

SUMMARIES OF RAINFALL DATA FOR GISBORNE AIRPORT  
 From the New Zealand Meteorological Service

RAINFALL OVER PERIOD 1937 TO 1980  
 (Rainfall in millimetres)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Highest monthly/ annual total	233	242	376	283	343	328	321	294	207	238	224	204	1431
Mean	72	69	91	98	103	116	115	116	83	70	57	68	1058
Lowest monthly/ annual total	4	3	12	8	18	26	19	38	8	20	3	8	717
Maximum 1-day rainfall	116	152	79	105	113	156	121	113	63	61	104	92	156
Maximum 2-day rainfall	128	168	139	126	170	218	150	148	100	84	150	97	218

HIGHEST RAINFALL IN ANY 24 HOUR PERIOD  
 (Rainfall in millimetres)

Year	Rainfall	Year	Rainfall
		1965	113 [Aug 13-14]
		1966	85
		1967	55
1948	114	1968	76
1949	72	1969	66
1950	121	1970	73
1951	59	1971	105 [May 03]
1952	65	1972	60
1953	83	1973	96
1954	93	1974	85
1955	119	1975	67
1956	77	1976	62
1957	112	1977	215 [Jun 20-21]
1958	94	1978	165 [Feb 05-06]
1959	83	1979	56
1960	112 [Nov 18-19]	1980	67
1961	121 [Jan 15-16]	1981	61
1962	93	1982	113 [Apr 09-10]
1963	80	1983	69
1964	94	1984	96
		1985	200 * [Jul 25-26]

\* 88 to 113 mm recorded in Makorori Beach on this date

GISBORNE AIRPORT - DAILY RAINFALL RECORD

1984

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Rainfall in millimetres													
DAY	:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
-----													
1	:		11		5			1	4	3	9		
2	:		1		4	1				1		1	
3	:		10								4	15	
4	:			5					1		1	12	
5	:		7	9			14	1	4				1
6	:	12		4			87		2				1
7	:		1	19			6	6		1			
8	:		1	6				1		7	2		
9	:		1			7							
10	:		1	10		8							8
11	:		29			5		2	1				7
12	:	10	2			1		6	3				
13	:						2		8	16			2
14	:	19		6				2	7	4			17
15	:					1		26	43	2		1	
16	:	3	4	3	9			12	1	2			
17	:		5					6		4			
18	:		2		7					15	2		
19	:	1			1		2			9			
20	:				1		8			7			
21	:				3		2			37			
22	:			6						12	3		5
23	:	10		23	1	10	9	1		1			2
24	:			1		12				9			
25	:			4		2		4				30	
26	:			3	1					6		3	
27	:									16			
28	:			3	3								
29	:	11											5
30	:	1				3	8		8	37			3
31	:								9				
-----													
MONTHLY	:												
TOTAL	:	67	75	102	35	50	138	68	91	189	21	62	51
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GISBORNE AIRPORT - DAILY RAINFALL RECORD

1985

Rainfall in millimetres

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1					4	19					8	
2	3		16		7	13		2				12
3	1			13	9	1		4	13		11	2
4									7	6	2	1
5								1				
6				2		6		8	1			
7			1			23						
8	3	4	5				1			2		
9			2									
10							1	1	5	2		
11	11				2				7	2		
12					1		2	6			2	
13			4		1	2	3	1				
14			17		2	2		4				
15		2	6	2	7	12			1	4		4
16		10	8	1	4	9				2		
17		31			3				2	1		
18						1			2	5		
19							4	5	2			
20				17			55		17		5	
21	1					1	23	1	3	3		
22					7	3						
23			2		43	12					4	
24						12	19					
25	3			9	19	5	200	4	3	3	2	
26	2		33	2	1	1	6	1	1	7	27	
27	5		18	5	10		4	1		5	1	
28				2	9		2	3				
29				30	4			2			3	2
30			1	14	9	2						
31					11		5					
MONTHLY												
TOTAL	29	47	113	97	153	124	325	44	64	42	65	21

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Rainfall in millimetres													
DAY	:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
-----													
	:												
1	:			15.0		1.0	17.5		1.5				
2	:	3.0				2.5	5.0						7.0
3	:				12.0	4.5				10.5		21.0	8.0
4	:				0.5				1.0	6.0	9.0	2.5	1.0
5	:					3.0			0.5	0.5	2.5		
6	:				4.5		5.0		8.5				
7	:						15.0		1.0				
8	:		8.5	12.0			1.0	1.5			2.0		
9	:		0.5	14.0				0.5	1.0			0.5	
10	:										1.5		
11	:	8.5				7.0				15.0	5.5		
12	:	0.5				0.5		6.0	7.0	0.5		1.5	
13	:			3.5		1.5	2.0	4.0	1.0			2.0	
14	:			14.0		1.0	1.0		6.0				
15	:		1.0	4.0	3.5	7.0	19.0		1.0	2.0	3.0		2.0
16	:		6.0	13.0	8.0	8.5	5.0				2.5		1.0
17	:		18.5	1.0	8.0	9.5	0.5			5.0	1.0		
18	:			0.5	3.0	0.5	1.0	2.0			3.0		
19	:		1.5					3.0	6.0	5.0	1.0		
20	:				16.0			45.0		11.0			
21	:							9.0	3.0	4.5	4.5		
22	:		6.0			12.0	6.5	1.0		1.0			
23	:		0.5	2.0		55.0	3.5					2.0	0.5
24	:					0.5	6.5	13.0		1.0	0.5		
25	:	3.0			5.0		2.0	110.0	2.5	2.0	3.0	8.5	
26	:			22.0	2.0	1.5	3.0	5.0	2.0	3.5	8.0	2.5	
27	:	3.0		13.0	1.0	8.0		6.0	0.5		3.5	6.0	
28	:				1.5	3.0		9.0	6.5	1.5	0.5		
29	:	2.0			25.0	5.0						2.5	3.0
30	:				14.0	8.0	2.5			1.0		0.5	
31	:			1.5		11.0		1.5					
-----													
MONTHLY	:												
TOTAL	:	20.0	42.5	115.5	104.0	150.5	96.0	216.5	49.0	70.0	51.0	49.5	22.5
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RAINFALL RECORD - RAINGAUGES NOS. 1 TO 5

1984 - 1985

Date of reading :			Raingauge Readings (mm)					Average
Date	Month	Year	1	2	3	4	5	
2	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
3	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
6	Aug	1984	7.0	7.0	5.0	7.0	7.0	6.6
7	Aug	1984	2.8	2.8	1.9	2.8	3.8	2.8
8	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
14	Aug	1984	13.0	13.0	16.0	15.0	12.0	13.8
16	Aug	1984	32.0	29.0	35.0	27.0	26.0	29.8
20	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
21	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
22	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
24	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
27	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
30	Aug	1984	0.0	0.0	0.0	0.0	0.0	0.0
3	Sept	1984	15.0	15.0	15.0	14.0	14.0	14.6
4	Sept	1984	0.0	0.0	0.0	0.0	0.0	0.0
6	Sept	1984	0.0	0.0	0.0	0.0	0.0	0.0
10	Sept	1984	8.0	8.0	8.0	8.0	9.0	8.2
13	Sept	1984	1.5	1.0	1.0	0.0	1.0	0.9
17	Sept	1984	16.0	15.0	13.0	15.0	15.0	14.8
18	Sept	1984	1.0	1.0	1.0	1.0	1.0	1.0
20	Sept	1984	41.0	41.0	36.0	38.0	40.0	39.2
21	Sept	1984	5.0	5.0	4.0	4.0	4.0	4.4
22	Sept	1984	62.0	62.0	63.0	57.0	55.0	59.8
25	Sept	1984	6.0	6.0	7.0	7.0	7.0	6.6
26	Sept	1984	0.0	0.0	0.0	0.0	0.0	0.0
28	Sept	1984	25.0	21.0	15.0	18.0	20.0	19.8
2	Oct	1984	48.0	49.0	38.0	42.0	49.0	45.2
3	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
4	Oct	1984	5.0	5.0	4.0	4.0	5.0	4.6
5	Oct	1984	4.0	3.5	4.0	4.0	4.0	3.9
8	Oct	1984	1.0	1.0	0.0	1.0	0.0	0.6
9	Oct	1984	2.0	2.0	2.0	1.0	2.0	1.8
10	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
11	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
15	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
16	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
18	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
19	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
23	Oct	1984	5.0	5.0	4.0	4.0	6.0	4.8
25	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
26	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
31	Oct	1984	0.0	0.0	0.0	0.0	0.0	0.0
5	Nov	1984	22.0	21.0	0.0	23.0	22.0	17.6
7	Nov	1984	0.0	0.0	0.0	0.0	0.0	0.0
20	Dec	1984	0.0	0.0	0.0	0.0	0.0	0.0

RAINFALL RECORD - RAINGAUGES NOS. 1 TO 5

1984 - 1985

Date of reading :			Raingauge Readings (mm)					Average
Date	Month	Year	1	2	3	4	5	
19	Apr	1985	0.0	0.0	0.0	0.0	0.0	0.0
27	Jun	1985	0.0	0.0	0.0	0.0	0.0	0.0
1	Jul	1985	4.0	0.7	0.0	5.1	3.5	2.7
4	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
5	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
8	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
9	Jul	1985	2.0	1.0	1.0	1.5	1.5	1.4
10	Jul	1985	1.5	1.0	0.8	0.8	1.3	1.1
11	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
12	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
15	Jul	1985	11.0	10.0	11.0	10.0	10.0	10.4
16	Jul	1985	0.8	0.8	0.3	0.8	0.5	0.6
17	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
18	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
19	Jul	1985	3.0	2.5	2.8	2.8	3.0	2.8
22	Jul	1985	56.0	52.0	54.0	50.0	50.0	52.4
23	Jul	1985	0.8	1.0	0.8	0.8	1.0	0.9
25	Jul	1985	20.0	17.0	22.0	23.0	25.0	21.4
26	Jul	1985	111.0	113.0	101.0	90.0	88.0	100.6
29	Jul	1985	19.0	18.0	16.0	18.0	21.0	18.4
30	Jul	1985	0.0	0.5	0.5	0.0	1.0	0.4
31	Jul	1985	0.0	0.0	0.0	0.0	0.0	0.0
5	Aug	1985	6.0	5.5	5.5	5.0	5.5	5.5
6	Aug	1985	0.8	0.3	0.5	0.3	0.3	0.4
7	Aug	1985	9.5	9.5	7.5	7.0	7.5	8.2
23	Sep	1985	88.0	81.0	78.0	77.0	65.0	77.8

MAKORORI BEACH - RAINGAUGES NOS. 1 TO 5 (AVERAGE) - RAINFALL REC 1984 - 85

Rainfall in millimetres

DAY	1984					1985		
	AUG	SEP	OCT	NOV		JUL	AUG	SEP
1		14.6					77.8	
2	0.0		0.0	22.2	0.0	5.5		
3		0.0	4.6					
4	6.6	0.0	3.9		0.0			
5						0.4		
6	2.8		0.6	0.0	0.0	8.2		
7	0.0	8.2						
8			1.8			1.4		
9			0.0			1.1		
10	13.8		0.0			0.0		
11		0.9				0.0		
12			0.0			10.4		
13								
14	29.8	14.8						
15			0.0			0.6		
16			0.0			0.0		
17	0.0	1.0				0.0		
18		39.2	0.0			2.8		
19								
20	0.0	4.4	4.8			52.4		
21	0.0	59.8						
22	0.0					0.9		
23		6.6				21.4		
24			0.0					
25	0.0	0.0	0.0			100.6		
26		19.8						
27						18.4		
28	0.0		0.0					
29		45.2				0.4		
30						0.0		
31								
MONTHLY								
TOTAL	53.0	214.5	15.7	22.2		210.4	14.1	77.8
				*			*	*

\* Part month only

MAKORORI BEACH TOWNSHIP : P2535/1

PERMEABILITY TEST RESULTS

METHOD: Groundwater level is recorded at the start of the test.  
A quantity of water is poured into the piezometer and the fall in  
in water level in the piezometer with time is recorded.

The permeability (k) is calculated after Hvorslev (1951) where

$$k = \frac{d^2 \ln(2mL/D)}{8L(t_2 - t_1)} \ln(H_1/H_2)$$

d = diameter standpipe

D = diameter of hole/filter

m = transformation ratio = 1

L = length of aquifer tested

H<sub>1</sub> = piezometric head for time t<sub>1</sub>

H<sub>2</sub> = piezometric head for time t<sub>2</sub>

SUMMARY OF RESULTS:

BOREHOLE NO.	PERMEABILITY (k) m/sec
1	4.6 x 10 <sup>-9</sup>
5	3.2 x 10 <sup>-8</sup>
6	2.4 x 10 <sup>-8</sup>
8	1.2 x 10 <sup>-9</sup> + 1.1 x 10 <sup>-9</sup>



FIELD DATA AND RESULTS

BOREHOLE NO. 1

Groundwater level at start of test - 4.12m below ground level  
(5.15m below top of pipe)

Elapsed time Minutes	Depth below top of pipe - metres	Depth below ground level - metres
1	2.86	2.04
1.5	2.89	2.07
2	2.91	2.09
2.5	2.94	2.12
3	2.97	2.15
3.5	2.98	2.16
4	3	2.18
4.5	3.02	2.2
5	3.04	2.22
5.5	3.06	2.24
6	3.07	2.25
6.5	3.08	2.26
7	3.11	2.29
7.5	3.13	2.31
8	3.14	2.32
8.5	3.16	2.34
9	3.18	2.36
9.5	3.19	2.37
10	3.2	2.38
11	3.24	2.42
12	3.26	2.44
13	3.29	2.47
14	3.32	2.5
15	3.34	2.52
16	3.36	2.54
17	3.39	2.57
18	3.41	2.59
19	3.44	2.62
20	3.46	2.64
500	4.5	3.68
1200	5.2	4.38

d = 37.5mm      D = 75mm  
m = 1            L = 6.47m

Period = 20 to 500 minutes

Permeability =  $4.6 \times 10^{-9}$  m/sec.  
=====

BOREHOLE NO. 5

Groundwater level at start of test - 4.37m below ground level  
(5.40m below top of pipe)

Elapsed Time Minutes	Depth below top of pipe - metres	Depth below ground level - metres
0.5	3.25	2.22
1	3.27	2.24
1.5	3.28	2.25
2	3.29	2.26
2.5	3.3	2.27
3	3.31	2.28
3.5	3.32	2.29
4	3.33	2.3
4.5	3.34	2.31
5	3.35	2.32
6	3.36	2.33
7	3.37	2.34
8	3.39	2.36
9	3.4	2.37
10	3.41	2.38
12	3.43	2.4
14	3.45	2.42
16	3.465	2.435
18	3.49	2.46
20	3.52	2.49
25	3.57	2.54
30	3.65	2.62
40	3.7	2.67
45	3.74	2.71
55	3.82	2.79
65	3.9	2.87
75	3.97	2.94
90	4.07	3.04
210	4.6	3.57
300	4.8	3.77

d = 75mm      D = 75mm  
m = 1          L = 5.83m

Period = 210 to 300 minutes

Permeability =  $3.2 \times 10^{-8}$  m/sec  
=====

BOREHOLE NO. 6

Groundwater level at start of test - 6.27m below ground level  
(7.2m below top of pipe)

Elapsed time Minutes	Depth below top of pipe - metres	Depth below ground level - metres
0.5	5	4.07
1	5.01	4.08
1.5	5.02	4.09
2	5.05	4.12
2.5	5.05	4.12
3	5.06	4.13
3.5	5.07	4.14
4	5.09	4.16
4.5	5.1	4.17
5	5.11	4.18
6	5.13	4.2
7	5.16	4.23
8	5.165	4.235
9	5.17	4.24
10	5.19	4.26
12	5.23	4.3
14	5.25	4.32
16	5.27	4.34
18	5.29	4.36
20	5.31	4.38
26	5.38	4.45
30	5.4	4.47
35	5.47	4.54
40	5.52	4.59
50	5.6	4.67
60	5.67	4.74
105	5.94	5.01
165	6.03	5.1
310	6.32	5.39

d = 75mm      D = 75mm  
m = 1          L = 4.0m

Period = 105 to 310 minutes

Permeability =  $2.4 \times 10^{-8}$  m/sec  
=====

BOREHOLE NO. 8

Groundwater level at start of test - 5.3m below ground level  
(6.2m below top of pipe)

Elapsed time Minutes	Depth below top of pipe - metres	Depth below ground level - metres
0.5	4.71	3.81
1	4.83	3.93
1.5	4.89	3.99
2	4.95	4.05
2.5	5	4.1
3	5.045	4.145
3.5	5.09	4.19
4	5.12	4.22
4.5	5.15	4.25
5	5.175	4.275
6	5.245	4.345
7	5.3	4.4
8.5	5.37	4.47
9	5.39	4.49
10	5.425	4.525
11	5.465	4.565
12	5.49	4.59
13	5.52	4.62
14	5.53	4.63
16	5.55	4.65
18	5.57	4.67
20	5.59	4.69
25	5.615	4.715
30	5.62	4.72
35	5.64	4.74
40	5.66	4.76
50	5.67	4.77
60	5.7	4.8
5000	5.82	4.92

d = 75mm  
m = 1

D = 75mm  
L = 2.78m

d = 75mm  
m = 1

D = 75mm  
L = 2.3m

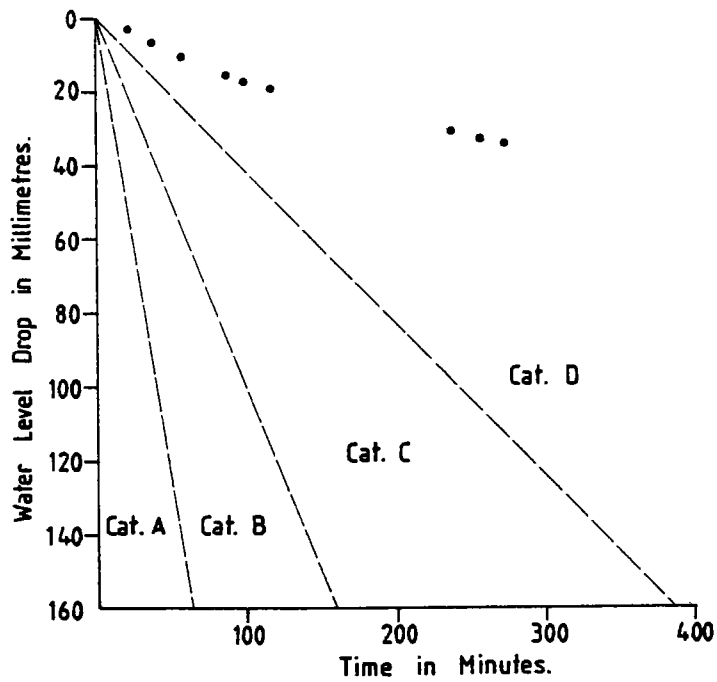
Period = 1 to 12 minutes

Period = 60 to 5000 minutes

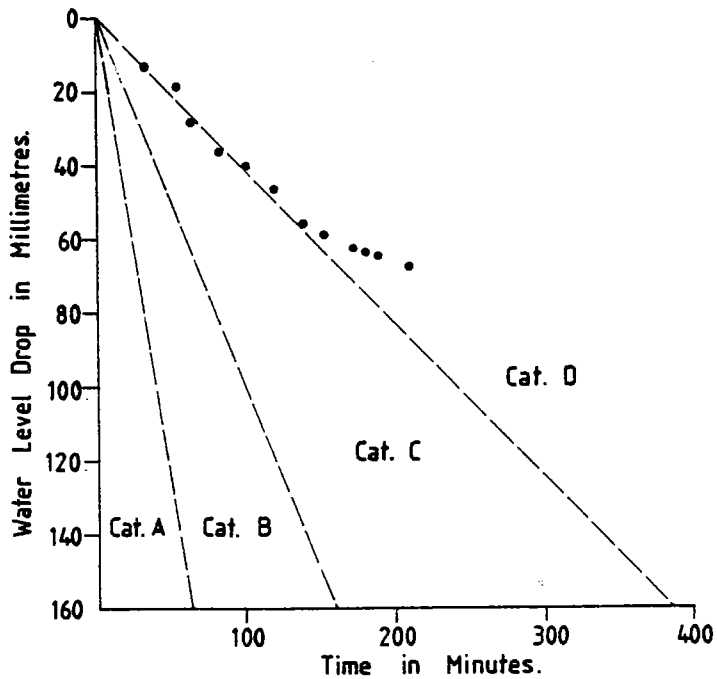
Permeability =  $1.1 \times 10^{-9}$  m/sec  
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Permeability =  $1.2 \times 10^{-6}$  m/sec  
=====

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### BORE N° 1



### BORE N° 5

NOTE: Categories in accordance with Table 2, NZS 4610: 1982. Household Septic Tank Systems.

## PERCOLATION TEST RESULTS - MAKORORI BEACH TOWNSHIP



Kingston Reynolds Thom & Allardice Limited  
Architects Engineers Planners and Quantity Surveyors

Designed WJRS

Drawn WJS

Traced

Checked *J Sheehy*

Date March 1986

Project

2535/1

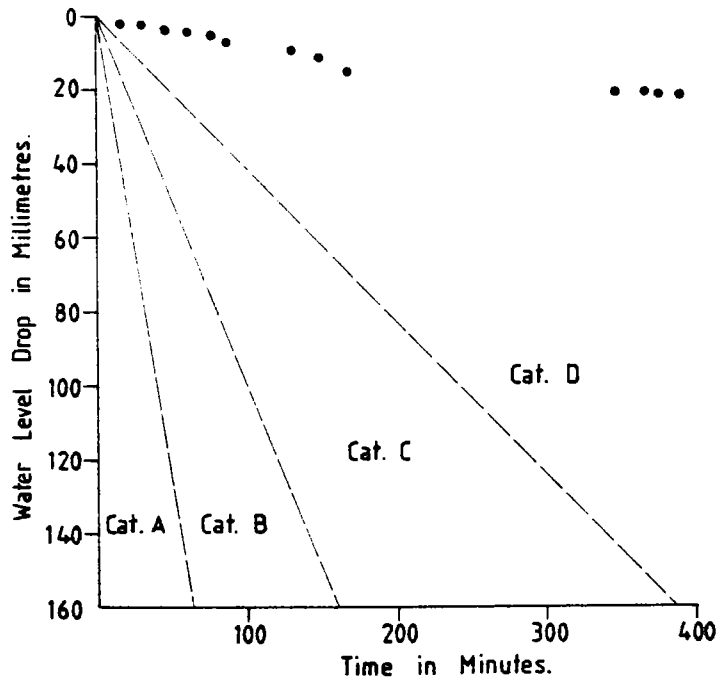
Scales -

Drawing

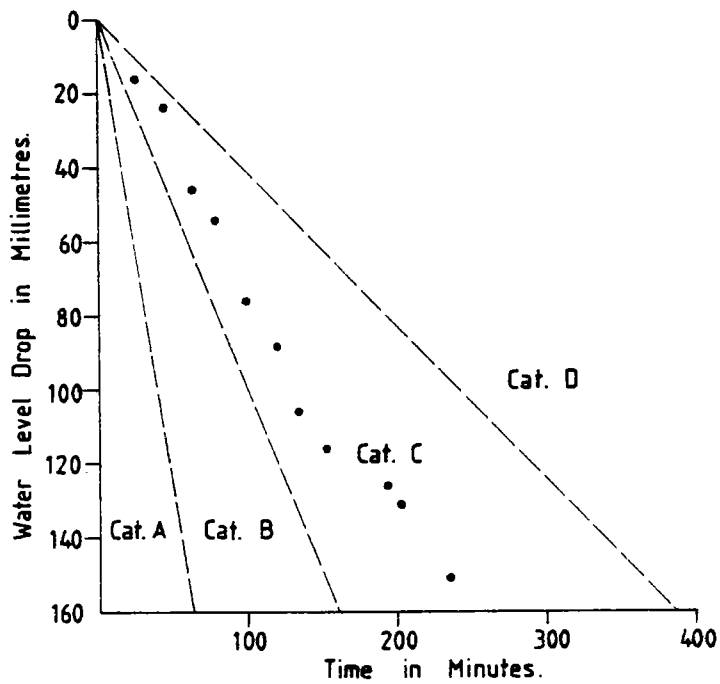
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### BORE N° 6



### BORE N° 8

NOTE: Categories in accordance with Table 2, NZS 4610:1982. Household Septic Tank Systems.

## PERCOLATION TEST RESULTS - MAKORORI BEACH TOWNSHIP



Kingston Reynolds Thom & Allardice Limited  
Architects Engineers Planners and Quantity Surveyors

Designed WJRS  
Drawn WJS  
Tracer  
Checked JSheehy

Date March 1986  
Project 2535/1

Scales -  
Drawing Rev

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