2.00
KW	-	2.00	1.80	.50	5.00	2.00	.00	.00	2.00
UHGL	M	5.629	4.302	4.335	4.133	4.110	3.400	3.300	4.115
UWSL	M	5.629	4.302	4.335	4.339	4.110	3.400	3.300	4.115
MWSL	M	6.956	4.919	4.397	4.340	4.110	3.500	3.450	4.349
IF	M3/S	.019	.015	.170	.099	-.020	.000	.000	.023

IC	M3/S	.120	.200	.170	.200	.000	.000	.000	.450
FC	-			#	*	@*	$	$	

ITEM	DIM	RESULT			
RN	-	41	42	43	44
PN	-	4/6	4/7	D3	D4
DN	-	4/7	D3	D4	D4
PT	-	99	99	99	0
DHGL	M	3.420	3.200	3.133	.000
DO	M	.600	2.100	2.100	2.100
QO	M3/S	.273	.267	2.833	8.032
VEL	M/S	.965	.077	.818	.000
KP	-	.00	.00	.00	.00
SF	M/M	.0016	.0000	.0002	.0000
LEN	M	37.00	5.00	5.00	.00
HGLP	M	3.840	3.400	3.200	.000
KU	-	2.00	.00	.00	.00
KW	-	2.00	.00	.00	.00
UHGL	M	3.935	3.400	3.200	3.133
UWSL	M	3.935	3.400	3.200	3.133
MWSL	M	4.110	3.500	3.400	3.133
IF	M3/S	.000	.000	.000	.000
IC	M3/S	.000	.000	.000	.000
FC	-	$	$	$	$*

END OF SUMMARY RETURN PERIOD 100 YEARS

ITEM	MEANING
RN	REACH NUMBER
PN	PIT NAME
DN	DOWNSTREAM PIT NAME
PT	PIT TYPE
DHGL	DOWNSTREAM TAKE-OFF HGL
DO	PIPE DIAMETER
QO	PIPE FLOW
VEL	PIPE VELOCITY
KP	INTER-NODAL LOSS COEFFICIENT
SF	PIPE FRICTION SLOPE
LEN	PIPE LENGTH
HGLP	PIT DOWNSTREAM HGL
KU	PIT PRESSURE CHANGE COEFFICIENT
KW	PIT WATER SURFACE COEFFICIENT
UHGL	PIT UPSTREAM HGL
UWSL	PIT WATER SURFACE LEVEL
MWSL	PIT WATER SURFACE LEVEL LIMIT
IF	PIT INLET FLOW
IC	PIT INLET CAPACITY
FC	REACH FAILURE (LIMIT) CODE

LIMIT CODES		
	*	HYDRAULIC LIMITING
	#	INLET LIMITING
	@	INLET SURCHARGE
	$	ZERO INLET CAPACITY

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 10/1												
20	.346	11.00	145.58	.856	.100	.246	10/2	.000	NONE	.30	1.40	.346
100	.492	11.00	188.28	.940	.100	.392	10/2	.000	NONE	.30	1.40	.492
POINT NO 10/2												
20	.382	11.05	145.34	.946	.200	.000	10/2a	.182	11/1	.40	1.50	.036
100	.537	11.09	187.66	1.030	.200	.000	10/2a	.337	11/1	.40	1.50	.047
POINT NO 11/1												
20	.848	11.00	145.58	1.646	.272	.000	10/5	.577	12/1	1.00	2.40	.666
100	1.255	11.00	188.28	1.753	.272	.000	10/5	.983	12/1	1.00	2.40	.917
POINT NO 12/1												
20	.728	11.00	145.58	.374	.076	.651	10/6	.000	NONE	.22	.55	.151
100	1.192	11.00	188.28	.399	.076	1.116	10/6	.000	NONE	.22	.55	.209
POINT NO 10/2a												
20	.199	11.16	144.75	.946	.200	.000	10/3	.000	NONE	.40	1.50	.000
100	.199	11.28	186.44	1.030	.199	.000	10/3	.000	NONE	.40	1.50	.000
POINT NO 10/3												
20	.198	11.28	144.11	.946	.199	.000	10/4	.000	NONE	.40	1.50	.000
100	.197	11.48	185.12	1.030	.198	.000	10/4	.000	NONE	.40	1.50	.000
POINT NO 10/4												
20	.360	11.53	142.80	1.358	.187	.000	10/5	.173	10/6	.65	2.10	.163
100	.417	11.90	182.43	1.469	.187	.000	10/5	.229	10/6	.65	2.10	.222

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 10/5												
20	.441	11.18	144.61	2.959	.443	.000	10/6	.000	NONE	1.65	4.42	.000
100	.423	11.37	185.84	3.153	.424	.000	10/6	.000	NONE	1.65	4.39	.000
POINT NO 10/6												
20	1.411	11.26	144.21	3.522	.939	.473	10/7	.000	NONE	2.08	5.18	.076
100	1.928	11.42	185.50	3.741	.939	.989	10/7	.000	NONE	2.08	5.15	.097
POINT NO 10/7												
20	1.465	12.08	140.12	3.764	.871	.000	10/8	.594	13/1	2.23	5.53	.094
100	2.025	11.91	182.38	3.998	.871	.000	10/8	1.154	13/1	2.23	5.50	.130
POINT NO 13/1												
20	1.524	12.00	140.49	2.380	.258	1.266	13/2	.000	NONE	1.40	3.50	.929
100	2.433	12.00	181.84	2.540	.258	2.175	13/2	.000	NONE	1.40	3.50	1.283
POINT NO 10/8												
20	.882	12.18	139.61	3.800	.739	.000	10/9	.143	13/2	2.27	5.57	.014
100	.886	12.02	181.72	4.034	.739	.000	10/9	.147	13/2	2.27	5.54	.018
POINT NO 13/2												
20	1.721	12.06	140.22	2.524	.407	1.314	13/3	.000	NONE	1.56	3.66	.056
100	2.639	12.17	180.83	2.684	.407	2.232	13/3	.000	NONE	1.56	3.66	.072
POINT NO 13/3												
20	1.665	13.05	135.67	2.524	.392	1.274	D1	.000	NONE	1.56	3.66	.000
100	2.594	12.69	177.72	2.684	.399	2.195	D1	.000	NONE	1.56	3.66	.000

RATHGL OUTPUT
PEARL BEACH - CATCHMENT B
20 and 100 Year ARI - Existing
File: Pearl 2.out

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 10/9												
20	.729	12.56	137.86	3.800	.727	.002	D1	.000	NONE	2.27	5.57	.000
100	.732	12.31	179.99	4.034	.729	.002	D1	.000	NONE	2.27	5.54	.000
POINT NO D1												
20	2.398	12.60	137.67	6.271	2.398	.000	NONE	.000	NONE	3.83	9.13	.000
100	3.324	12.39	179.49	6.668	3.324	.000	NONE	.000	NONE	3.83	9.12	.000

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 10/1										
20	.346	11.00	145.58	.856	.100	.246	10/2	.000	NONE	1.40
100	.492	11.00	188.28	.940	.100	.392	10/2	.000	NONE	1.40
POINT NO 10/2										
20	.382	11.05	145.34	.946	.200	.000	10/2a	.182	11/1	1.50
100	.537	11.09	187.66	1.030	.200	.000	10/2a	.337	11/1	1.50
POINT NO 11/1										
20	.848	11.00	145.58	1.646	.272	.000	10/5	.577	12/1	2.40
100	1.255	11.00	188.28	1.753	.272	.000	10/5	.983	12/1	2.40
POINT NO 12/1										
20	.728	11.00	145.58	.374	.076	.651	10/6	.000	NONE	.55
100	1.192	11.00	188.28	.399	.076	1.116	10/6	.000	NONE	.55
POINT NO 10/2a										
20	.199	11.16	144.75	.946	.199	.000	10/3	.000	NONE	1.50
100	.199	11.28	186.44	1.030	.199	.000	10/3	.000	NONE	1.50
POINT NO 10/3										
20	.198	11.28	144.11	.946	.198	.000	10/4	.000	NONE	1.50
100	.197	11.48	185.12	1.030	.197	.000	10/4	.000	NONE	1.50
POINT NO 10/4										
20	.360	11.53	142.80	1.358	.187	.000	10/5	.173	10/6	2.10
100	.417	11.90	182.43	1.469	.187	.000	10/5	.229	10/6	2.10

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 10/5										
20	.447	11.95	140.73	3.005	.443	.000	10/6	.004	NONE	4.50
100	.443	12.39	179.47	3.222	.424	.000	10/6	.019	NONE	4.50
POINT NO 10/6										
20	1.391	12.03	140.36	3.567	.939	.452	10/7	.000	NONE	5.26
100	1.896	12.45	179.15	3.810	.939	.957	10/7	.000	NONE	5.26
POINT NO 10/7										
20	1.445	12.84	136.57	3.809	.871	.000	10/8	.574	13/1	5.61
100	1.992	12.94	176.33	4.067	.871	.000	10/8	1.121	13/1	5.61

POINT NO 13/1

20	1.519	12.00	140.49	2.380	.258	1.261	13/2	.000	NONE	3.50
100	2.438	12.00	181.84	2.540	.258	2.180	13/2	.000	NONE	3.50

POINT NO 10/8

20	.882	12.95	136.09	3.845	.739	.000	10/9	.143	13/2	5.65
100	.886	13.05	175.72	4.103	.739	.000	10/9	.147	13/2	5.65

POINT NO 13/2

20	1.720	12.06	140.22	2.524	.407	1.313	13/3	.000	NONE	3.66
100	2.649	12.17	180.83	2.684	.407	2.242	13/3	.000	NONE	3.66

POINT NO 13/3

20	1.664	13.05	135.67	2.524	.392	1.272	D1	.000	NONE	3.66
100	2.603	12.69	177.72	2.684	.399	2.204	D1	.000	NONE	3.66

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 10/9										
20	.730	13.33	134.46	3.845	.727	.003	D1	.000	NONE	5.65
100	.732	13.34	174.15	4.103	.729	.003	D1	.000	NONE	5.65
POINT NO D1										
20	2.376	13.37	134.28	6.369	2.376	.000	NONE	.000	NONE	9.31
100	3.274	13.42	173.70	6.786	3.274	.000	NONE	.000	NONE	9.31

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 20 YEARS
PROJECT:PEARL BEACH 1

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	10/1	10/2	11/1	12/1	10/2a	10/3	10/4	10/5
DN	-	10/2	10/2a	10/5	10/6	10/3	10/4	10/5	10/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	22.492	17.836	7.671	7.650	14.365	8.402	7.671	7.650
DO	M	.375	.375	.600	.450	.375	.375	.375	.600
QO	M3/S	.100	.200	.272	.076	.200	.199	.187	.443
VEL	M/S	.905	1.811	.961	.481	1.811	1.803	1.695	1.566
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0025	.0100	.0016	.0006	.0100	.0099	.0088	.0042
LEN	M	5.50	20.00	22.00	9.50	22.00	46.00	50.00	5.00
HGLP	M	22.506	22.325	7.706	7.656	17.786	14.095	8.109	7.671
KU	-	3.00	1.00	2.00	3.00	.30	1.00	2.00	.00
KW	-	3.00	1.00	2.00	3.00	.30	1.00	2.00	.00
UHGL	M	22.631	22.492	7.800	7.691	17.836	14.261	8.402	7.671
UWSL	M	22.631	22.492	7.800	7.691	17.836	14.261	8.402	7.671
MWSL	M	23.361	23.261	7.800	7.691	18.041	14.916	8.402	7.700
IF	M3/S	.100	.100	.272	.076	.000	.000	-.009	.000
IC	M3/S	.100	.100	.420	.100	.000	.000	.100	.000
FC	-	#	#	*	*	$	$	@*	$

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	10/6	10/7	13/1	10/8	13/2	13/3	10/9	D1
DN	-	10/7	10/8	13/2	10/9	13/3	D1	D1	D1
PT	-	99	99	99	99	99	99	99	0
DHGL	M	4.712	4.611	3.841	3.050	3.295	3.000	3.000	.000
DO	M	.600	.600	.450	.600	.525	2.100	2.100	2.100
QO	M3/S	.939	.871	.258	.739	.407	.392	.727	2.398
VEL	M/S	3.319	1.541	.812	2.613	1.879	.113	.210	.000
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0185	.0040	.0016	.0115	.0071	.0000	.0000	.0000
LEN	M	98.00	10.00	10.00	45.00	59.50	5.00	5.00	.00
HGLP	M	6.527	4.652	3.940	3.568	3.715	3.200	3.000	.000
KU	-	2.00	.50	3.00	3.00	.70	.00	.00	.00
KW	-	2.00	.50	3.00	3.00	.70	.00	.00	.00
UHGL	M	7.650	4.712	4.041	4.611	3.841	3.200	3.000	3.000

UWSL	M	7.650	4.712	4.041	4.611	3.841	3.200	3.000	3.000
MWSL	M	7.654	4.715	4.036	4.615	3.936	3.398	3.100	3.000
IF	M3/S	.423	-.041	.258	-.129	.150	.000	.000	.000
IC	M3/S	.520	.140	.470	.200	.150	.000	.000	.000
FC	-	*	@*	*	@*	#	$	$	$*

END OF SUMMARY RETURN PERIOD 20 YEARS

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 100 YEARS
PROJECT:PEARL BEACH 1

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	10/1	10/2	11/1	12/1	10/2a	10/3	10/4	10/5
DN	-	10/2	10/2a	10/5	10/6	10/3	10/4	10/5	10/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	22.492	17.836	7.669	7.650	14.365	8.401	7.669	7.650
DO	M	.375	.375	.600	.450	.375	.375	.375	.600
QO	M3/S	.100	.200	.272	.076	.199	.198	.187	.424
VEL	M/S	.905	1.811	.961	.481	1.805	1.795	1.695	1.501
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0025	.0100	.0016	.0006	.0099	.0098	.0088	.0038
LEN	M	5.50	20.00	22.00	9.50	22.00	46.00	50.00	5.00
HGLP	M	22.506	22.325	7.704	7.656	17.786	14.095	8.108	7.669
KU	-	3.00	1.00	2.00	3.00	.30	1.00	2.00	.00
KW	-	3.00	1.00	2.00	3.00	.30	1.00	2.00	.00
UHGL	M	22.631	22.492	7.798	7.691	17.836	14.259	8.401	7.669
UWSL	M	22.631	22.492	7.798	7.691	17.836	14.259	8.401	7.669
MWSL	M	23.361	23.261	7.800	7.691	18.041	14.916	8.402	7.700
IF	M3/S	.100	.100	.272	.076	.000	.000	-.007	.000
IC	M3/S	.100	.100	.420	.100	.000	.000	.100	.000
FC	-	#	#	*	*	$	$	@*	$

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	10/6	10/7	13/1	10/8	13/2	13/3	10/9	D1
DN	-	10/7	10/8	13/2	10/9	13/3	D1	D1	D1
PT	-	99	99	99	99	99	99	99	0
DHGL	M	4.712	4.611	3.841	3.050	3.295	3.000	3.000	.000
DO	M	.600	.600	.450	.600	.525	2.100	2.100	2.100
QO	M3/S	.939	.871	.258	.739	.407	.399	.729	3.324
VEL	M/S	3.319	1.541	.812	2.613	1.879	.115	.211	.000
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0185	.0040	.0016	.0115	.0071	.0000	.0000	.0000
LEN	M	98.00	10.00	10.00	45.00	59.50	5.00	5.00	.00
HGLP	M	6.527	4.652	3.940	3.568	3.715	3.200	3.000	.000
KU	-	2.00	.50	3.00	3.00	.70	.00	.00	.00
KW	-	2.00	.50	3.00	3.00	.70	.00	.00	.00
UHGL	M	7.650	4.712	4.041	4.611	3.841	3.200	3.000	3.000
UWSL	M	7.650	4.712	4.041	4.611	3.841	3.200	3.000	3.000
MWSL	M	7.654	4.715	4.036	4.615	3.936	3.398	3.100	3.000
IF	M3/S	.441	-.052	.258	-.129	.150	.000	.000	.000
IC	M3/S	.520	.140	.470	.200	.150	.000	.000	.000
FC	-	*	@*	*	@*	#	$	$	$*

END OF SUMMARY RETURN PERIOD 100 YEARS

ITEM	MEANING
RN	REACH NUMBER
PN	PIT NAME
DN	DOWNSTREAM PIT NAME
PT	PIT TYPE
DHGL	DOWNSTREAM TAKE-OFF HGL
DO	PIPE DIAMETER
QO	PIPE FLOW
VEL	PIPE VELOCITY
KP	INTER-NODAL LOSS COEFFICIENT
SF	PIPE FRICTION SLOPE
LEN	PIPE LENGTH
HGLP	PIT DOWNSTREAM HGL
KU	PIT PRESSURE CHANGE COEFFICIENT
KW	PIT WATER SURFACE COEFFICIENT
UHGL	PIT UPSTREAM HGL
UWSL	PIT WATER SURFACE LEVEL

MWSL	PIT WATER SURFACE LEVEL LIMIT
IF	PIT INLET FLOW
IC	PIT INLET CAPACITY
FC	REACH FAILURE (LIMIT) CODE

LIMIT CODES	*	HYDRAULIC LIMITING
	#	INLET LIMITING
	@	INLET SURCHARGE
	$	ZERO INLET CAPACITY

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/1												
50	.005	7.00	201.39	.009	.005	.000	6/2	.000	NONE	.01	.01	.005
POINT NO 7/1												
50	.105	7.00	201.39	.187	.105	.000	6/2	.000	NONE	.00	.32	.105
POINT NO 6/2												
50	.144	7.11	200.29	.259	.145	.000	6/3	.000	NONE	.08	.40	.035
POINT NO 6/3												
50	.163	7.23	199.08	.295	.164	.000	6/4	.000	NONE	.12	.44	.020
POINT NO 6/4												
50	.161	7.50	196.51	.295	.161	.000	6/5	.000	6/6	.12	.44	.000
POINT NO 8/1												
50	2.848	21.00	128.58	7.973	1.000	.000	6/5	1.848	6/6	2.50	12.30	2.848
POINT NO 6/5												
50	1.101	21.16	128.13	8.268	1.107	.000	6/6	.000	NONE	2.62	12.74	.000
POINT NO 6/6												
50	3.169	21.33	127.65	8.937	1.151	2.017	6/7	.000	NONE	3.00	13.68	.237
POINT NO 9/1												
50	.496	11.00	169.88	1.050	.110	.386	9/2	.000	NONE	.33	1.62	.496

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 9/2												
50	.523	11.13	169.09	1.113	.010	.513	6/7	.000	NONE	.40	1.69	.030
POINT NO 6/7												
50	3.638	21.40	127.45	10.275	.643	2.995	6/8	.000	NONE	3.65	15.62	.080
POINT NO 6/8												
50	3.688	21.49	127.22	10.437	1.245	2.444	6/9	.000	NONE	3.83	15.80	.057
POINT NO 6/9												
50	3.659	21.87	126.19	10.437	1.243	2.416	6/10	.000	NONE	3.83	15.80	.000
POINT NO 6/10												
50	3.708	22.28	125.09	10.671	2.065	.000	6/11	1.643	3/1	3.96	16.13	.081
POINT NO 6/11												
50	2.073	22.34	124.93	10.702	2.066	.000	6/12	.007	3/2	4.00	16.16	.011
POINT NO 6/12												
50	2.049	22.76	123.86	10.702	2.041	.007	6/13	.000	NONE	4.00	16.16	.000
POINT NO 6/13												
50	2.041	22.94	123.40	10.702	1.324	.717	6/14	.000	NONE	4.00	16.16	.000
POINT NO 2/1												

RATHGL OUTPUT
PEARL BEACH – CATCHMENT A
50 Year ARI – Existing
File: Pearl 11.out

50	.556	11.00	169.88	1.178	.156	.400	2/2	.000	NONE	.40	1.80	.556

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RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 2/2												
50	.596	11.08	169.36	1.268	.594	.000	2/3	.002	3/1	.50	1.90	.042
POINT NO 3/1												
50	2.666	11.00	169.88	.917	.064	2.602	3/2	.000	NONE	.50	1.30	.433
POINT NO 3/2												
50	2.710	11.08	169.37	1.007	.080	.000	2/3	2.630	6/14	.60	1.40	.042
POINT NO 6/14												
50	4.037	23.16	122.86	10.986	1.812	.000	6/15	2.225	2/5	4.16	16.56	.097
POINT NO 6/15												
50	1.807	23.30	122.51	10.986	1.800	.000	D2	.006	5/1	4.16	16.56	.000
POINT NO 2/3												
50	.685	11.23	168.49	2.305	.545	.140	2/3A	.000	NONE	1.14	3.33	.017
POINT NO 2/3A												
50	.675	11.64	166.03	2.305	.008	.666	2/4	.000	NONE	1.14	3.33	.000
POINT NO 2/4												
50	.662	12.22	162.81	2.305	.232	.430	2/5	.000	NONE	1.14	3.33	.000
POINT NO 4/1												
50	.611	11.00	169.88	1.294	.181	.430	4/2	.000	NONE	.40	2.00	.611

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 4/2												
50	.650	11.13	169.10	1.384	.379	.271	4/3	.000	NONE	.50	2.10	.042
POINT NO 4/3												
50	.666	11.19	168.73	1.420	.496	.169	4/4	.000	NONE	.54	2.14	.017
POINT NO 4/4												
50	.675	11.34	167.80	1.447	.465	.000	4/5	.210	2/5	.57	2.17	.013
POINT NO 2/5												
50	4.396	12.26	162.56	3.607	.402	.000	2/6	3.994	5/1	1.88	5.16	.588
POINT NO 5/1												
50	5.023	7.00	201.39	.117	.099	.000	2/6	4.924	2/7	.13	.13	.065
POINT NO 2/6												
50	.480	12.43	161.69	3.724	.463	.017	2/7	.000	NONE	2.01	5.29	.000
POINT NO 2/7												
50	4.389	12.73	160.06	3.724	.461	3.928	D2	.000	NONE	2.01	5.29	.000
POINT NO D2												

50	5.354	12.90	159.20	11.656	1.452	3.901	D3	.000	NONE	6.16	16.62	.000
POINT NO 4/5													
50	.483	11.48	167.01	1.492	.372	.000	4/6	.111	4/7	.62	2.22	.021

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 4/6												
50	.371	11.53	166.67	1.492	.370	.001	4/7	.000	NONE	.62	2.22	.000
POINT NO 4/7												
50	.477	11.84	164.90	1.492	.365	.112	D3	.000	NONE	.62	2.22	.000
POINT NO D3												
50	5.808	12.82	159.63	13.098	1.793	4.015	D4	.000	NONE	6.78	18.76	.000
POINT NO 1/1												
50	1.222	11.00	169.88	2.589	.042	1.179	1/2	.000	NONE	.80	4.00	1.222
POINT NO 1/2												
50	1.251	11.09	169.31	2.661	.212	.000	1/3	1.039	1/4	.88	4.08	.034
POINT NO 1/3												
50	.252	11.38	167.57	2.751	.251	.001	1/4	.000	NONE	.98	4.18	.042
POINT NO 1/4												
50	1.259	11.86	164.82	2.751	.246	1.013	D4	.000	NONE	.98	4.18	.000
POINT NO D4												
50	7.028	11.94	164.35	15.395	7.028	.000	NONE	.000	NONE	7.76	22.16	.000

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/1										
50	.005	7.00	201.39	.009	.005	.000	6/2	.000	NONE	.01
POINT NO 7/1										
50	.105	7.00	201.39	.187	.105	.000	6/2	.000	NONE	.32
POINT NO 6/2										
50	.144	7.11	200.29	.259	.144	.000	6/3	.000	NONE	.40
POINT NO 6/3										
50	.163	7.23	199.08	.295	.163	.000	6/4	.000	NONE	.44
POINT NO 6/4										
50	.161	7.50	196.51	.295	.161	.000	6/5	.000	6/6	.44
POINT NO 8/1										
50	2.848	21.00	128.58	7.973	1.000	.000	6/5	1.848	6/6	12.30
POINT NO 6/5										
50	1.101	21.16	128.13	8.268	1.101	.000	6/6	.000	NONE	12.74
POINT NO 6/6										
50	3.169	21.33	127.65	8.937	1.151	2.017	6/7	.000	NONE	13.68

POINT NO 9/1

50 .496 11.00 169.88 1.050 .110 .386 9/2 .000 NONE 1.62

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 9/2										
50	.523	11.13	169.09	1.113	.010	.513	6/7	.000	NONE	1.69
POINT NO 6/7										
50	3.638	21.40	127.45	10.275	.643	2.995	6/8	.000	NONE	15.62
POINT NO 6/8										
50	3.688	21.49	127.22	10.437	1.245	2.444	6/9	.000	NONE	15.80
POINT NO 6/9										
50	3.659	21.87	126.19	10.437	1.243	2.416	6/10	.000	NONE	15.80
POINT NO 6/10										
50	3.708	22.28	125.09	10.671	2.065	.000	6/11	1.643	3/1	16.13
POINT NO 6/11										
50	2.073	22.34	124.93	10.702	2.066	.000	6/12	.007	3/2	16.16
POINT NO 6/12										
50	2.049	22.76	123.86	10.702	2.041	.007	6/13	.000	NONE	16.16
POINT NO 6/13										
50	2.041	22.94	123.40	10.702	1.324	.717	6/14	.000	NONE	16.16
POINT NO 2/1										
50	.556	11.00	169.88	1.178	.156	.400	2/2	.000	NONE	1.80

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 2/2										
50	.596	11.08	169.36	1.268	.594	.000	2/3	.002	3/1	1.90
POINT NO 3/1										
50	2.666	11.00	169.88	.917	.064	2.602	3/2	.000	NONE	1.30
POINT NO 3/2										
50	2.710	11.08	169.37	1.007	.080	.000	2/3	2.630	6/14	1.40
POINT NO 6/14										
50	4.037	23.16	122.86	10.986	1.812	.000	6/15	2.225	2/5	16.56
POINT NO 6/15										
50	1.807	23.30	122.51	10.986	1.800	.000	D2	.006	5/1	16.56
POINT NO 2/3										
50	.685	11.35	167.74	2.311	.545	.139	2/3A	.000	NONE	3.34
POINT NO 2/3A										
50	.675	11.77	165.31	2.311	.008	.666	2/4	.000	NONE	3.34

POINT NO 2/4

50 .662 12.34 162.13 2.311 .232 .430 2/5 .000 NONE 3.34

POINT NO 4/1

50 .611 11.00 169.88 1.294 .181 .430 4/2 .000 NONE 2.00

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 4/2										
50	.650	11.13	169.10	1.384	.379	.271	4/3	.000	NONE	2.10
POINT NO 4/3										
50	.666	11.19	168.73	1.420	.496	.169	4/4	.000	NONE	2.14
POINT NO 4/4										
50	.675	11.34	167.80	1.447	.465	.000	4/5	.210	2/5	2.17
POINT NO 2/5										
50	4.380	12.39	161.89	3.613	.402	.000	2/6	3.978	5/1	5.17
POINT NO 5/1										
50	5.024	7.00	201.39	.117	.099	.000	2/6	4.925	2/7	.13
POINT NO 2/6										
50	.480	12.55	161.02	3.730	.463	.016	2/7	.000	NONE	5.30
POINT NO 2/7										
50	4.374	12.86	159.41	3.730	.461	3.913	D2	.000	NONE	5.30
POINT NO D2										
50	5.157	23.34	122.41	14.716	1.452	3.705	D3	.000	NONE	21.87
POINT NO 4/5										
50	.483	11.48	167.01	1.492	.372	.000	4/6	.111	4/7	2.22

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 4/6										
50	.371	11.53	166.67	1.492	.370	.001	4/7	.000	NONE	2.22
POINT NO 4/7										
50	.477	11.84	164.90	1.492	.365	.112	D3	.000	NONE	2.22
POINT NO D3										
50	5.507	23.38	122.30	16.209	1.793	3.714	D4	.000	NONE	24.09
POINT NO 1/1										
50	1.222	11.00	169.88	2.589	.042	1.179	1/2	.000	NONE	4.00
POINT NO 1/2										
50	1.251	11.09	169.31	2.661	.212	.000	1/3	1.039	1/4	4.08
POINT NO 1/3										
50	.252	11.38	167.57	2.751	.251	.001	1/4	.000	NONE	4.18
POINT NO 1/4										

50	1.259	11.86	164.82	2.751	.246	1.013	D4	.000	NONE	4.18

POINT NO D4

50	6.436	23.42	122.20	18.959	6.436	.000	NONE	.000	NONE	28.27

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	6/1	7/1	6/2	6/3	6/4	8/1	6/5	6/6
DN	-	6/2	6/2	6/3	6/4	6/5	6/5	6/6	6/7
PT	-	99	99	99	99	99	99	99	99
DHGL	M	16.400	16.400	15.365	11.322	11.248	11.248	11.028	10.499
DO	M	.450	.450	.450	.450	.450	.900	.900	.900
QO	M3/S	.005	.105	.145	.164	.161	1.000	1.107	1.151
VEL	M/S	.032	.659	.910	1.030	1.015	1.572	1.740	1.810
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0000	.0011	.0020	.0026	.0025	.0025	.0031	.0034
LEN	M	12.50	13.00	22.00	48.00	17.00	28.50	21.00	8.50
HGLP	M	16.550	16.700	16.350	15.230	11.290	12.460	11.093	10.527
KU	-	1.70	5.00	.70	2.50	.60	2.00	1.00	3.00
KW	-	1.70	5.00	.70	2.50	.60	2.00	1.00	3.00
UHGL	M	16.550	16.811	16.380	15.365	11.322	12.712	11.248	11.028
UWSL	M	16.550	16.811	16.380	15.365	11.322	12.712	11.248	11.028
MWSL	M	18.000	16.900	16.800	15.978	12.272	12.789	12.100	11.301
IF	M3/S	.005	.105	.035	.020	.000	1.000	.000	.050
IC	M3/S	.500	.150	.100	.200	.000	1.000	.000	.050
FC	-					$	#	$	#

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	9/1	9/2	6/7	6/8	6/9	6/10	6/11	6/12
DN	-	9/2	6/7	6/8	6/9	6/10	6/11	6/12	6/13
PT	-	99	99	99	99	99	99	99	99
DHGL	M	12.390	10.499	10.256	9.390	7.489	6.869	5.706	5.218
DO	M	.375	.100	.750	.750	.750	.900	.900	.900
QO	M3/S	.110	.010	.643	1.245	1.243	2.065	2.066	2.041
VEL	M/S	.996	1.253	1.455	2.817	2.813	3.246	3.248	3.208
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0031	.0263	.0027	.0101	.0101	.0107	.0107	.0105
LEN	M	23.00	72.00	10.00	45.50	50.00	11.00	50.00	21.50
HGLP	M	14.370	12.390	10.283	9.851	8.180	7.220	6.600	5.443
KU	-	5.00	.00	2.00	1.00	3.00	.50	.50	.50
KW	-	5.00	.00	2.00	1.00	3.00	.50	.50	.50
UHGL	M	14.623	12.390	10.499	10.256	9.390	7.489	6.869	5.706
UWSL	M	14.623	12.390	10.499	10.256	9.390	7.489	6.869	5.706
MWSL	M	14.883	12.392	10.500	10.400	9.394	7.720	7.620	5.854
IF	M3/S	.110	-.100	-.514	.600	.008	.840	.011	.000
IC	M3/S	.110	.000	.800	.600	.050	.840	.500	.050
FC	-	#	@*	@*	#	*	#		

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	17	18	19	20	21	22	23	24
PN	-	6/13	2/1	2/2	3/1	3/2	6/14	6/15	2/3
DN	-	6/14	2/2	2/3	3/2	2/3	6/15	D2	2/3A
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.155	10.658	7.102	7.209	7.102	3.880	3.400	5.298
DO	M	.675	.375	.450	.375	.375	.917	2.100	.525
QO	M3/S	1.324	.156	.594	.064	.080	1.812	1.800	.545
VEL	M/S	1.849	1.409	3.735	.580	.726	1.373	.520	2.519
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0050	.0061	.0335	.0011	.0016	.0024	.0001	.0126
LEN	M	26.00	15.00	26.00	9.00	32.50	17.00	5.00	50.00
HGLP	M	4.695	10.749	10.160	7.218	7.155	4.030	3.500	6.455
KU	-	3.00	.00	.70	.00	2.00	.50	.00	2.00
KW	-	3.00	5.00	.70	5.00	2.00	.50	.00	2.00
UHGL	M	5.218	10.749	10.658	7.218	7.209	4.078	3.500	7.102
UWSL	M	5.218	11.255	10.658	7.304	7.209	4.078	3.500	7.102

MWSL	M	5.221	11.252	10.771	7.301	7.206	4.418	3.900	7.106
IF	M3/S	-.710	.156	.441	.064	.016	.500	.000	-.123
IC	M3/S	.050	.300	.500	.220	.400	.500	.000	.200
FC	-	@*	*		*	*	#	$	@*

ITEM	DIM	RESULT							
RN	-	25	26	27	28	29	30	31	32
PN	-	2/3A	2/4	4/1	4/2	4/3	4/4	2/5	5/1
DN	-	2/4	2/5	4/2	4/3	4/4	4/5	2/6	2/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.454	4.337	7.815	6.566	4.915	4.346	4.114	4.114
DO	M	.100	.525	.375	.450	.450	.525	.525	.375
QO	M3/S	.008	.232	.181	.379	.496	.465	.402	.099
VEL	M/S	1.081	1.070	1.638	2.382	3.122	2.146	1.859	.900
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0196	.0023	.0082	.0137	.0235	.0092	.0069	.0025
LEN	M	43.00	5.50	11.50	11.00	28.00	16.00	19.50	9.00
HGLP	M	5.298	4.349	7.909	6.980	5.572	4.493	4.249	4.136
KU	-	.00	1.80	.00	.50	2.00	1.80	.50	.00
KW	-	.00	1.80	5.00	.50	2.00	1.80	.50	5.00
UHGL	M	5.298	4.454	7.909	7.125	6.566	4.915	4.337	4.136
UWSL	M	5.298	4.454	8.593	7.125	6.566	4.915	4.337	4.343
MWSL	M	5.300	4.455	8.597	8.395	6.956	4.919	4.397	4.340
IF	M3/S	-.529	.223	.181	.200	.120	-.029	.170	.099
IC	M3/S	10.000	.500	.300	.200	.120	.200	.170	.200
FC	-	@*	*	*	#	#	@*	#	*

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	33	34	35	36	37	38	39	40
PN	-	2/6	2/7	D2	4/5	4/6	4/7	D3	1/1
DN	-	2/7	D2	D3	4/6	4/7	D3	D4	1/2
PT	-	99	99	99	99	99	99	99	99
DHGL	M	3.420	3.300	3.200	4.015	3.420	3.200	3.133	5.165
DO	M	.600	2.100	2.100	.525	.600	2.100	2.100	.375
QO	M3/S	.463	.461	1.452	.372	.370	.365	1.793	.042
VEL	M/S	1.639	.133	.419	1.719	1.310	.105	.518	.383
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0046	.0000	.0001	.0059	.0029	.0000	.0001	.0005
LEN	M	37.00	5.00	5.00	5.00	37.00	5.00	5.00	10.00
HGLP	M	3.840	3.400	3.300	4.044	3.840	3.400	3.200	5.170
KU	-	2.00	.00	.00	2.00	2.00	.00	.00	.00
KW	-	2.00	.00	.00	2.00	2.00	.00	.00	5.00
UHGL	M	4.114	3.400	3.300	4.346	4.015	3.400	3.200	5.170
UWSL	M	4.114	3.400	3.300	4.346	4.015	3.400	3.200	5.207
MWSL	M	4.110	3.500	3.450	4.349	4.110	3.500	3.400	5.205
IF	M3/S	-.017	.000	.000	-.090	.000	.000	.000	.042
IC	M3/S	.000	.000	.000	.450	.000	.000	.000	.400
FC	-	@*	$	$	@*	$	$	$	*

ITEM	DIM	RESULT			
RN	-	41	42	43	44
PN	-	1/2	1/3	1/4	D4
DN	-	1/3	1/4	D4	D4
PT	-	99	99	99	0
DHGL	M	4.506	3.480	3.133	.000
DO	M	.375	.450	2.100	2.100
QO	M3/S	.212	.251	.246	7.028
VEL	M/S	1.924	1.580	.071	.000
KP	-	.00	.00	.00	.00
SF	M/M	.0113	.0061	.0000	.0000
LEN	M	25.00	57.00	10.00	.00
HGLP	M	4.788	4.290	3.400	.000
KU	-	2.00	1.70	.00	.00
KW	-	2.00	1.70	.00	.00
UHGL	M	5.165	4.506	3.400	3.133
UWSL	M	5.165	4.506	3.400	3.133
MWSL	M	5.170	5.070	3.500	3.133
IF	M3/S	.170	.042	.000	.000
IC	M3/S	.280	.600	.000	.000
FC	-	*		$	$*

END OF SUMMARY RETURN PERIOD 50 YEARS

ITEM	MEANING
RN	REACH NUMBER
PN	PIT NAME
DN	DOWNSTREAM PIT NAME
PT	PIT TYPE
DHGL	DOWNSTREAM TAKE-OFF HGL
DO	PIPE DIAMETER
QO	PIPE FLOW
VEL	PIPE VELOCITY
KP	INTER-NODAL LOSS COEFFICIENT
SF	PIPE FRICTION SLOPE
LEN	PIPE LENGTH
HGLP	PIT DOWNSTREAM HGL
KU	PIT PRESSURE CHANGE COEFFICIENT
KW	PIT WATER SURFACE COEFFICIENT
UHGL	PIT UPSTREAM HGL
UWSL	PIT WATER SURFACE LEVEL
MWSL	PIT WATER SURFACE LEVEL LIMIT
IF	PIT INLET FLOW
IC	PIT INLET CAPACITY
FC	REACH FAILURE (LIMIT) CODE

LIMIT CODES		
	*	HYDRAULIC LIMITING
	#	INLET LIMITING
	@	INLET SURCHARGE
	$	ZERO INLET CAPACITY

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/1												
50	.005	7.00	201.39	.009	.005	.000	6/2	.000	NONE	.01	.01	.005
POINT NO 7/1												
50	.105	7.00	201.39	.187	.105	.000	6/2	.000	NONE	.00	.32	.105
POINT NO 6/2												
50	.144	7.11	200.29	.259	.145	.000	6/3	.000	9/1	.08	.40	.035
POINT NO 9/1												
50	.496	11.00	169.88	1.050	.110	.000	9/2	.386	2/1	.33	1.62	.496
POINT NO 2/1												
50	.941	11.00	169.88	1.178	.175	.000	2/2	.766	4/1	.40	1.80	.556
POINT NO 4/1												
50	1.377	11.00	169.88	1.294	.181	.000	4/2	1.196	1/1	.40	2.00	.611
POINT NO 1/1												
50	2.417	11.00	169.88	2.589	.042	2.375	1/2	.000	NONE	.80	4.00	1.222
POINT NO 1/2												
50	2.443	11.09	169.31	2.661	.212	.000	1/3	2.231	1/4	.88	4.08	.034
POINT NO 1/3												
50	.252	11.38	167.57	2.751	.251	.001	1/4	.000	NONE	.98	4.18	.042

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 1/4												
50	2.420	11.86	164.82	2.751	.246	2.173	D4	.000	NONE	.98	4.18	.000
POINT NO 6/3												
50	.163	7.23	199.08	.295	.164	.000	6/4	.000	NONE	.12	.44	.020
POINT NO 6/4												
50	.161	7.50	196.51	.295	.161	.000	6/5	.000	6/6	.12	.44	.000
POINT NO 8/1												
50	2.848	21.00	128.58	7.973	1.626	.000	6/5	1.221	6/6	2.50	12.30	2.848
POINT NO 6/5												
50	1.725	21.16	128.13	8.268	1.731	.000	6/6	.000	NONE	2.62	12.74	.000
POINT NO 6/6												
50	3.173	21.27	127.81	8.937	1.767	1.406	6/7	.000	NONE	3.00	13.68	.238
POINT NO 9/2												
50	.139	11.13	169.09	1.113	.010	.129	6/7	.000	NONE	.40	1.69	.030
POINT NO 6/7												
50	3.353	21.35	127.61	10.275	.928	2.424	6/8	.000	NONE	3.65	15.62	.080
POINT NO 6/8												

RATHGL OUTPUT
PEARL BEACH - CATCHMENT A
50 Year ARI - Improved (Min + Beryl)
File: Pearl 11.out

50	3.404	21.43	127.38	10.437	1.524	1.879	6/9	.000	NONE	3.83	15.80	.057

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/9												
50	3.376	21.81	126.35	10.437	1.562	1.814	6/10	.000	NONE	3.83	15.80	.000
POINT NO 6/10												
50	3.428	22.23	125.24	10.671	2.380	.000	6/11	1.048	3/1	3.96	16.13	.081
POINT NO 6/11												
50	2.388	22.29	125.08	10.702	2.377	.000	6/12	.011	3/2	4.00	16.17	.011
POINT NO 6/12												
50	2.357	22.70	124.01	10.702	2.326	.031	6/13	.000	NONE	4.00	16.17	.000
POINT NO 6/13												
50	2.348	22.88	123.55	10.702	2.292	.056	6/14	.000	NONE	4.00	16.17	.000
POINT NO 2/2												
50	.217	11.08	169.36	1.268	.218	.000	2/3	.000	3/1	.50	1.90	.042
POINT NO 3/1												
50	1.854	11.00	169.88	.917	.066	1.788	3/2	.000	NONE	.50	1.30	.433
POINT NO 3/2												
50	1.906	11.08	169.37	1.007	.159	.000	2/3	1.747	6/14	.60	1.40	.042
POINT NO 6/14												
50	3.703	23.10	123.01	10.986	2.773	.931	6/15	.000	NONE	4.16	16.57	.097

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE AREAS IMPERV HA	TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 6/15												
50	3.693	23.24	122.65	10.986	2.754	.938	D2	.000	NONE	4.16	16.57	.000
POINT NO 2/3												
50	.388	11.23	168.49	2.305	.390	.000	2/3A	.000	NONE	1.14	3.33	.017
POINT NO 2/3A												
50	.383	11.64	166.03	2.305	.008	.374	2/4	.000	NONE	1.14	3.33	.000
POINT NO 2/4												
50	.375	12.22	162.81	2.305	.232	.144	2/5	.000	NONE	1.14	3.33	.000
POINT NO 4/2												
50	.222	11.13	169.10	1.384	.223	.000	4/3	.000	NONE	.50	2.10	.042
POINT NO 4/3												
50	.239	11.19	168.73	1.420	.239	.000	4/4	.000	NONE	.54	2.14	.017
POINT NO 4/4												
50	.250	11.34	167.80	1.447	.251	.000	4/5	.000	2/5	.57	2.17	.013
POINT NO 2/5												

50	.963	12.26	162.56	3.607	.402	.000	2/6	.560	5/1	1.88	5.16	.588

POINT NO 5/1

50	.760	7.00	201.39	.117	.099	.000	2/6	.660	2/7	.13	.13	.065

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 2/6												
50	.480	12.43	161.69	3.724	.463	.017	2/7	.000	NONE	2.01	5.29	.000
POINT NO 2/7												
50	1.000	12.73	160.06	3.724	.461	.539	D2	.000	NONE	2.01	5.29	.000
POINT NO D2												
50	4.444	12.90	159.20	11.673	2.683	1.761	D3	.000	NONE	6.16	16.65	.000
POINT NO 4/5												
50	.270	11.48	167.01	1.492	.269	.000	4/6	.001	4/7	.62	2.22	.021
POINT NO 4/6												
50	.269	11.53	166.67	1.492	.269	.000	4/7	.000	NONE	.62	2.22	.000
POINT NO 4/7												
50	.266	11.84	164.90	1.492	.266	.000	D3	.000	NONE	.62	2.22	.000
POINT NO D3												
50	4.691	12.82	159.63	13.114	2.916	1.775	D4	.000	NONE	6.78	18.79	.000
POINT NO D4												
50	7.036	11.94	164.35	15.412	7.036	.000	NONE	.000	NONE	7.76	22.19	.000

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/1										
50	.005	7.00	201.39	.009	.005	.000	6/2	.000	NONE	.01
POINT NO 7/1										
50	.105	7.00	201.39	.187	.105	.000	6/2	.000	NONE	.32
POINT NO 6/2										
50	.144	7.11	200.29	.259	.144	.000	6/3	.000	9/1	.40
POINT NO 9/1										
50	.496	11.00	169.88	1.050	.110	.000	9/2	.386	2/1	1.62
POINT NO 2/1										
50	.941	11.00	169.88	1.178	.175	.000	2/2	.766	4/1	1.80
POINT NO 4/1										
50	1.377	11.00	169.88	1.294	.181	.000	4/2	1.196	1/1	2.00
POINT NO 1/1										
50	2.417	11.00	169.88	2.589	.042	2.375	1/2	.000	NONE	4.00
POINT NO 1/2										
50	2.443	11.09	169.31	2.661	.212	.000	1/3	2.231	1/4	4.08

POINT NO 1/3

50 .252 11.38 167.57 2.751 .251 .001 1/4 .000 NONE 4.18

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 1/4										
50	2.420	11.86	164.82	2.751	.246	2.173	D4	.000	NONE	4.18
POINT NO 6/3										
50	.163	7.23	199.08	.295	.163	.000	6/4	.000	NONE	.44
POINT NO 6/4										
50	.161	7.50	196.51	.295	.161	.000	6/5	.000	6/6	.44
POINT NO 8/1										
50	2.848	21.00	128.58	7.973	1.626	.000	6/5	1.221	6/6	12.30
POINT NO 6/5										
50	1.725	21.16	128.13	8.268	1.725	.000	6/6	.000	NONE	12.74
POINT NO 6/6										
50	3.173	21.27	127.81	8.937	1.767	1.406	6/7	.000	NONE	13.68
POINT NO 9/2										
50	.139	11.13	169.09	1.113	.010	.129	6/7	.000	NONE	1.69
POINT NO 6/7										
50	3.353	21.35	127.61	10.275	.928	2.424	6/8	.000	NONE	15.62
POINT NO 6/8										
50	3.404	21.43	127.38	10.437	1.524	1.879	6/9	.000	NONE	15.80

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/9										
50	3.376	21.81	126.35	10.437	1.562	1.814	6/10	.000	NONE	15.80
POINT NO 6/10										
50	3.428	22.23	125.24	10.671	2.380	.000	6/11	1.048	3/1	16.13
POINT NO 6/11										
50	2.388	22.29	125.08	10.702	2.377	.000	6/12	.011	3/2	16.17
POINT NO 6/12										
50	2.357	22.70	124.01	10.702	2.326	.031	6/13	.000	NONE	16.17
POINT NO 6/13										
50	2.348	22.88	123.55	10.702	2.292	.056	6/14	.000	NONE	16.17
POINT NO 2/2										
50	.217	11.08	169.36	1.268	.217	.000	2/3	.000	3/1	1.90
POINT NO 3/1										
50	1.854	11.00	169.88	.917	.066	1.788	3/2	.000	NONE	1.30

POINT NO 3/2

50 1.906 11.08 169.37 1.007 .159 .000 2/3 1.747 6/14 1.40

POINT NO 6/14

50 3.703 23.10 123.01 10.986 2.773 .931 6/15 .000 NONE 16.57

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 6/15										
50	3.693	23.24	122.65	10.986	2.754	.938	D2	.000	NONE	16.57
POINT NO 2/3										
50	.389	11.35	167.74	2.311	.389	.000	2/3A	.000	NONE	3.34
POINT NO 2/3A										
50	.384	11.77	165.31	2.311	.008	.375	2/4	.000	NONE	3.34
POINT NO 2/4										
50	.376	12.34	162.13	2.311	.232	.145	2/5	.000	NONE	3.34
POINT NO 4/2										
50	.222	11.13	169.10	1.384	.222	.000	4/3	.000	NONE	2.10
POINT NO 4/3										
50	.239	11.19	168.73	1.420	.239	.000	4/4	.000	NONE	2.14
POINT NO 4/4										
50	.250	11.34	167.80	1.447	.250	.000	4/5	.000	2/5	2.17
POINT NO 2/5										
50	.961	12.39	161.89	3.613	.402	.000	2/6	.559	5/1	5.17
POINT NO 5/1										
50	.761	7.00	201.39	.117	.099	.000	2/6	.661	2/7	.13

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 2/6										
50	.480	12.55	161.02	3.730	.463	.016	2/7	.000	NONE	5.30
POINT NO 2/7										
50	.998	12.86	159.41	3.730	.461	.538	D2	.000	NONE	5.30
POINT NO D2										
50	4.457	23.28	122.55	14.716	2.683	1.774	D3	.000	NONE	21.87
POINT NO 4/5										
50	.270	11.48	167.01	1.492	.269	.000	4/6	.001	4/7	2.22
POINT NO 4/6										
50	.269	11.53	166.67	1.492	.269	.000	4/7	.000	NONE	2.22
POINT NO 4/7										
50	.266	11.84	164.90	1.492	.266	.000	D3	.000	NONE	2.22
POINT NO D3										

50 4.651 23.32 122.45 16.209 2.916 1.735 D4 .000 NONE 24.09

POINT NO D4

50 6.443 23.37 122.34 18.959 6.443 .000 NONE .000 NONE 28.27

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	6/1	7/1	6/2	9/1	2/1	4/1	1/1	1/2
DN	-	6/2	6/2	6/3	9/2	2/2	4/2	1/2	1/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	16.400	16.400	15.365	12.389	10.227	7.815	5.165	4.506
DO	M	.450	.450	.450	.375	.375	.375	.375	.375
QO	M3/S	.005	.105	.145	.110	.175	.181	.042	.212
VEL	M/S	.032	.659	.910	.996	1.586	1.638	.383	1.924
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0000	.0011	.0020	.0031	.0077	.0082	.0005	.0113
LEN	M	12.50	13.00	22.00	23.00	15.00	11.50	10.00	25.00
HGLP	M	16.550	16.700	16.350	14.370	10.615	7.909	5.170	4.788
KU	-	1.70	5.00	.70	5.00	.00	.00	.00	2.00
KW	-	1.70	5.00	.70	5.00	5.00	5.00	5.00	2.00
UHGL	M	16.550	16.811	16.380	14.623	10.615	7.909	5.170	5.165
UWSL	M	16.550	16.811	16.380	14.623	11.256	8.593	5.207	5.165
MWSL	M	18.000	16.900	16.800	14.883	11.252	8.597	5.205	5.170
IF	M3/S	.005	.105	.035	.110	.175	.181	.042	.170
IC	M3/S	.500	.150	.100	.110	.300	.300	.400	.280
FC	-				#	*	*	*	*

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	1/3	1/4	6/3	6/4	8/1	6/5	6/6	9/2
DN	-	1/4	D4	6/4	6/5	6/5	6/6	6/7	6/7
PT	-	99	99	99	99	99	99	99	99
DHGL	M	3.480	3.133	11.432	11.357	11.357	10.758	10.495	10.495
DO	M	.450	2.100	.450	.450	.900	.900	.900	.100
QO	M3/S	.251	.246	.164	.161	1.626	1.731	1.767	.010
VEL	M/S	1.580	.071	1.030	1.015	2.556	2.721	2.777	1.254
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0061	.0000	.0026	.0025	.0067	.0075	.0079	.0263
LEN	M	57.00	10.00	48.00	17.00	28.50	21.00	8.50	72.00
HGLP	M	4.290	3.400	15.230	11.400	12.460	10.980	10.562	12.389
KU	-	1.70	.00	2.50	.60	1.00	1.00	.50	.00
KW	-	1.70	.00	2.50	.60	1.00	1.00	.50	.00
UHGL	M	4.506	3.400	15.365	11.432	12.793	11.357	10.758	12.389
UWSL	M	4.506	3.400	15.365	11.432	12.793	11.357	10.758	12.389
MWSL	M	5.070	3.500	15.978	12.272	12.789	12.100	11.301	12.392
IF	M3/S	.042	.000	.020	.000	1.626	.000	.050	-.100
IC	M3/S	.600	.000	.200	.000	10.000	.000	.050	.000
FC	-		$		$	*	$	#	@*

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	17	18	19	20	21	22	23	24
PN	-	6/7	6/8	6/9	6/10	6/11	6/12	6/13	2/2
DN	-	6/8	6/9	6/10	6/11	6/12	6/13	6/14	2/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	9.988	8.691	7.577	6.956	5.851	5.218	4.155	6.786
DO	M	.750	.750	.750	.900	.900	.900	.675	.450
QO	M3/S	.928	1.524	1.562	2.380	2.377	2.326	2.292	.218
VEL	M/S	2.101	3.451	3.535	3.741	3.737	3.656	3.203	1.369
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0057	.0152	.0159	.0142	.0142	.0136	.0149	.0046
LEN	M	10.00	45.50	50.00	11.00	50.00	21.50	26.00	26.00
HGLP	M	10.045	9.382	8.373	7.220	6.600	5.510	4.695	10.160
KU	-	2.00	1.00	.50	.50	.50	.50	1.00	.70
KW	-	2.00	1.00	.50	.50	.50	.50	1.00	.70
UHGL	M	10.495	9.988	8.691	7.577	6.956	5.851	5.218	10.227
UWSL	M	10.495	9.988	8.691	7.577	6.956	5.851	5.218	10.227

MWSL	M	10.500	10.400	9.394	7.720	7.620	5.854	5.221	10.771
IF	M3/S	-.843	.600	.050	.840	.011	-.031	-.025	.042
IC	M3/S	.800	.600	.050	.840	.500	.050	.050	.500
FC	-	@*	#	#	#		@*	@*	

ITEM	DIM	RESULT							
RN	-	25	26	27	28	29	30	31	32
PN	-	3/1	3/2	6/14	6/15	2/3	2/3A	2/4	4/2
DN	-	3/2	2/3	6/15	D2	2/3A	2/4	2/5	4/3
PT	-	99	99	99	99	99	99	99	99
DHGL	M	7.203	6.786	3.880	3.400	5.298	4.454	4.337	5.760
DO	M	.375	.375	.917	2.100	.525	.100	.525	.450
QO	M3/S	.066	.159	2.773	2.754	.390	.008	.232	.223
VEL	M/S	.596	1.440	2.100	.795	1.801	1.081	1.070	1.402
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0011	.0063	.0056	.0002	.0065	.0196	.0023	.0048
LEN	M	9.00	32.50	17.00	5.00	50.00	43.00	5.50	11.00
HGLP	M	7.213	6.992	4.030	3.500	6.455	5.298	4.349	6.980
KU	-	.00	2.00	.50	.00	2.00	.00	1.80	.50
KW	-	5.00	2.00	.50	.00	2.00	.00	1.80	.50
UHGL	M	7.213	7.203	4.142	3.500	6.786	5.298	4.454	7.030
UWSL	M	7.304	7.203	4.142	3.500	6.786	5.298	4.454	7.030
MWSL	M	7.301	7.206	4.418	3.900	7.106	5.300	4.455	8.395
IF	M3/S	.066	.094	.500	.000	.017	-.374	.223	.042
IC	M3/S	.220	.400	.500	.000	.200	10.000	.500	.200
FC	-	*	*	#	$		@*	*	

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 2

ITEM	DIM	RESULT							
RN	-	33	34	35	36	37	38	39	40
PN	-	4/3	4/4	2/5	5/1	2/6	2/7	D2	4/5
DN	-	4/4	4/5	2/6	2/6	2/7	D2	D3	4/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	4.298	4.105	4.114	4.114	3.420	3.300	3.200	3.932
DO	M	.450	.525	.525	.375	.600	2.100	2.100	.525
QO	M3/S	.239	.251	.402	.099	.463	.461	2.683	.269
VEL	M/S	1.505	1.160	1.859	.900	1.639	.133	.775	1.243
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0055	.0027	.0069	.0025	.0046	.0000	.0002	.0031
LEN	M	28.00	16.00	19.50	9.00	37.00	5.00	5.00	5.00
HGLP	M	5.390	4.175	4.249	4.136	3.840	3.400	3.300	3.948
KU	-	2.00	1.80	.50	.00	2.00	.00	.00	2.00
KW	-	2.00	1.80	.50	5.00	2.00	.00	.00	2.00
UHGL	M	5.621	4.298	4.337	4.136	4.114	3.400	3.300	4.105
UWSL	M	5.621	4.298	4.337	4.343	4.114	3.400	3.300	4.105
MWSL	M	6.956	4.919	4.397	4.340	4.110	3.500	3.450	4.349
IF	M3/S	.017	.013	.170	.099	-.017	.000	.000	.021
IC	M3/S	.120	.200	.170	.200	.000	.000	.000	.450
FC	-			#	*	@*	$	$	

ITEM	DIM	RESULT			
RN	-	41	42	43	44
PN	-	4/6	4/7	D3	D4
DN	-	4/7	D3	D4	D4
PT	-	99	99	99	0
DHGL	M	3.420	3.200	3.133	.000
DO	M	.600	2.100	2.100	2.100
QO	M3/S	.269	.266	2.916	7.036
VEL	M/S	.950	.077	.842	.000
KP	-	.00	.00	.00	.00
SF	M/M	.0015	.0000	.0003	.0000
LEN	M	37.00	5.00	5.00	.00
HGLP	M	3.840	3.400	3.200	.000
KU	-	2.00	.00	.00	.00
KW	-	2.00	.00	.00	.00
UHGL	M	3.932	3.400	3.200	3.133
UWSL	M	3.932	3.400	3.200	3.133
MWSL	M	4.110	3.500	3.400	3.133
IF	M3/S	.000	.000	.000	.000
IC	M3/S	.000	.000	.000	.000
FC	-	$	$	$	$*

END OF SUMMARY RETURN PERIOD 50 YEARS

ITEM	MEANING
RN	REACH NUMBER
PN	PIT NAME
DN	DOWNSTREAM PIT NAME
PT	PIT TYPE
DHGL	DOWNSTREAM TAKE-OFF HGL
DO	PIPE DIAMETER
QO	PIPE FLOW
VEL	PIPE VELOCITY
KP	INTER-NODAL LOSS COEFFICIENT
SF	PIPE FRICTION SLOPE
LEN	PIPE LENGTH
HGLP	PIT DOWNSTREAM HGL
KU	PIT PRESSURE CHANGE COEFFICIENT
KW	PIT WATER SURFACE COEFFICIENT
UHGL	PIT UPSTREAM HGL
UWSL	PIT WATER SURFACE LEVEL
MWSL	PIT WATER SURFACE LEVEL LIMIT
IF	PIT INLET FLOW
IC	PIT INLET CAPACITY
FC	REACH FAILURE (LIMIT) CODE

LIMIT CODES		
	*	HYDRAULIC LIMITING
	#	INLET LIMITING
	@	INLET SURCHARGE
	$	ZERO INLET CAPACITY

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 10/1												
50	.431	11.00	169.88	.912	.100	.331	10/2	.000	NONE	.30	1.40	.431
POINT NO 10/2												
50	.472	11.05	169.59	1.002	.200	.000	10/2a	.272	11/1	.40	1.50	.042
POINT NO 11/1												
50	1.083	11.00	169.88	1.718	.273	.000	10/5	.810	12/1	1.00	2.40	.810
POINT NO 12/1												
50	.994	11.00	169.88	.391	.077	.917	10/6	.000	NONE	.22	.55	.184
POINT NO 10/2a												
50	.199	11.16	168.92	1.002	.200	.000	10/3	.000	NONE	.40	1.50	.000
POINT NO 10/3												
50	.198	11.28	168.18	1.002	.199	.000	10/4	.000	NONE	.40	1.50	.000
POINT NO 10/4												
50	.395	11.53	166.67	1.432	.187	.000	10/5	.208	10/6	.65	2.10	.199
POINT NO 10/5												
50	.438	11.18	168.76	3.100	.439	.000	10/6	.000	NONE	1.65	4.42	.000
POINT NO 10/6												
50	1.720	11.26	168.30	3.680	.939	.781	10/7	.000	NONE	2.08	5.18	.088

?

RATHGL HYDROLOGIC ANALYSIS CRITICAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	CRITICAL AREA TC MIN	RAINFALL INTENSITY MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	OVERLAND NODE	OUTFLOWS FLOW CUMEC	OUTFLOWS NODE	CUMULATIVE IMPERV HA	AREAS TOTAL HA	LOCAL INFLOW CUMEC
POINT NO 10/7												
50	1.786	12.08	163.59	3.931	.867	.000	10/8	.920	13/1	2.23	5.53	.114
POINT NO 13/1												
50	2.055	12.00	164.01	2.486	.258	1.797	13/2	.000	NONE	1.40	3.50	1.133
POINT NO 10/8												
50	.880	12.18	163.00	3.967	.739	.000	10/9	.141	13/2	2.27	5.57	.016
POINT NO 13/2												
50	2.258	12.06	163.70	2.630	.407	1.852	13/3	.000	NONE	1.56	3.66	.065
POINT NO 13/3												
50	2.186	13.05	158.45	2.630	.392	1.794	D1	.000	NONE	1.56	3.66	.000
POINT NO 10/9												
50	.730	12.56	160.98	3.967	.727	.002	D1	.000	NONE	2.27	5.57	.000
POINT NO D1												
50	2.920	12.60	160.76	6.540	2.920	.000	NONE	.000	NONE	3.83	9.13	.000

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD	TOTAL FLOW	TOTAL AREA	TC	RAINFALL INTENSIT	EQ IMP AREA	PIPE FLOW	OVERLAND FLOW	OVERLAND NODE	OUTFLOWS FL	* TOTAL

RATHGL OUTPUT
PEARL BEACH - CATCHMENT B
50 Year ARI - Existing
File: Pearl 2.out

YEARS	CUMEC	MIN	MM/HR	HA	CUMEC	CUMEC		CUMEC		HA
POINT NO 10/1										
50	.431	11.00	169.88	.912	.100	.331	10/2	.000	NONE	1.40
POINT NO 10/2										
50	.472	11.05	169.59	1.002	.200	.000	10/2a	.272	11/1	1.50
POINT NO 11/1										
50	1.083	11.00	169.88	1.718	.273	.000	10/5	.810	12/1	2.40
POINT NO 12/1										
50	.994	11.00	169.88	.391	.077	.917	10/6	.000	NONE	.55
POINT NO 10/2a										
50	.199	11.16	168.92	1.002	.199	.000	10/3	.000	NONE	1.50
POINT NO 10/3										
50	.198	11.28	168.18	1.002	.198	.000	10/4	.000	NONE	1.50
POINT NO 10/4										
50	.395	11.53	166.67	1.432	.187	.000	10/5	.208	10/6	2.10
POINT NO 10/5										
50	.449	11.95	164.28	3.149	.439	.000	10/6	.010	NONE	4.50
POINT NO 10/6										
50	1.697	12.03	163.86	3.729	.939	.759	10/7	.000	NONE	5.26

RATHGL HYDROLOGIC ANALYSIS TOTAL AREA RESULTS

RETURN PERIOD YEARS	TOTAL FLOW CUMEC	TOTAL AREA TC MIN	RAINFALL INTENSIT MM/HR	EQ IMP AREA HA	PIPE FLOW CUMEC	OVERLAND FLOW CUMEC	NODE	OUTFLOWS FLOW CUMEC	NODE	* TOTAL * AREA HA
POINT NO 10/7										
50	1.764	12.84	159.49	3.981	.867	.000	10/8	.897	13/1	5.61
POINT NO 13/1										
50	2.055	12.00	164.01	2.486	.258	1.797	13/2	.000	NONE	3.50
POINT NO 10/8										
50	.879	12.95	158.94	4.017	.739	.000	10/9	.141	13/2	5.65
POINT NO 13/2										
50	2.262	12.06	163.70	2.630	.407	1.855	13/3	.000	NONE	3.66
POINT NO 13/3										
50	2.189	13.05	158.45	2.630	.392	1.797	D1	.000	NONE	3.66
POINT NO 10/9										
50	.730	13.33	157.06	4.017	.727	.003	D1	.000	NONE	5.65
POINT NO D1										
50	2.896	13.37	156.85	6.647	2.896	.000	NONE	.000	NONE	9.31

HGL PIPE NETWORK ANALYSIS SUMMARY RETURN PERIOD 50 YEARS
PROJECT:PEARL BEACH 1

ITEM	DIM	RESULT							
RN	-	1	2	3	4	5	6	7	8
PN	-	10/1	10/2	11/1	12/1	10/2a	10/3	10/4	10/5

DN	-	10/2	10/2a	10/5	10/6	10/3	10/4	10/5	10/6
PT	-	99	99	99	99	99	99	99	99
DHGL	M	22.492	17.836	7.671	7.650	14.365	8.402	7.671	7.650
DO	M	.375	.375	.600	.450	.375	.375	.375	.600
QO	M3/S	.100	.200	.273	.077	.200	.199	.187	.439
VEL	M/S	.905	1.811	.967	.487	1.811	1.803	1.695	1.554
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0025	.0100	.0016	.0006	.0100	.0099	.0088	.0041
LEN	M	5.50	20.00	22.00	9.50	22.00	46.00	50.00	5.00
HGLP	M	22.506	22.325	7.706	7.656	17.786	14.095	8.109	7.671
KU	-	3.00	1.00	2.00	3.00	.30	1.00	2.00	.00
KW	-	3.00	1.00	2.00	3.00	.30	1.00	2.00	.00
UHGL	M	22.631	22.492	7.801	7.692	17.836	14.261	8.402	7.671
UWSL	M	22.631	22.492	7.801	7.692	17.836	14.261	8.402	7.671
MWSL	M	23.361	23.261	7.800	7.691	18.041	14.916	8.402	7.700
IF	M3/S	.100	.100	.273	.077	.000	.000	-.009	.000
IC	M3/S	.100	.100	.420	.100	.000	.000	.100	.000
FC	-	#	#	*	*	$	$	@*	$

ITEM	DIM	RESULT							
RN	-	9	10	11	12	13	14	15	16
PN	-	10/6	10/7	13/1	10/8	13/2	13/3	10/9	D1
DN	-	10/7	10/8	13/2	10/9	13/3	D1	D1	D1
PT	-	99	99	99	99	99	99	99	0
DHGL	M	4.711	4.611	3.841	3.050	3.295	3.000	3.000	.000
DO	M	.600	.600	.450	.600	.525	2.100	2.100	2.100
QO	M3/S	.939	.867	.258	.739	.407	.392	.727	2.920
VEL	M/S	3.320	1.532	.812	2.613	1.879	.113	.210	.000
KP	-	.00	.00	.00	.00	.00	.00	.00	.00
SF	M/M	.0185	.0040	.0016	.0115	.0071	.0000	.0000	.0000
LEN	M	98.00	10.00	10.00	45.00	59.50	5.00	5.00	.00
HGLP	M	6.527	4.651	3.940	3.568	3.715	3.200	3.000	.000
KU	-	2.00	.50	3.00	3.00	.70	.00	.00	.00
KW	-	2.00	.50	3.00	3.00	.70	.00	.00	.00
UHGL	M	7.650	4.711	4.041	4.611	3.841	3.200	3.000	3.000
UWSL	M	7.650	4.711	4.041	4.611	3.841	3.200	3.000	3.000
MWSL	M	7.654	4.715	4.036	4.615	3.936	3.398	3.100	3.000
IF	M3/S	.425	-.046	.258	-.125	.150	.000	.000	.000
IC	M3/S	.520	.140	.470	.200	.150	.000	.000	.000
FC	-	*	@*	*	@*	#	$	$	$*

END OF SUMMARY RETURN PERIOD 50 YEARS

ITEM	MEANING
RN	REACH NUMBER
PN	PIT NAME
DN	DOWNSTREAM PIT NAME
PT	PIT TYPE
DHGL	DOWNSTREAM TAKE-OFF HGL
DO	PIPE DIAMETER
QO	PIPE FLOW
VEL	PIPE VELOCITY
KP	INTER-NODAL LOSS COEFFICIENT
SF	PIPE FRICTION SLOPE
LEN	PIPE LENGTH
HGLP	PIT DOWNSTREAM HGL
KU	PIT PRESSURE CHANGE COEFFICIENT
KW	PIT WATER SURFACE COEFFICIENT
UHGL	PIT UPSTREAM HGL
UWSL	PIT WATER SURFACE LEVEL
MWSL	PIT WATER SURFACE LEVEL LIMIT
IF	PIT INLET FLOW
IC	PIT INLET CAPACITY
FC	REACH FAILURE (LIMIT) CODE

LIMIT CODES	*	HYDRAULIC LIMITING
	#	INLET LIMITING
	@	INLET SURCHARGE
	$	ZERO INLET CAPACITY

APPENDIX E

LAGOON – HYDRAULIC COMPUTATIONS

* * * I L S A X * * *

Version V2.05 April 1989
Produced at University of Technology, Sydney
for IBM-PC and compatible microcomputers

* *
*
* PEARL BEACH LAGOON ANALYSIS *
*
* PEARL BEACH *
*
* RUN NUMBER : 1 NO. OF RAINFALL PATTERNS IS 1 *
* HYDROGRAPHS ARE FORMED USING TIME-AREA METHOD APPLIED TO RAINFALLS *
* GRASSED AREA LOSSES ARE SUBTRACTED FROM FLOW DEPTH DISTRIBUTION *
* DEFAULT MODE IS DESIGN *
* TIME SHIFT ROUTING *
* DETAILED OUTPUT *
* DIAMETER AND UNIT COST SET USED IS : *
* EXACT DIAMETERS 152 TO 2134 mm, COSTS AT AUGUST 1988 *
* MINIMUM DIAMETER IS 300 mm *
* MANNING'S EQUATION IS USED FOR PIPES *
* OLD AND NEW DEFAULT PIPE ROUGHNESSES ARE .012 AND .012 *
*
* *

RUN & RAINFALL FILE : PEARL.RN
SYSTEM PIPE FILE : PEARL.DAT
OUTPUT DATA FILE : P.OUT
INTERMEDIATE DATA FILE : not used

USER ..... DATE 19/8/92.

REFERENCE Lagoon outlet culvert tailwater = RL 2.0

.....

CATCHMENT PARAMETERS
****

DEPRESSION STORAGE (mm) PAVED AREA	DEPRESSION STORAGE (mm) GRASSED	SOIL TYPE 1234=ABCD 5=NEW	AMC	INFILTRATION PARAMETERS	
				FI =	38.0 mm
				F0 =	200.0 mm/h
				FC =	13.0 mm/h
1.0	10.0	2.00	2.00	K =	2.0 /h
				FID =	35.0 mm
				INITIAL RATE =	130.1 mm/h

RAINFALL PARAMETERS AND DATA
****

DURATION (minutes)	TIME INCREMENT (minutes)	NUMBER OF RAINFALL INCREMENTS	TOTAL RAINFALL (mm)
60.0	5.0	12	.0

STANDARD AUSTRALIAN RAINFALL PATTERN FOR ZONE 1
WITH AVERAGE INTENSITY .00 mm/h (MULTIPLIER = 1.000)

.0 .0 .0 .0 .0 .0 .0 .0 .0 .0
.0 .0

COMPUTATIONAL TIME STEP = 5.0 minutes

PIPE SYSTEM DETAILS
****

REACH L1 - 1 ** EVALUATION MODE **
****

NO SUBCATCHMENT

	PAVED	SUPPLEMENTARY	GRASSED	TOTAL CONTRIBUTING
ACCUMULATED AREA	.00 ha	.00 ha	.00 ha	.00 ha
	.0 %	.0 %	.0 %	.0 %

USER-PROVIDED HYDROGRAPH WITHIN PIPES (m3/s) - VOLUME = 19800 m3

DETENTION BASIN ROUTING

HEIGHT-STORAGE-OUTFLOW RELATIONSHIP

HEIGHT (m)	STORAGE (m3)	OUTFLOW (m3/s)
2.400	0.	.000
2.600	1800.	1.320
2.800	3600.	2.310
3.000	5400.	3.480
3.200	7200.	4.830
3.400	9000.	6.270
3.600	10800.	6.870

STARTING STORAGE IS 0. m3

VOLUMES OF INFLOW AND OUTFLOW HYDROGRAPHS ARE 19800. AND 19799. m3
AND RESPECTIVE PEAKS ARE 11.000 AND 6.051 m3/s
PEAK HEIGHT IN BASIN IS 3.370 m, AND TIME OF PONDING IS 275.0 minutes

INFLOW HYDROGRAPH (m3/s)

.000 2.750 5.500 8.250 11.000 9.625 8.250 6.875 5.500 4.125
2.750 1.375 .000

OUTFLOW HYDROGRAPH (m3/s)

.000 .273 1.036 1.992 3.295 4.689 5.591 6.013 6.051 5.785
5.282 4.606 3.813 3.095 2.545 2.124 1.800 1.526 1.285 1.030
.826 .662 .531 .426 .341 .274 .220 .176 .141 .113
.091 .073 .058 .047 .037 .030 .024 .019 .015 .012
.010 .008 .006 .005 .004 .003 .003 .002 .002 .001
.001 .001 .001 .001 .000

* * * I L S A X * * *

Version V2.05 April 1989
Produced at University of Technology, Sydney
for IBM-PC and compatible microcomputers

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* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                                               *
*  PEARL BEACH LAGOON ANALYSIS                                                  *
*                                                                               *
*  PEARL BEACH                                                                  *
*                                                                               *
*  RUN NUMBER :  1           NO. OF RAINFALL PATTERNS IS  1                     *
*  HYDROGRAPHS ARE FORMED USING TIME-AREA METHOD APPLIED TO RAINFALLS           *
*  GRASSED AREA LOSSES ARE SUBTRACTED FROM FLOW DEPTH DISTRIBUTION              *
*  DEFAULT MODE IS DESIGN                                                       *
*  TIME SHIFT ROUTING                                                           *
*  DETAILED OUTPUT                                                              *
*  DIAMETER AND UNIT COST SET USED IS :                                         *
*   EXACT DIAMETERS 152 TO 2134 mm, COSTS AT AUGUST 1988                        *
*  MINIMUM DIAMETER IS  300 mm                                                  *
*  MANNING'S EQUATION IS USED FOR PIPES                                         *
*  OLD AND NEW DEFAULT PIPE ROUGHNESSES ARE  .012 AND  .012                     *
*                                                                               *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

RUN & RAINFALL FILE : PEARL.RN
SYSTEM PIPE FILE : P3_0.DAT
OUTPUT DATA FILE : P3_0.OUT
INTERMEDIATE DATA FILE : not used

USER .... DATE ..19/8/92..

REFERENCE ..Lagoon outlet culvert tailwater = RL 3.0

....

CATCHMENT PARAMETERS
****

DEPRESSION STORAGE (mm) PAVED AREA	GRASSED	SOIL TYPE 1234=ABCD 5=NEW	AMC	INFILTRATION PARAMETERS	
				FI =	38.0 mm
				F0 =	200.0 mm/h
				FC =	13.0 mm/h
1.0	10.0	2.00	2.00	K =	2.0 /h
				FID =	35.0 mm
				INITIAL RATE =	130.1 mm/h

RAINFALL PARAMETERS AND DATA
****

DURATION (minutes)	TIME INCREMENT (minutes)	NUMBER OF RAINFALL INCREMENTS	TOTAL RAINFALL (mm)
60.0	5.0	12	.0

STANDARD AUSTRALIAN RAINFALL PATTERN FOR ZONE 1
WITH AVERAGE INTENSITY .00 mm/h (MULTIPLIER = 1.000)

.0 .0 .0 .0 .0 .0 .0 .0 .0 .0
.0 .0

COMPUTATIONAL TIME STEP = 5.0 minutes

PIPE SYSTEM DETAILS

****

REACH L1 - 1 ** EVALUATION MODE **

****

NO SUBCATCHMENT

	PAVED	SUPPLEMENTARY	GRASSED	TOTAL CONTRIBUTING
ACCUMULATED AREA	.00 ha	.00 ha	.00 ha	.00 ha
	.0 %	.0 %	.0 %	.0 %

USER-PROVIDED HYDROGRAPH WITHIN PIPES (m3/s) - VOLUME = 19800 m3

DETENTION BASIN ROUTING

HEIGHT-STORAGE-OUTFLOW RELATIONSHIP

HEIGHT (m)	STORAGE (m3)	OUTFLOW (m3/s)
2.400	0.	.000
3.000	5400.	.010
3.100	6300.	2.710
3.200	7200.	4.080
3.400	9000.	5.500
3.600	10800.	6.730

STARTING STORAGE IS 0. m3

OUTFLOW HYDROGRAPH IS CURTAILED

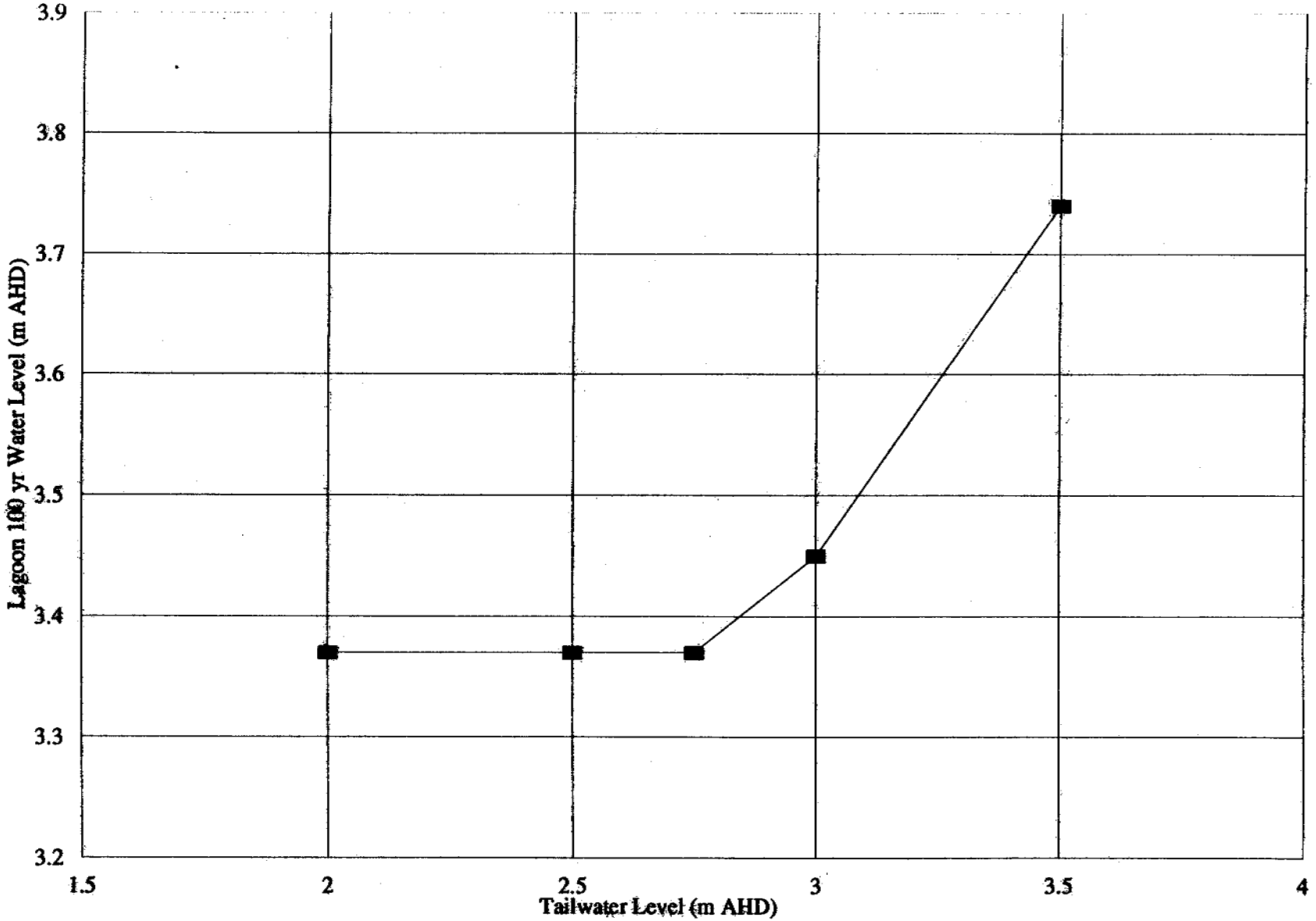
VOLUMES OF INFLOW AND OUTFLOW HYDROGRAPHS ARE 19800. AND 16142. m3
AND RESPECTIVE PEAKS ARE 11.000 AND 6.079 m3/s
PEAK HEIGHT IN BASIN IS 3.494 m, AND TIME OF PONDING IS 3600.0 minutes

INFLOW HYDROGRAPH (m3/s)

.000 2.750 5.500 8.250 11.000 9.625 8.250 6.875 5.500 4.125
2.750 1.375 .000

OUTFLOW HYDROGRAPH (m3/s)

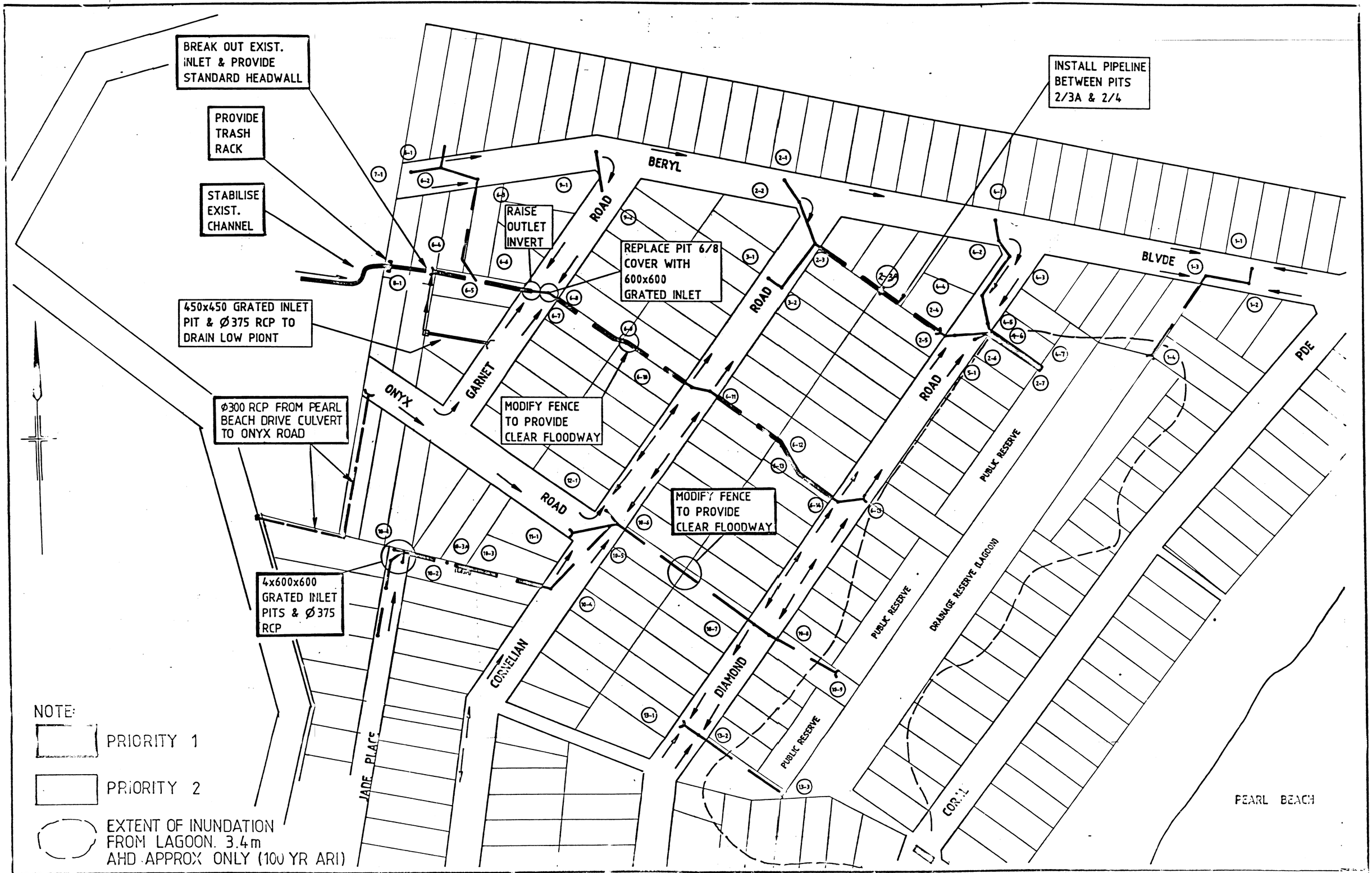
.000 .001 .003 .007 2.483 4.880 5.709 6.054 6.079 5.843
5.382 4.679 3.649 2.012 .763 .290 .110 .042 .016 .010
.010 .010 .010 .010 .010 .010 .010 .010 .010 .010
.010 .010 .010 .010 .010 .010 .010 .010 .010 .010
.010 .010 .010 .010 .010 .010 .010 .010 .010 .010



(Lagoon)

Aug-92 Pearl Beach Stormwater - Flooding and Drainage Investigation

100 yr Lagoon Water Level
vs Tailwater Level



No.	Description	Date	Inits.
	Revisions		

Job

FLOODING & DRAINAGE INVESTIGATION – PEARL BEACH

Design		Traced	
Drawn		Checked	
Scale	1:2000		
Approved			
Date			

Gutteridge, Haskins & Davey Pty Ltd
Incorporated in ACT
Consulting Engineers – Planners – Surveyors
99 Regent St., Railway Square
Tel. 699 7070

FIGURE 3.1
PROPOSED MINOR WORKS

Job No.

LEGEND

- NODE NUMBER
- STORMWATER PIPE
- (1.8m) STORMWATER PIPE WITHIN EASEMENT (WIDTH)
- SEWER PIPE
- 8 / 69 LOT NUMBERS / STREET NUMBERS
- T TELECOM SERVICE
- W WATER MAIN SERVICE
- FL5.35(S) / FL4.76(P) FLOOR LEVEL S - SLAB, P - PIERS
- HOUSE (SURVEYED)
- OVERLAND FLOWPATH OR REPORTED PROPERTY INUNDATION
- PROPERTY & HOUSE INUNDATION (88.90) (FROM QUESTIONNAIRES)
- HOUSE - SCHEMATIC ONLY (UNSURVEYED)
- DRAINAGE RESERVE
- PUBLIC RESERVE
- EXTENT OF INUNDATION FROM LAGOON 3.4m AHD APPROX ONLY (100 YR ARI)

CAD Drawing File Name & Plot Date

DWG NAME : 24071-12.DWG
PLOT DATE : 01/10/1992

No.	Date	Amendment	Initial

Client: GOSFORD CITY COUNCIL

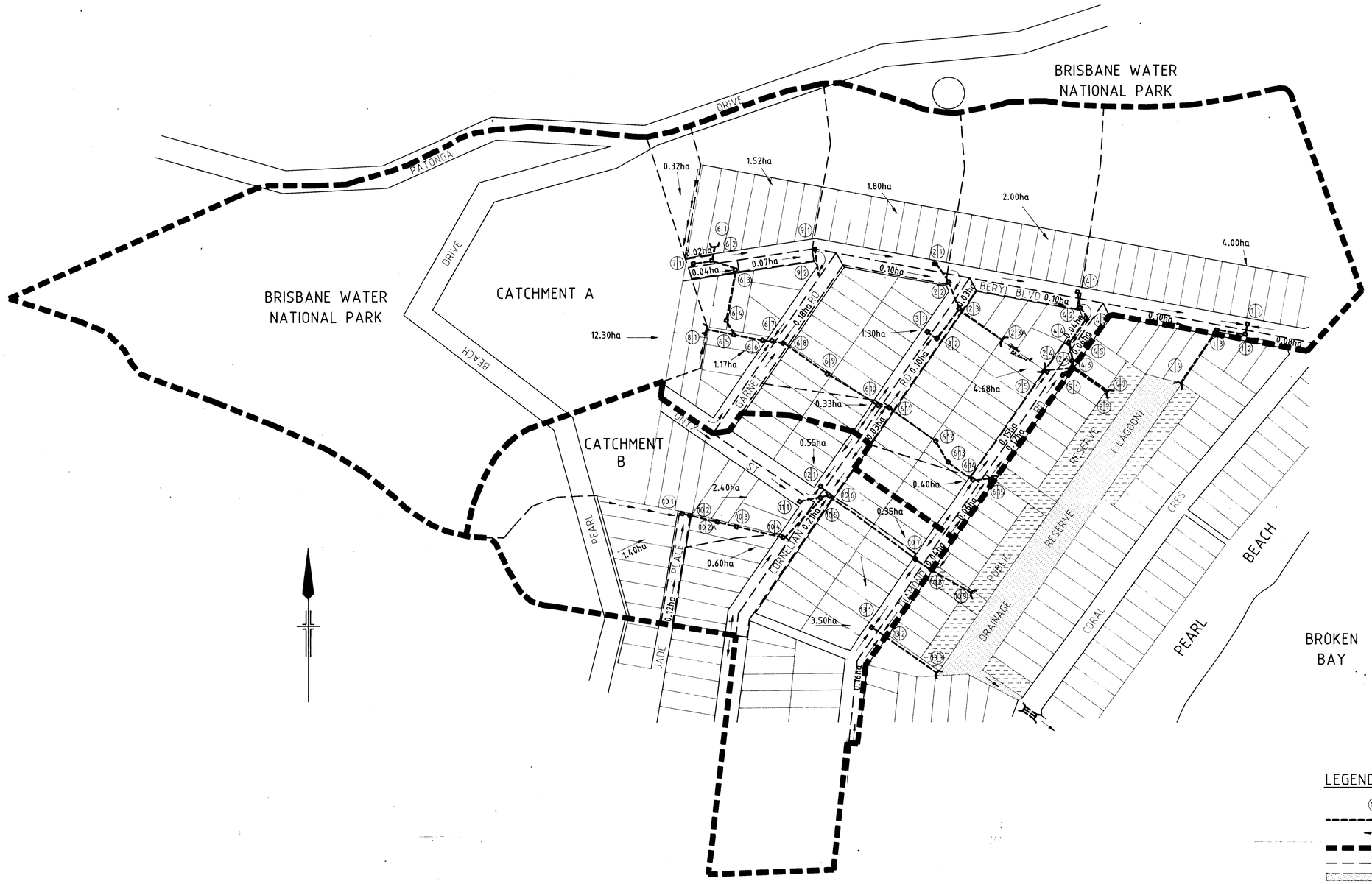
Gutteridge Haskins & Davey Pty Ltd fnr in ACT
Consulting Engineers, Planners, Surveyors, Project Managers
39 Regent Street, Railway Square
Tel No. (02) 690 7070 Fax No. (062 698 1780

Design Engineer	D BANNIGAN	Scale 1 : 1000	
Draftsperson	P STARC	Checked	
		Approved	Date

Job: FLOODING & DRAINAGE INVESTIGATION PEARL BEACH

Title: EXISTING DRAINAGE SYSTEM

Job No.	Drg. No.	Amdt.
214-024071	1.2	



LEGEND

- (11) NODE No.
- STORMWATER PIPE
- DIRECTION OF OVERLAND FLOW
- CATCHMENT BOUNDARY
- SUB-CATCHMENT BOUNDARY
- DRAINAGE RESERVE
- PUBLIC RESERVE

SCALE 1:2000 — 0 40 80m — 40 20

No.	Date	Amendment	Initial

No.	Date	Amendment	Initial

No.	Date	Amendment	Initial
–			

Client: GOSFORD CITY COUNCIL

Gutteridge Haskins & Davey Pty Ltd Inc in ACT
Consulting Engineers, Planners, Surveyors, Project Managers
GHD 39 Regent Street, Railway Square
Tel No. (02) 690 7070 Fax No. (062 698 1780
AZEA

Design Engineer	J LAWRENCE	Scale 1:2000	
Draftsperson	P STARC	Checked	

Job: FLOODING & DRAINAGE INVESTIGATION PEARL BEACH

Checked	Date
Approved	Date

Title: CATCHMENT PLAN –

Job No.	Drg. No.	Amdt.
214-024071	1.1	

RE-SURFACE ROAD TO PROVIDE 2 WAY 3% CROSSFALL

3×600×600 GRATED INLET PITS

600×600 GRATED INLET PIT

Ø900 RCP FROM 8/1 TO 6/15

Ø600 RCP

Ø600 RCP BENEATH 900 DEEP DRAIN

3×600×600 GRATED INLET PITS

2.4W×0.48H RCBC 1/1 TO 1/3

DRIVE

BEACH

GARNET ST

ONYX ST

BERYL BLVD

EASEMENT

PDE

PEARL ST

JADE ST

CORNELIAN DRIVE

DIAMOND ST

DRAINAGE

CORAL

PEARL BEACH

NOTE:

PRIORITY 3

PRIORITY 4

EXTENT OF INUNDATION FROM LAGOON. 3.4m AHD APPROX ONLY (100 YR ARI)

No.	Description	Date	Inits.
	Revisions		

Job
FLOODING & DRAINAGE INVESTIGATION - PEARL BEACH

Design		Traced	
Drawn		Checked	
Scale	1: 2000		
Approved			
Date			

Gutteridge, Haskins & Davey Pty Ltd.
Incorporated in ACT
Consulting Engineers – Planners – Surveyors

30 Regent St., Railway Square
Tel. 699 7070

FIGURE 3.2
PROPOSED MAJOR WORKS

Job No.
214/024071
PROPOSED MAJOR WORKS

End of Report