Tasmania

Tasmanian Geological Survey
Record 2001/12

A review of groundwater monitoring at Rosetta (1991–2001)

A. Waite

Introduction

A landslide was identified in the Hone Road area of Rosetta in 1990 and declared as a landslip zone, as defined under the *Local Government (Building and Miscellaneous Provisions) Act 1993*. Donaldson (1991) regarded groundwater as a major contributor to landslide activity in the area, and piezometers were installed to monitor groundwater levels.

A series of active and passive drainage systems was installed in the landslide by the Glenorchy City Council (GCC) in the period 1991/1992. Groundwater monitoring in the landslide and surrounding area has continued on a regular basis since 1991.

This report provides a summary of the observations made between 1991 and 2001.

Previous work

Investigations in 1990 (Weldon, 1990*a*, *b*) and 1991 (Donaldson, 1991) confirmed the existence of an active landslide in the Hone Road area at Rosetta. During the investigation work by Donaldson (1991), a number of piezometers were installed in boreholes to monitor groundwater levels in the body of the landslide and the surrounding area (fig. 1).

The investigation by Donaldson (1991) identified groundwater levels as a significant contributor to the activity of the landslide. In the period 1991–1992, the Glenorchy City Council installed a number of active and passive drainage systems in the area to control groundwater. These consisted of a number of horizontal drains drilled at low angles into the landslide body, and three vertical extraction boreholes up gradient of the active landslide and fitted with automatically operated borehole pumps. Water produced from these drainage systems was directed to stormwater lines outside the landslip zone. The locations of the vertical wells and drainage fans are shown in Figure 2.

The effects of these dewatering measures on the local groundwater has been observed by regular monitoring of the water levels in the piezometers and vertical extraction wells.

Groundwater monitoring

Piezometers in a total of 17 boreholes were measured on a regular basis over the period from 1991 to 2001. Certain boreholes became unusable over the period, and monitoring in these was discontinued. Water levels in the three vertical pumped drainage boreholes were also monitored.

Flow rates from the sub-horizontal drains, based on the time required to fill a calibrated container, were recorded during the periods of borehole and piezometer monitoring.

At each monitoring period, a sample of groundwater was also extracted from the common discharge point of the horizontal drainage system and transferred to the MRT laboratory for conductivity analysis.

The results of the piezometer and borehole water level monitoring are summarised in graphical form in Appendix 1, and graphs of monthly and annual rainfall data for the period are presented in Appendix 2. Flow rates from the horizontal drains are shown in Appendix 3 and water conductivity readings in Appendix 4.

Discussion

Examination of the monitoring data indicates that a noticeable decrease in average groundwater levels has been observed in most holes over the period from 1991, although water levels in a small number of the boreholes showed very little change over the period.

The greatest changes have occurred in the area with the greatest density of horizontal drains, with significant decreases (up to 10 m) in groundwater level observed in boreholes 7, 7a and 23. The holes showing the least or no difference are those wholly within geological materials other than Tertiary sediments, suggesting the presence of different hydrogeological conditions in these older fractured aquifers and

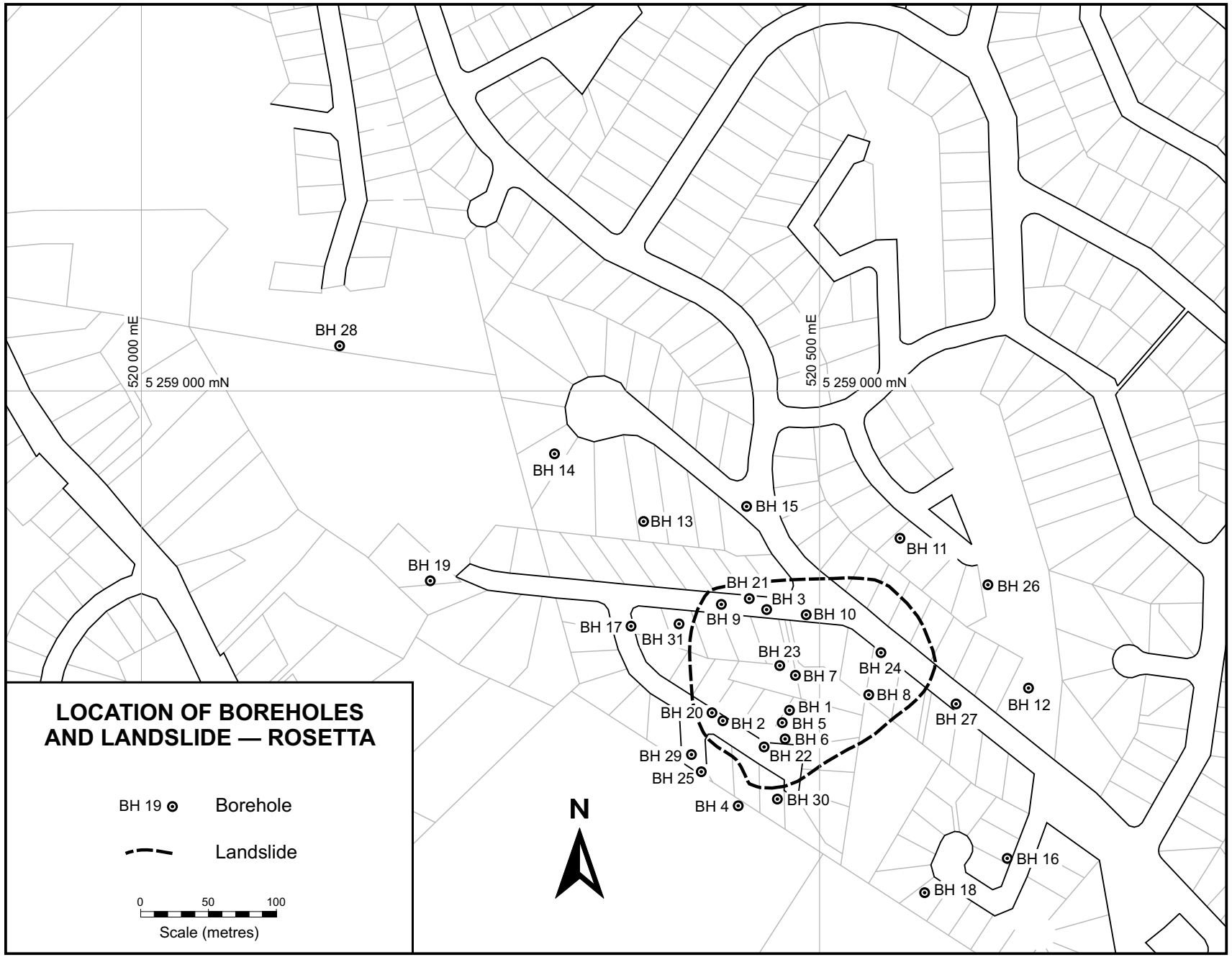

LOCATION OF BOREHOLES
AND LANDSLIDE — ROSETTA
BH 19 Borehole
Landslide
0 50 100
Scale (metres)
520 000 mE
5 259 000 mN
520 500 mE
5 259 000 mN
N
BH 28
BH 14
BH 15
BH 13
BH 11
BH 19
BH 21
BH 3
BH 9
BH 10
BH 17
BH 31
BH 23
BH 7
BH 24
BH 8
BH 26
BH 12
BH 27
BH 20
BH 2
BH 1
BH 5
BH 6
BH 22
BH 29
BH 25
BH 4
BH 30
BH 16
BH 18

Figure 1

possible boundary conditions between them and the Tertiary sediments. In these cases, the minor differences may possibly be attributable to long-term variations in rainfall patterns.

Borehole 18 showed an increase in observed water level over the period, indicating a source of recharge to this location. This anomalous behaviour may also be influenced by the local hydrogeological conditions, resulting from the hole's proximity to a fault line.

The 'crude but direct' relationship between rainfall and groundwater levels, with rapid response times to rainfall events (Donaldson, 1991), has generally become more obvious since 1991, indicating that the dewatering measures have probably significantly altered local hydrogeological conditions. The success of the dewatering is also indicated by the reduction in flow rates from the horizontal drains over time (Appendix 3).

The sensitivity of the local groundwater to recharge is confirmed by the conductivity data (Appendix 4). There is a strong relationship between major rainfall events and the decreasing conductivity, in particular for the period of peak rainfall from 1995 to 1997.

Recommendations

The regular monitoring of the groundwater levels in the Rosetta boreholes and drains should continue, with the data being passed to the Glenorchy City Council as part of the management plan for the Rosetta landslide. Regular reviews of the results should be carried out by private consultants and the number and nature of the monitoring locations should be reconsidered if appropriate.

References

DONALDSON, R. C. 1991. Rosetta landslide, geological investigation and slope risk assessment. *Unpublished Report Division of Mines and Mineral Resources Tasmania* 1991/20.

WELDON, B. D. 1990*a*. Investigation of a landslide, Hone Road–Officer Street, Rosetta. *Unpublished Report Division of Mines and Mineral Resources Tasmania* 1990/20.

WELDON, B. D. 1990*b*. Interim report on a landslide at Hone Road, Rosetta *Unpublished Report Division of Mines and Mineral Resources Tasmania* 1990/29.

[5 December 2001]

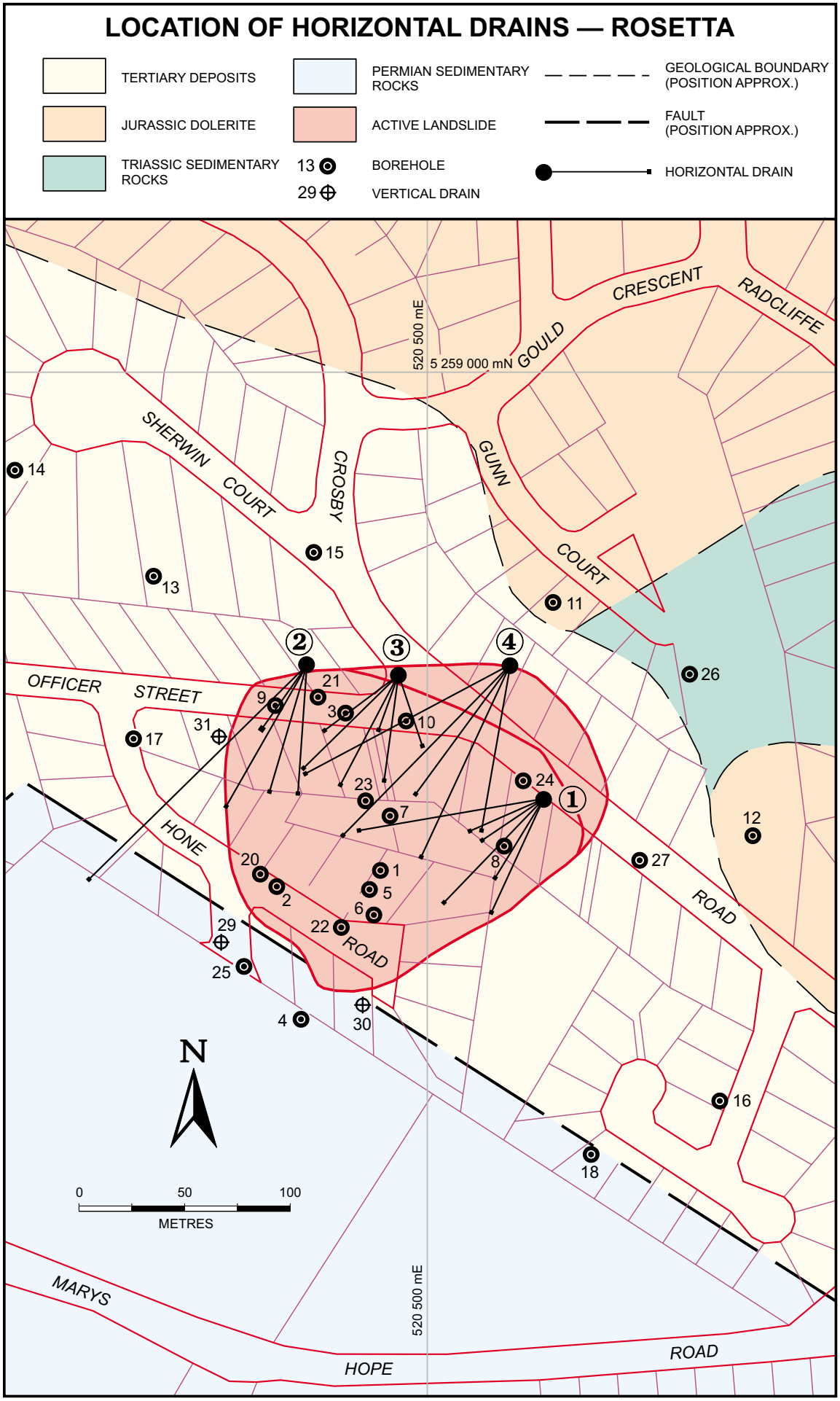
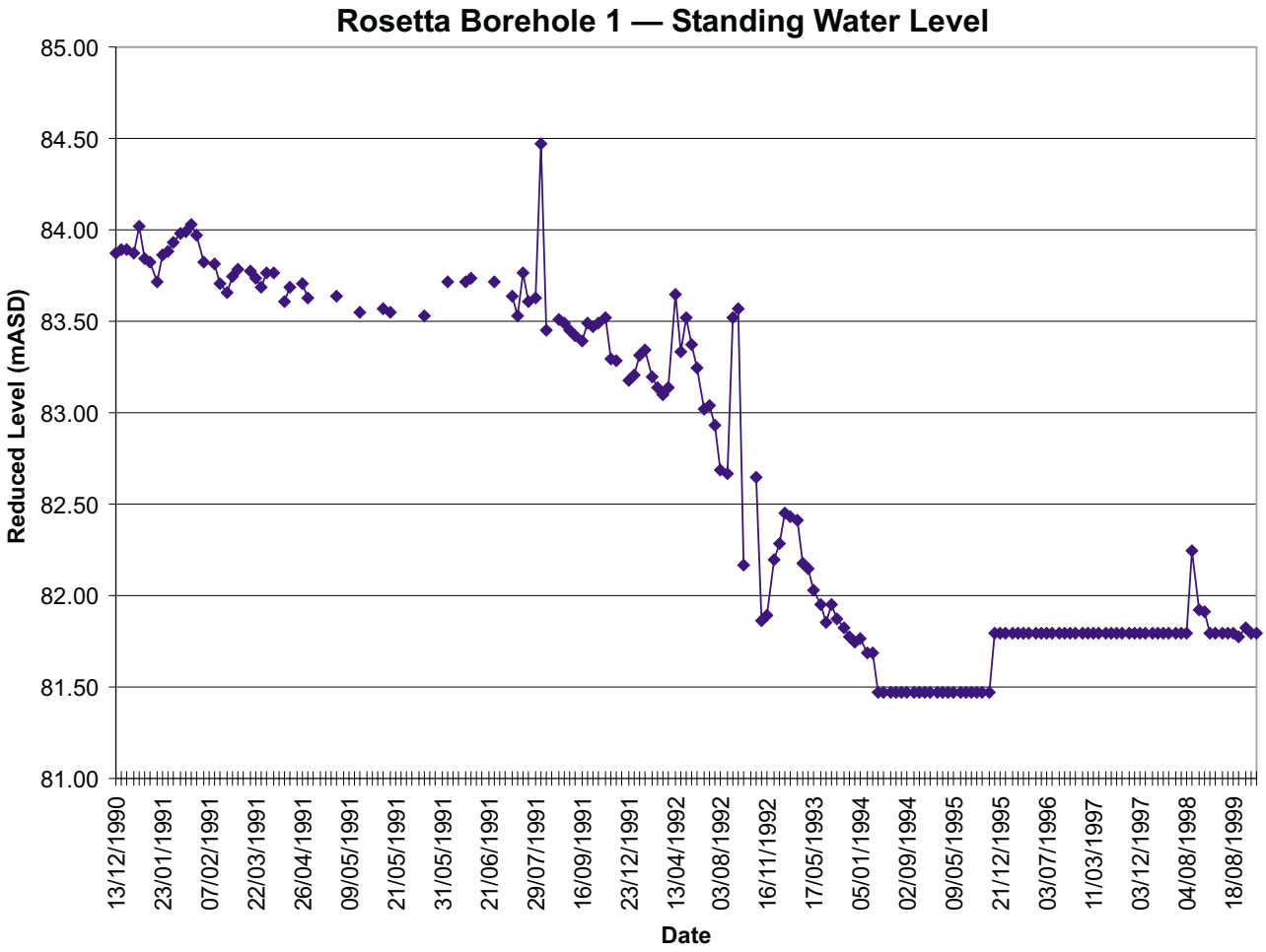
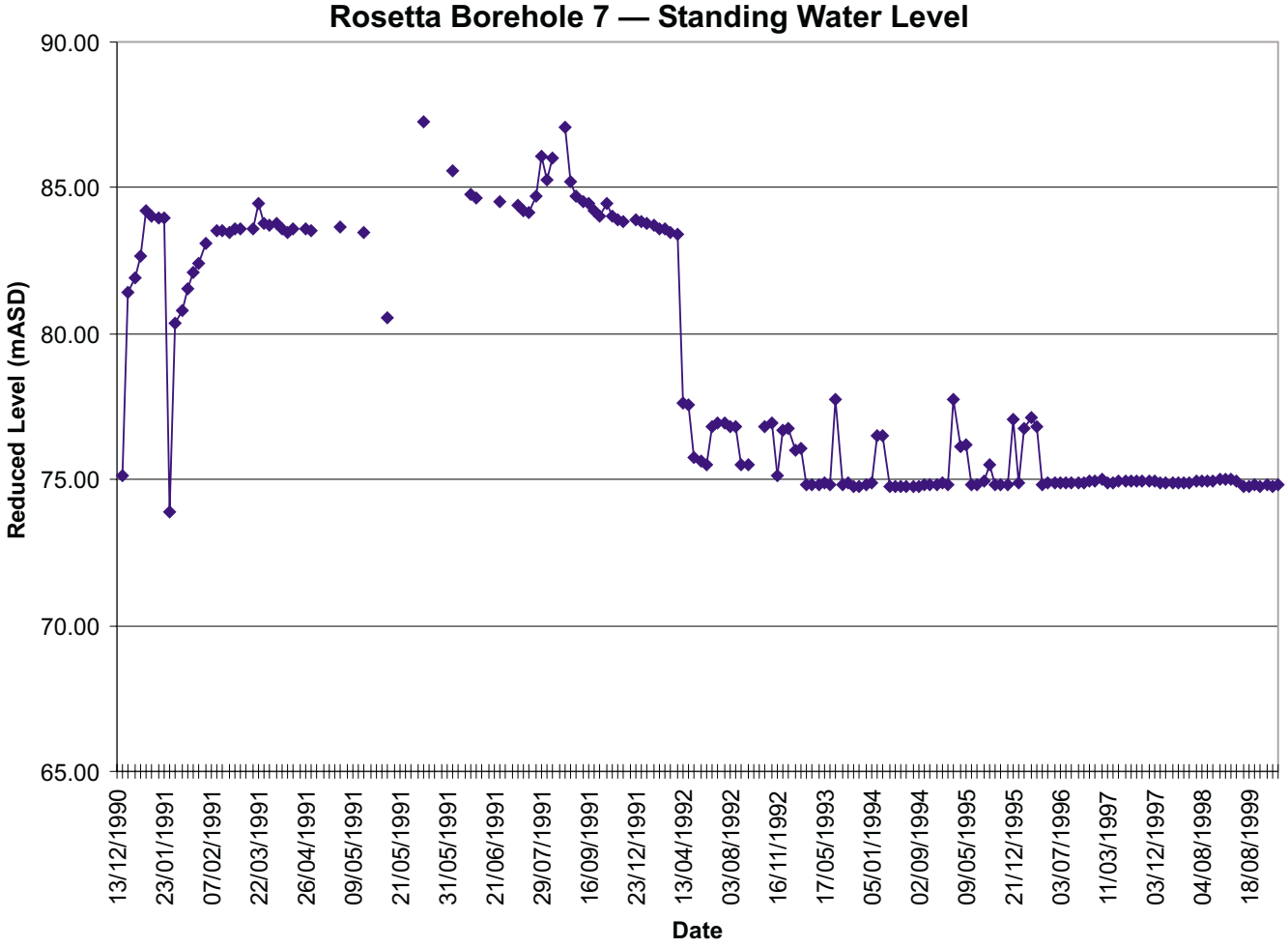

LOCATION OF HORIZONTAL DRAINS — ROSETTA
TERTIARY DEPOSITS
JURASSIC DOLERITE
TRIASSIC SEDIMENTARY ROCKS
PERMIAN SEDIMENTARY ROCKS
ACTIVE LANDSLIDE
13 BOREHOLE
29 VERTICAL DRAIN
GEOLOGICAL BOUNDARY (POSITION APPROX.)
FAULT (POSITION APPROX.)
HORIZONTAL DRAIN
520 500 mE
5 259 000 mN
GOULD
CRESCENT
RADCLIFFE
SHERWIN
COURT
CROSBY
GUNN
COURT
OFFICER
STREET
HONE
ROAD
ROAD
MARYS
HOPE
ROAD
N
0
50
100
METRES
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20
21
22
23
24
25
26
27
29
30
31

Figure 2

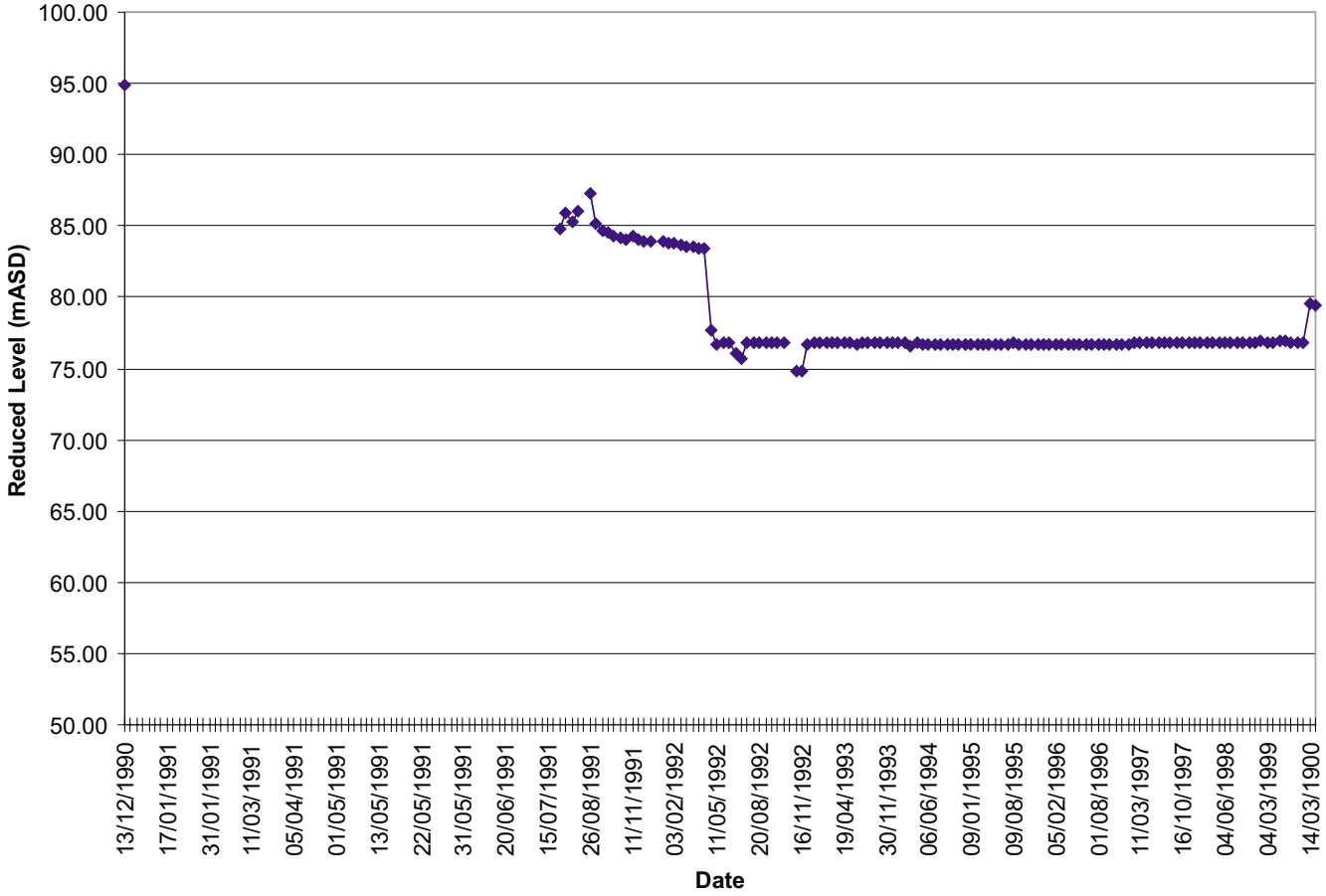
APPENDIX 1

Groundwater levels in boreholes

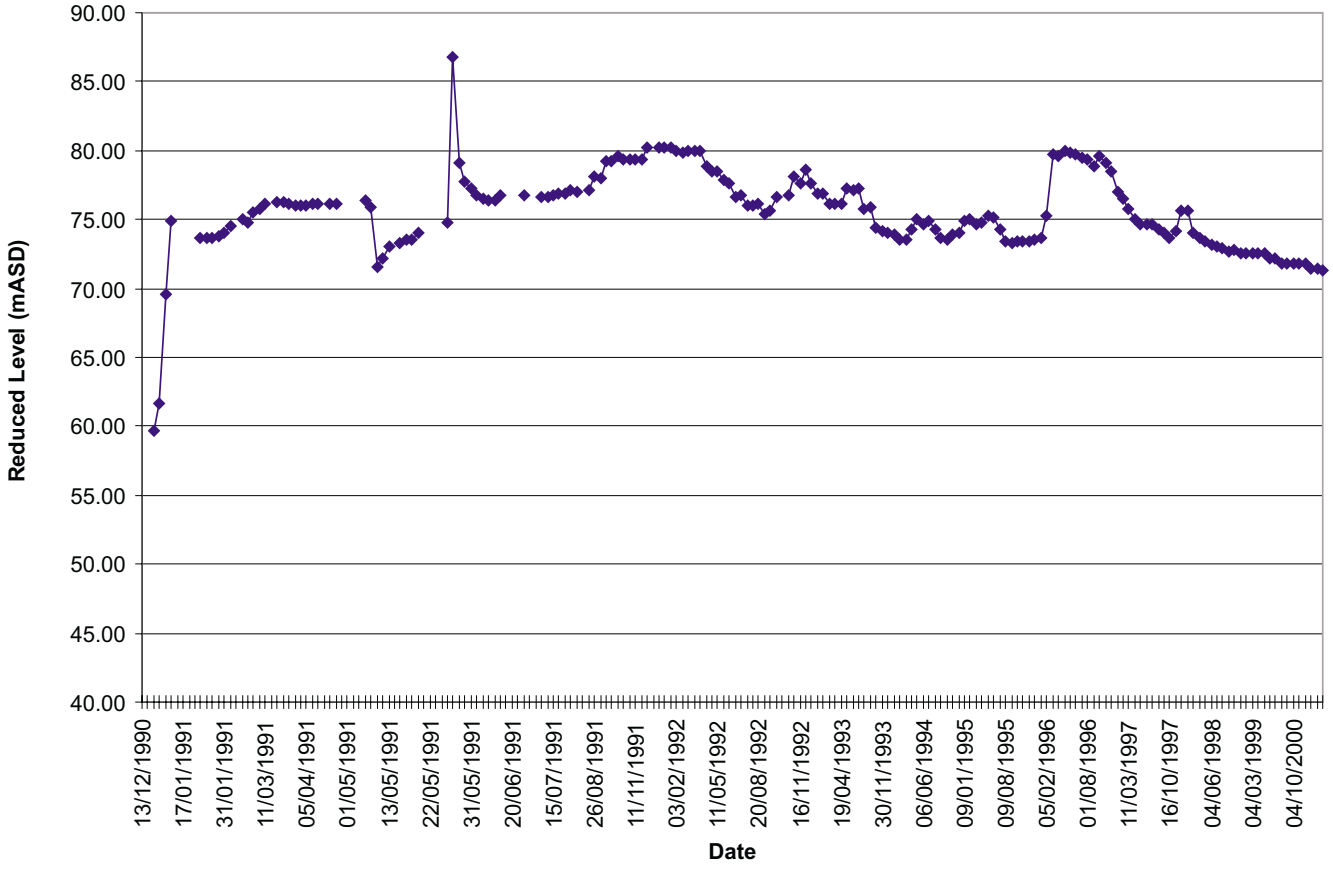

Rosetta Borehole 1 — Standing Water Level
Reduced Level (mASD)
85.00
84.50
84.00
83.50
83.00
82.50
82.00
81.50
81.00
13/12/1990
23/01/1991
07/02/1991
22/03/1991
26/04/1991
09/05/1991
21/05/1991
31/05/1991
21/06/1991
29/07/1991
16/09/1991
23/12/1991
13/04/1992
03/08/1992
16/11/1992
17/05/1993
05/01/1994
02/09/1994
09/05/1995
21/12/1995
03/07/1996
11/03/1997
03/12/1997
04/08/1998
18/08/1999
Date

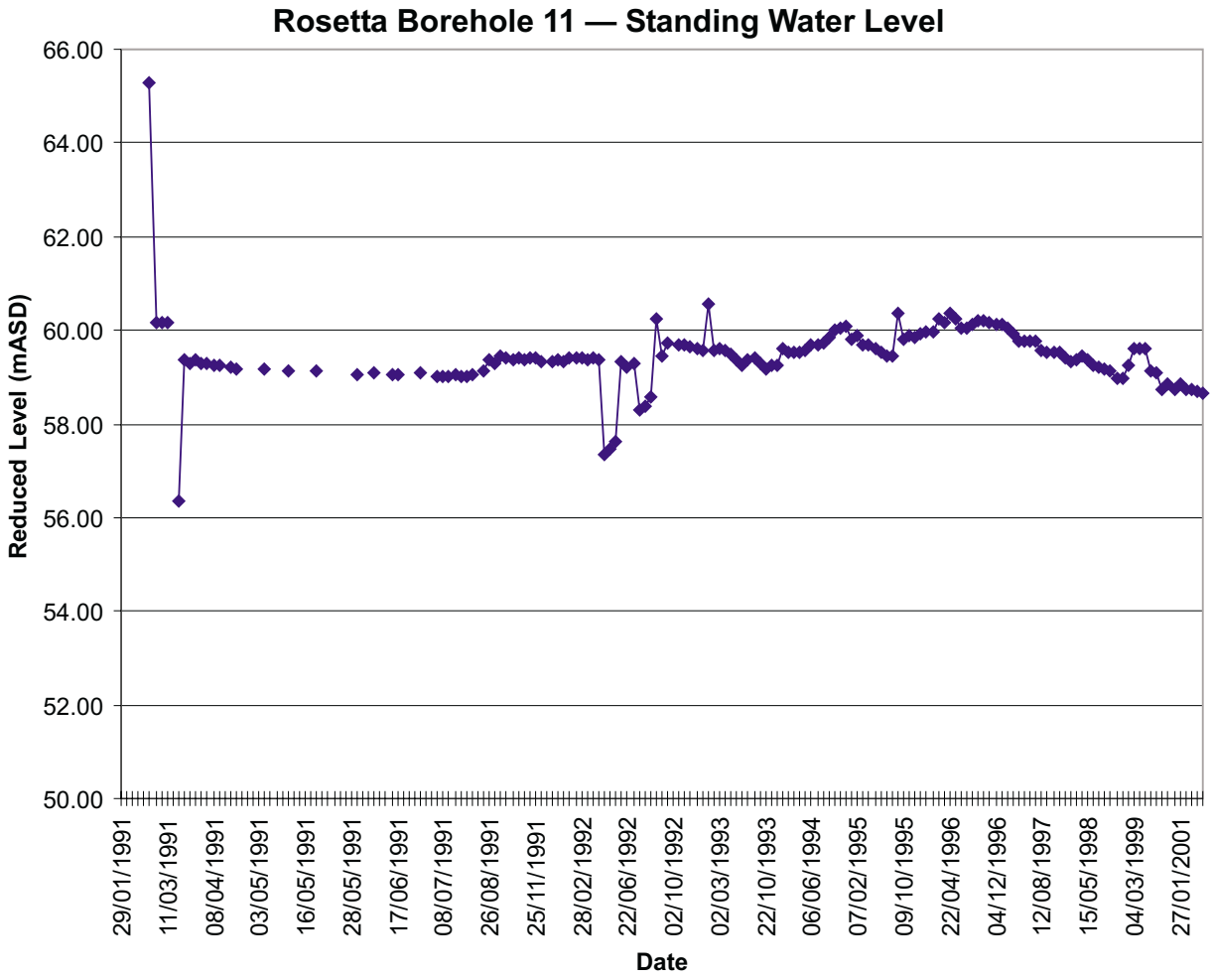

Rosetta Borehole 7 — Standing Water Level
Reduced Level (mASD)
90.00
85.00
80.00
75.00
70.00
65.00
13/12/1990
23/01/1991
07/02/1991
22/03/1991
26/04/1991
09/05/1991
21/05/1991
31/05/1991
21/06/1991
29/07/1991
16/09/1991
23/12/1991
13/04/1992
03/08/1992
16/11/1992
17/05/1993
05/01/1994
02/09/1994
09/05/1995
21/12/1995
03/07/1996
11/03/1997
03/12/1997
04/08/1998
18/08/1999
Date

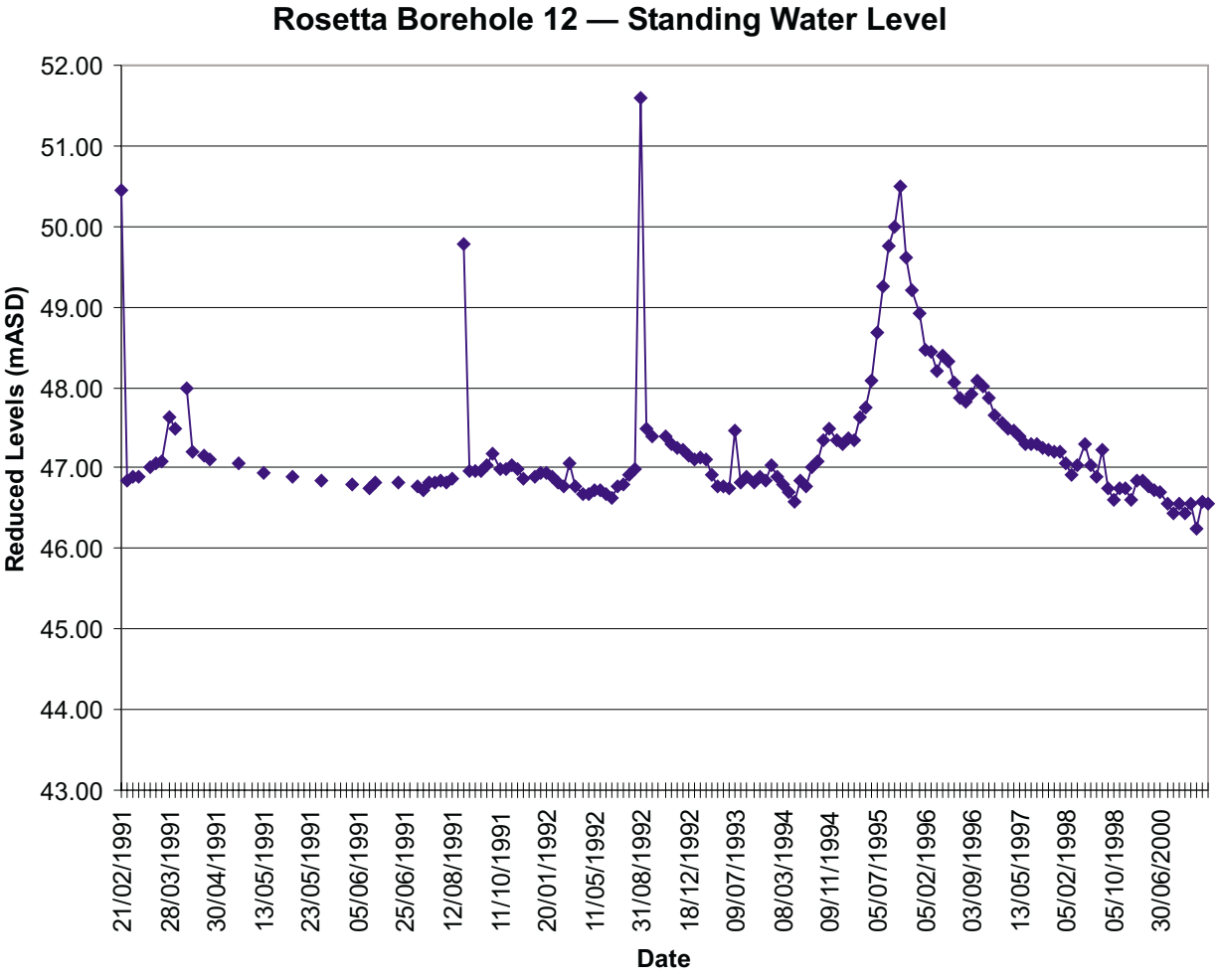
Rosetta Borehole 7A — Standing Water Level

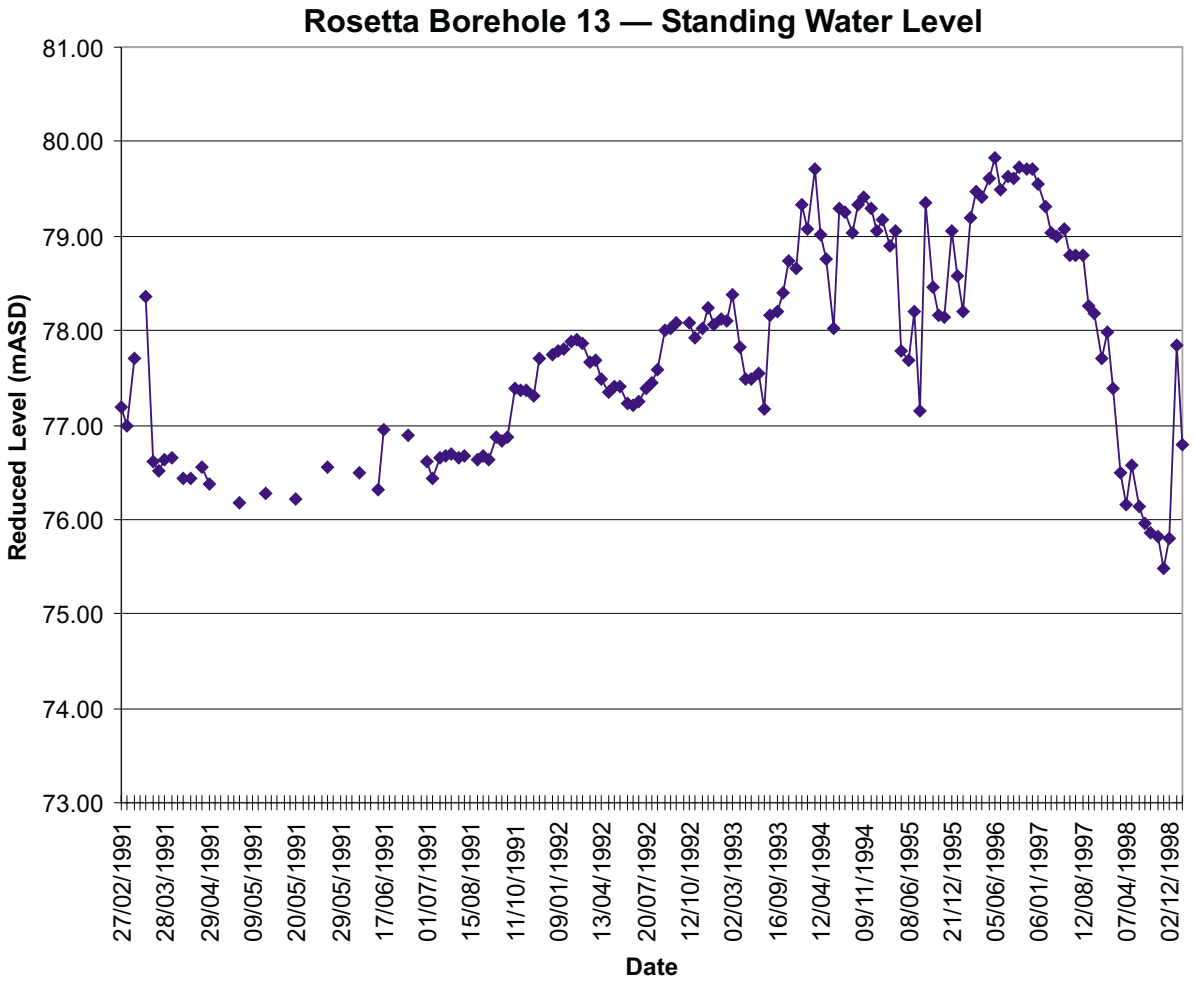


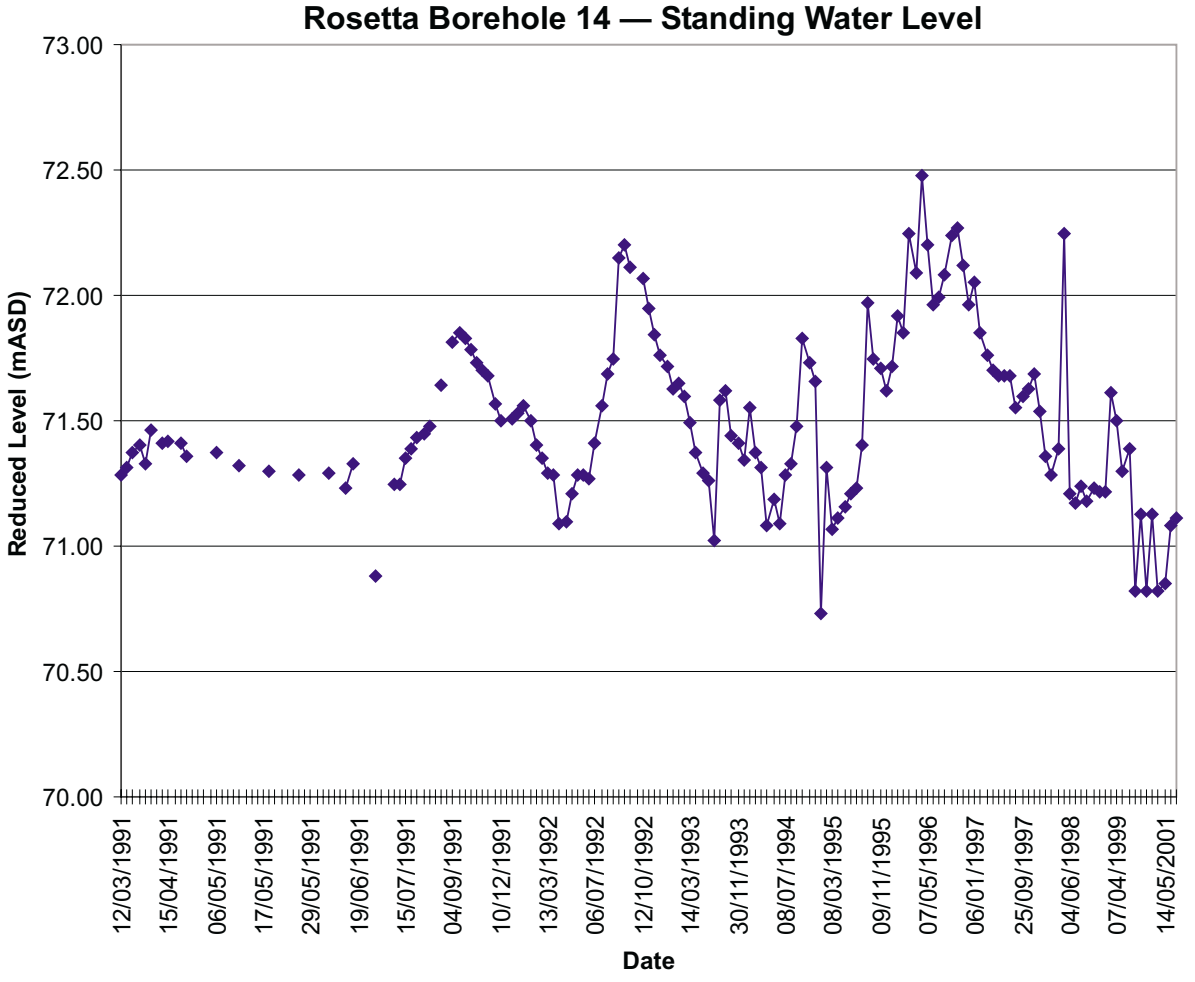
Rosetta Borehole 8 — Standing Water Level

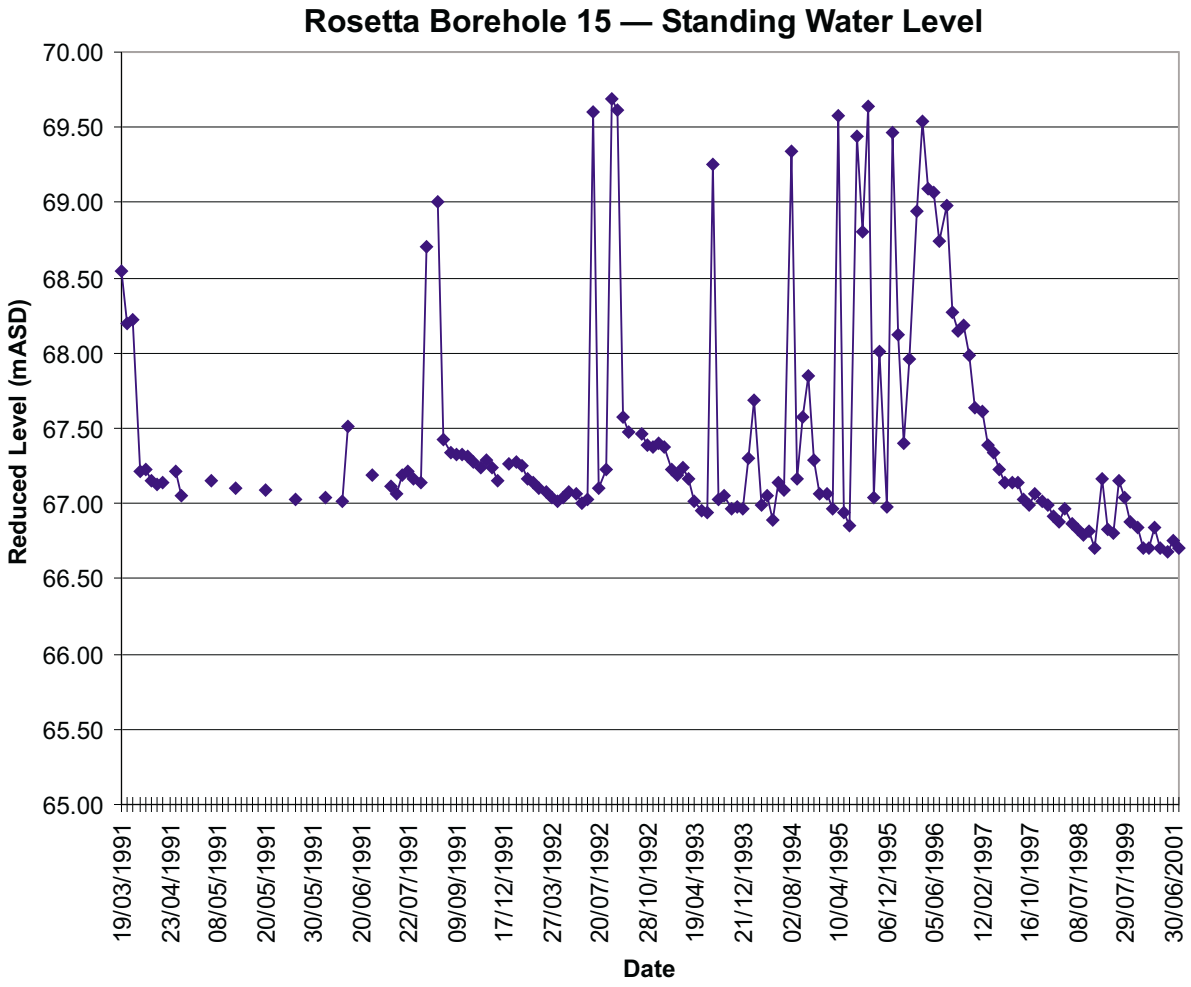


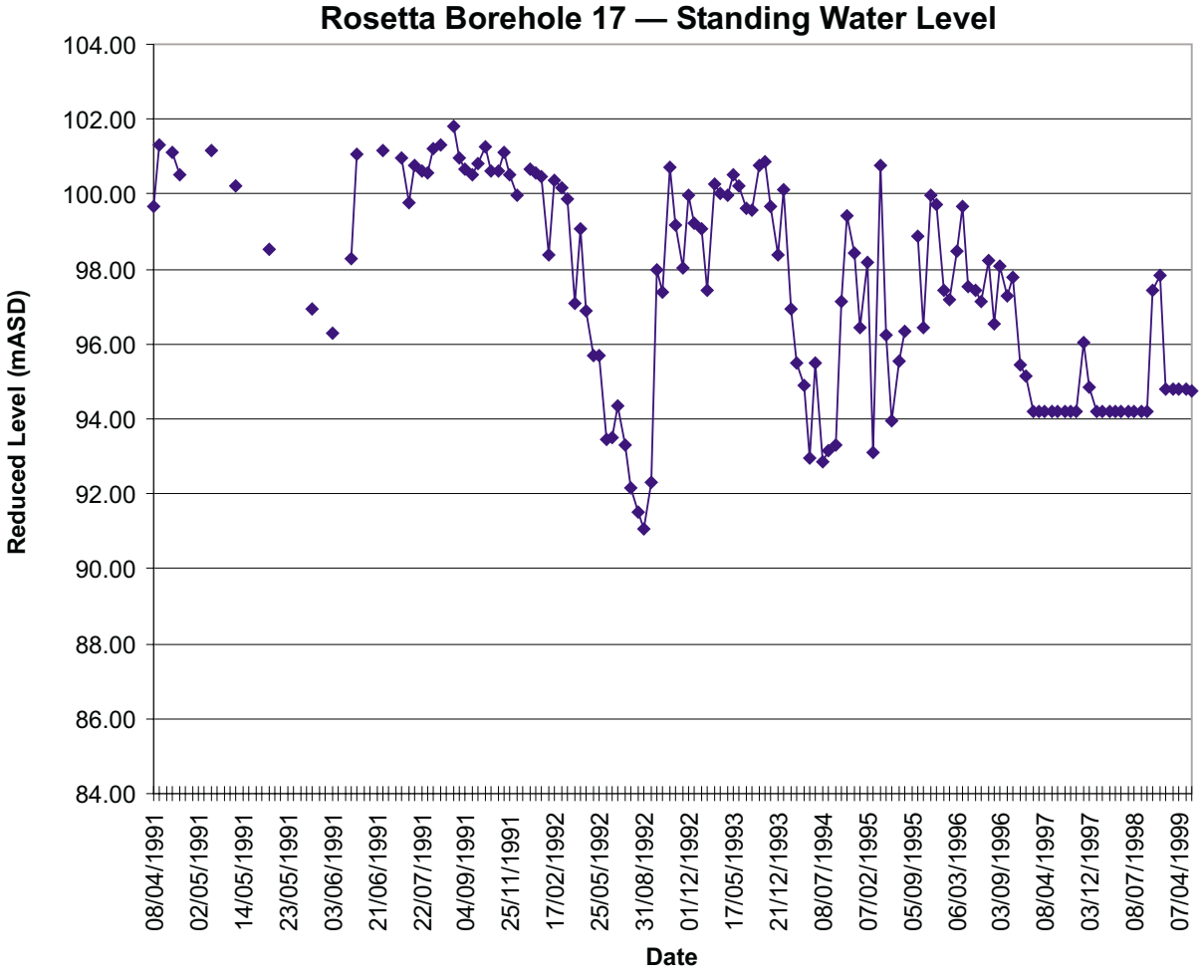

Rosetta Borehole 11 — Standing Water Level
Reduced Level (mASD)
66.00
64.00
62.00
60.00
58.00
56.00
54.00
52.00
50.00
29/01/1991
11/03/1991
08/04/1991
03/05/1991
16/05/1991
28/05/1991
17/06/1991
08/07/1991
26/08/1991
25/11/1991
28/02/1992
22/06/1992
02/10/1992
02/03/1993
22/10/1993
06/06/1994
07/02/1995
09/10/1995
22/04/1996
04/12/1996
12/08/1997
15/05/1998
04/03/1999
27/01/2001
Date

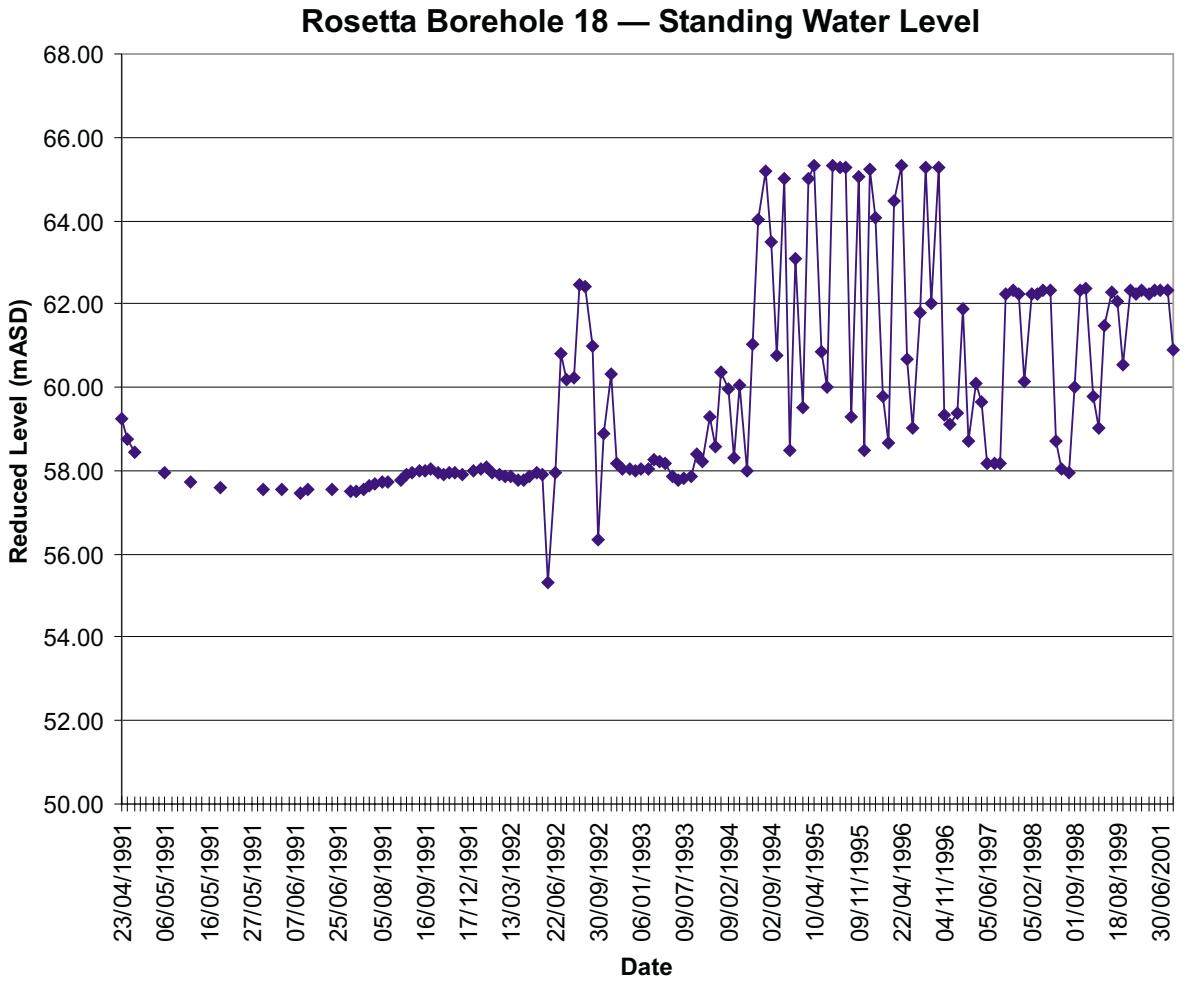

Rosetta Borehole 12 — Standing Water Level
Reduced Levels (mASD)
52.00
51.00
50.00
49.00
48.00
47.00
46.00
45.00
44.00
43.00
21/02/1991
28/03/1991
30/04/1991
13/05/1991
23/05/1991
05/06/1991
25/06/1991
12/08/1991
11/10/1991
20/01/1992
11/05/1992
31/08/1992
18/12/1992
09/07/1993
08/03/1994
09/11/1994
05/07/1995
05/02/1996
03/09/1996
13/05/1997
05/02/1998
05/10/1998
30/06/2000
Date

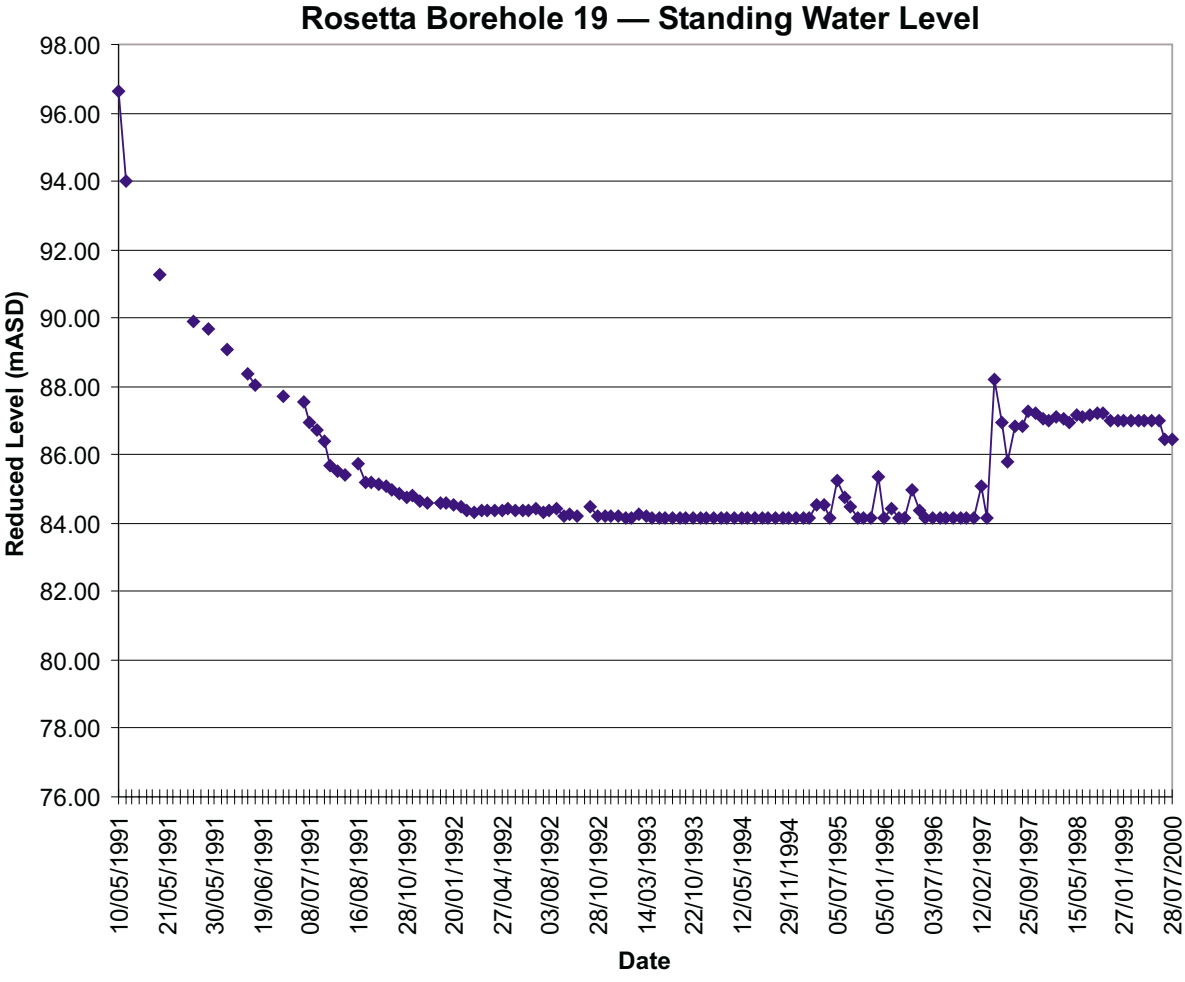

Rosetta Borehole 13 — Standing Water Level
Reduced Level (mASD)
81.00
80.00
79.00
78.00
77.00
76.00
75.00
74.00
73.00
27/02/1991
28/03/1991
29/04/1991
09/05/1991
20/05/1991
29/05/1991
17/06/1991
01/07/1991
15/08/1991
11/10/1991
09/01/1992
13/04/1992
20/07/1992
12/10/1992
02/03/1993
16/09/1993
12/04/1994
09/11/1994
08/06/1995
21/12/1995
05/06/1996
06/01/1997
12/08/1997
07/04/1998
02/12/1998
Date


Rosetta Borehole 14 — Standing Water Level
Reduced Level (mASD)
73.00
72.50
72.00
71.50
71.00
70.50
70.00
12/03/1991
15/04/1991
06/05/1991
17/05/1991
29/05/1991
19/06/1991
15/07/1991
04/09/1991
10/12/1991
13/03/1992
06/07/1992
12/10/1992
14/03/1993
30/11/1993
08/07/1994
08/03/1995
09/11/1995
07/05/1996
06/01/1997
25/09/1997
04/06/1998
07/04/1999
14/05/2001
Date


Rosetta Borehole 15 — Standing Water Level
Reduced Level (mASD)
70.00
69.50
69.00
68.50
68.00
67.50
67.00
66.50
66.00
65.50
65.00
19/03/1991
23/04/1991
08/05/1991
20/05/1991
30/05/1991
20/06/1991
22/07/1991
09/09/1991
17/12/1991
27/03/1992
20/07/1992
28/10/1992
19/04/1993
21/12/1993
02/08/1994
10/04/1995
06/12/1995
05/06/1996
12/02/1997
16/10/1997
08/07/1998
29/07/1999
30/06/2001
Date


Rosetta Borehole 17 — Standing Water Level
Reduced Level (mASD)
104.00
102.00
100.00
98.00
96.00
94.00
92.00
90.00
88.00
86.00
84.00
08/04/1991
02/05/1991
14/05/1991
23/05/1991
03/06/1991
21/06/1991
22/07/1991
04/09/1991
25/11/1991
17/02/1992
25/05/1992
31/08/1992
01/12/1992
17/05/1993
21/12/1993
08/07/1994
07/02/1995
05/09/1995
06/03/1996
03/09/1996
08/04/1997
03/12/1997
08/07/1998
07/04/1999
Date


Rosetta Borehole 18 — Standing Water Level
Reduced Level (mASD)
68.00
66.00
64.00
62.00
60.00
58.00
56.00
54.00
52.00
50.00
23/04/1991
06/05/1991
16/05/1991
27/05/1991
07/06/1991
25/06/1991
05/08/1991
16/09/1991
17/12/1991
13/03/1992
22/06/1992
30/09/1992
06/01/1993
09/07/1993
09/02/1994
02/09/1994
10/04/1995
09/11/1995
22/04/1996
04/11/1996
05/06/1997
05/02/1998
01/09/1998
18/08/1999
30/06/2001
Date


Rosetta Borehole 19 — Standing Water Level
Reduced Level (mASD)
98.00
96.00
94.00
92.00
90.00
88.00
86.00
84.00
82.00
80.00
78.00
76.00
10/05/1991
21/05/1991
30/05/1991
19/06/1991
08/07/1991
16/08/1991
28/10/1991
20/01/1992
27/04/1992
03/08/1992
28/10/1992
14/03/1993
22/10/1993
12/05/1994
29/11/1994
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28/07/2000
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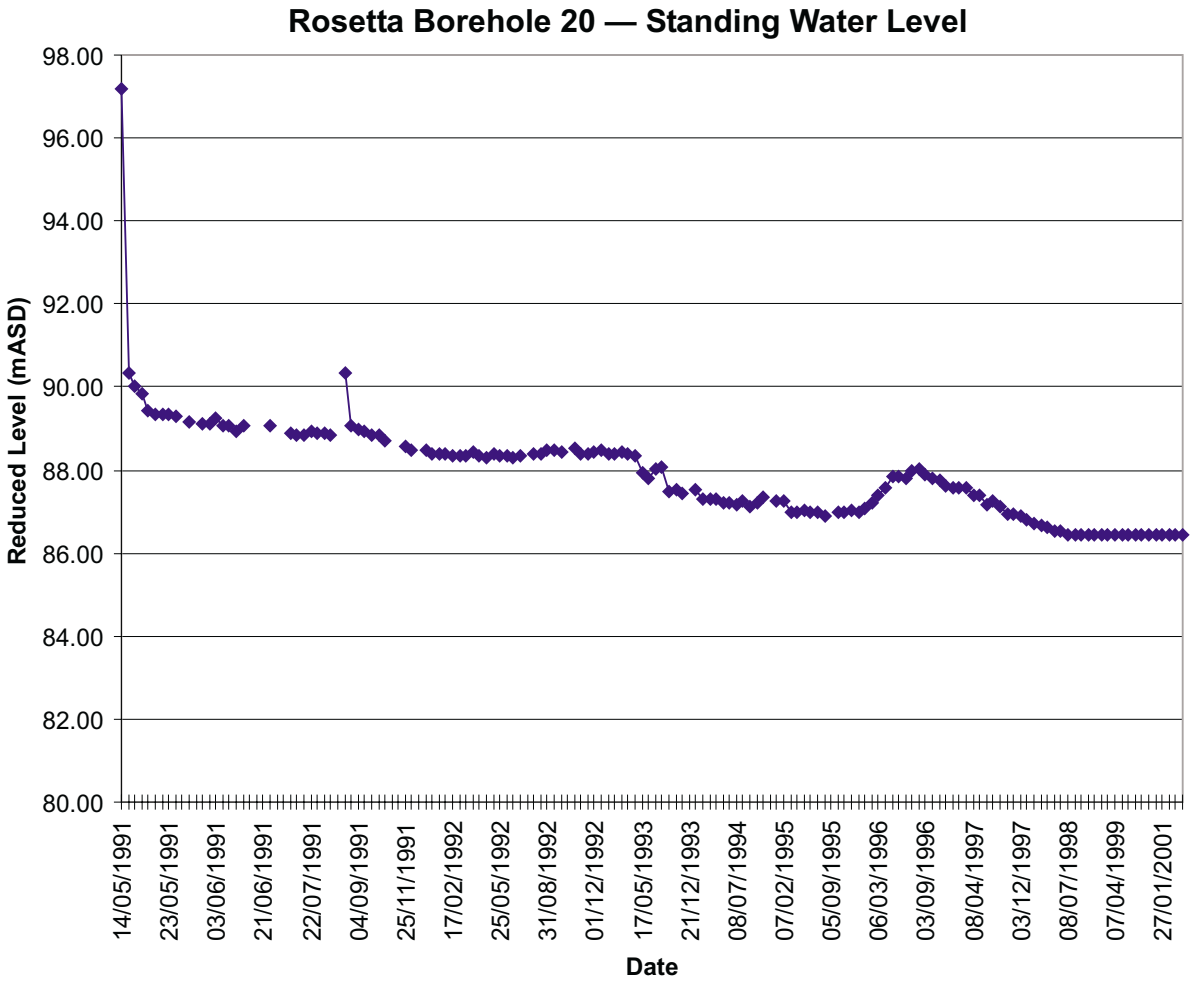
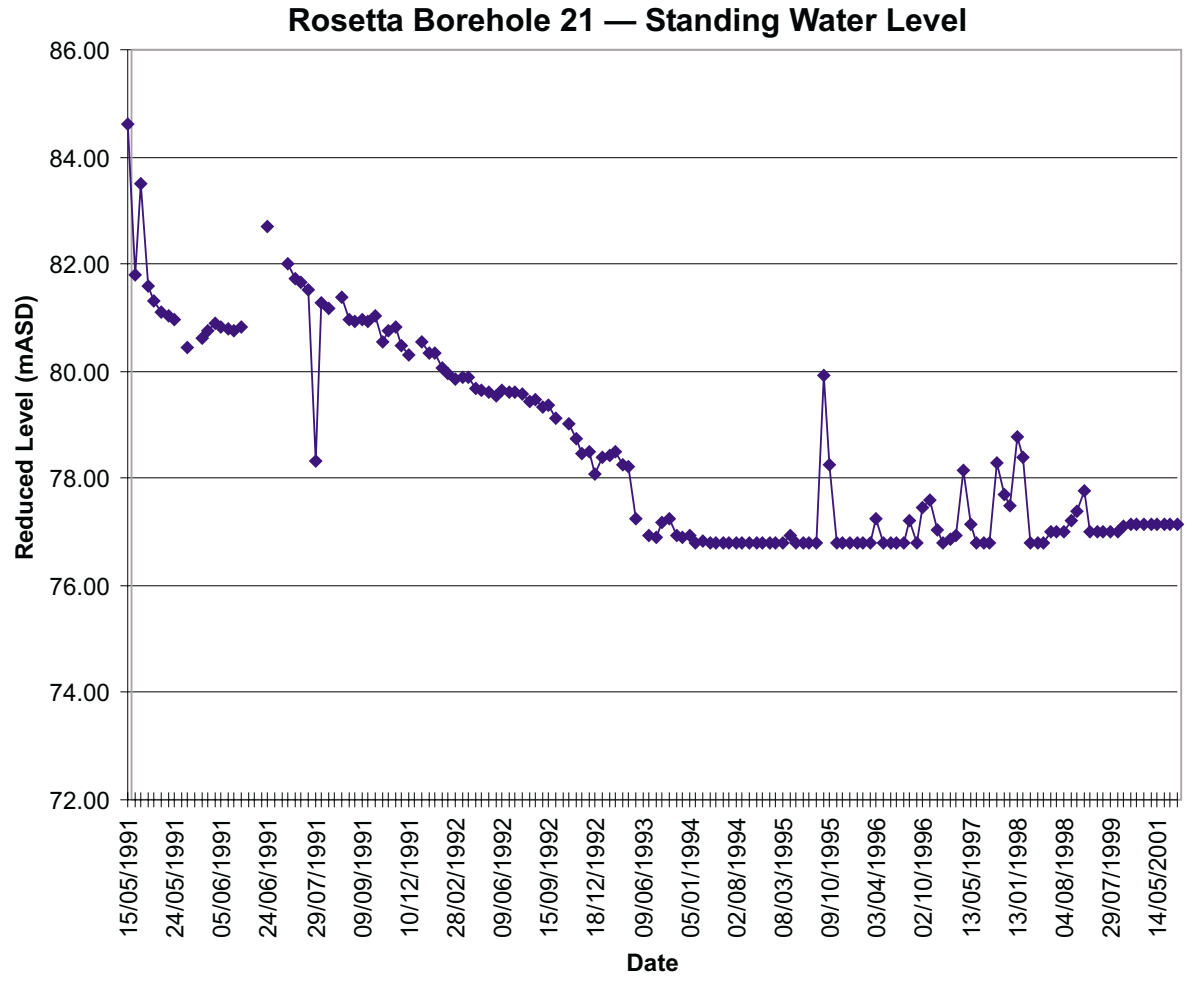
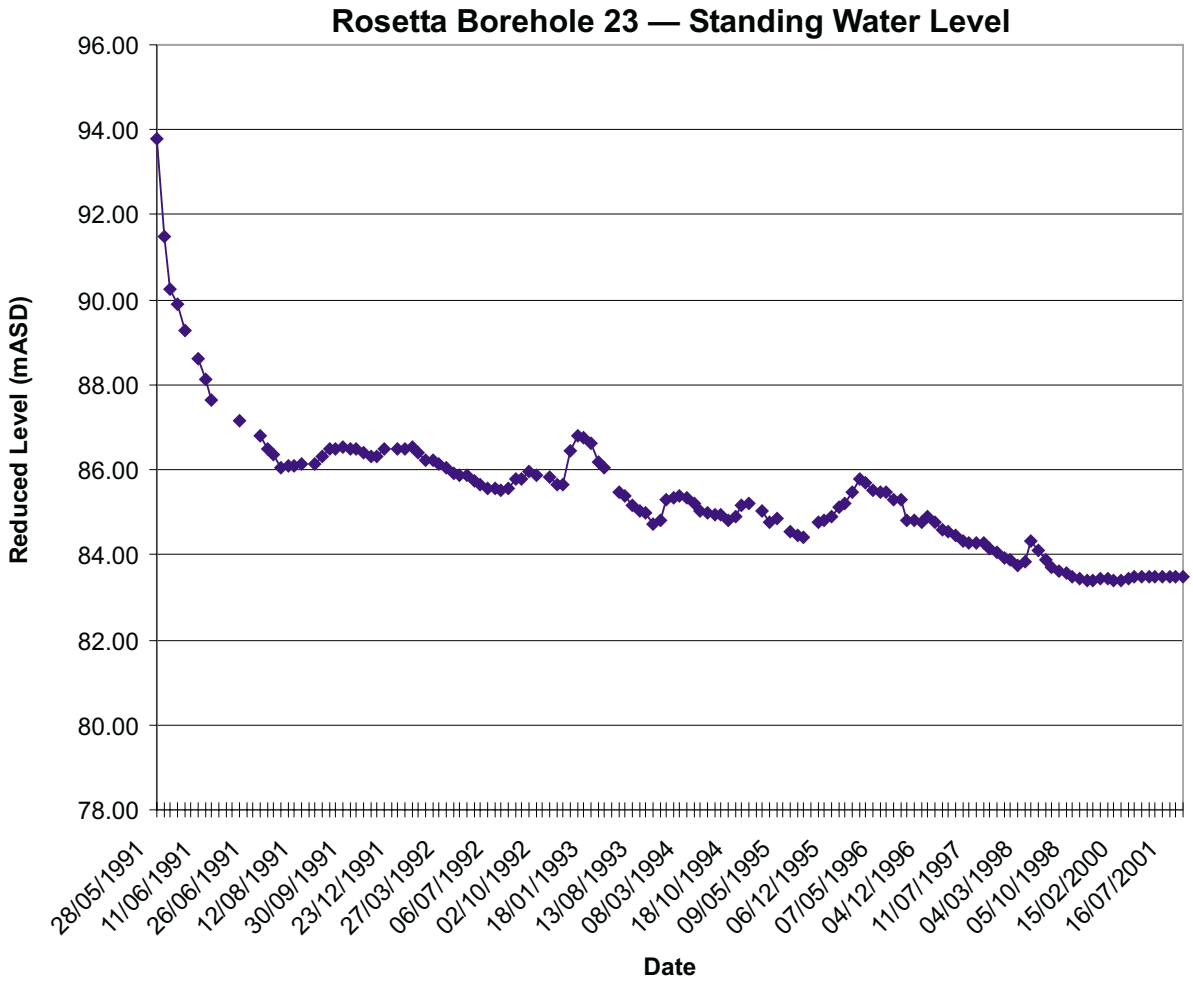

Rosetta Borehole 20 — Standing Water Level
Reduced Level (mASD)
98.00
96.00
94.00
92.00
90.00
88.00
86.00
84.00
82.00
80.00
14/05/1991
23/05/1991
03/06/1991
21/06/1991
22/07/1991
04/09/1991
25/11/1991
17/02/1992
25/05/1992
31/08/1992
01/12/1992
17/05/1993
21/12/1993
08/07/1994
07/02/1995
05/09/1995
06/03/1996
03/09/1996
08/04/1997
03/12/1997
08/07/1998
07/04/1999
27/01/2001
Date


Rosetta Borehole 21 — Standing Water Level
Reduced Level (mASD)
86.00
84.00
82.00
80.00
78.00
76.00
74.00
72.00
15/05/1991
24/05/1991
05/06/1991
24/06/1991
29/07/1991
09/09/1991
10/12/1991
28/02/1992
09/06/1992
15/09/1992
18/12/1992
09/06/1993
05/01/1994
02/08/1994
08/03/1995
09/10/1995
03/04/1996
02/10/1996
13/05/1997
13/01/1998
04/08/1998
29/07/1999
14/05/2001
Date


Rosetta Borehole 23 — Standing Water Level
Reduced Level (mASD)
96.00
94.00
92.00
90.00
88.00
86.00
84.00
82.00
80.00
78.00
28/05/1991
11/06/1991
26/06/1991
12/08/1991
30/09/1991
23/12/1991
27/03/1992
06/07/1992
02/10/1992
18/01/1993
13/08/1993
08/03/1994
18/10/1994
09/05/1995
06/12/1995
07/05/1996
04/12/1996
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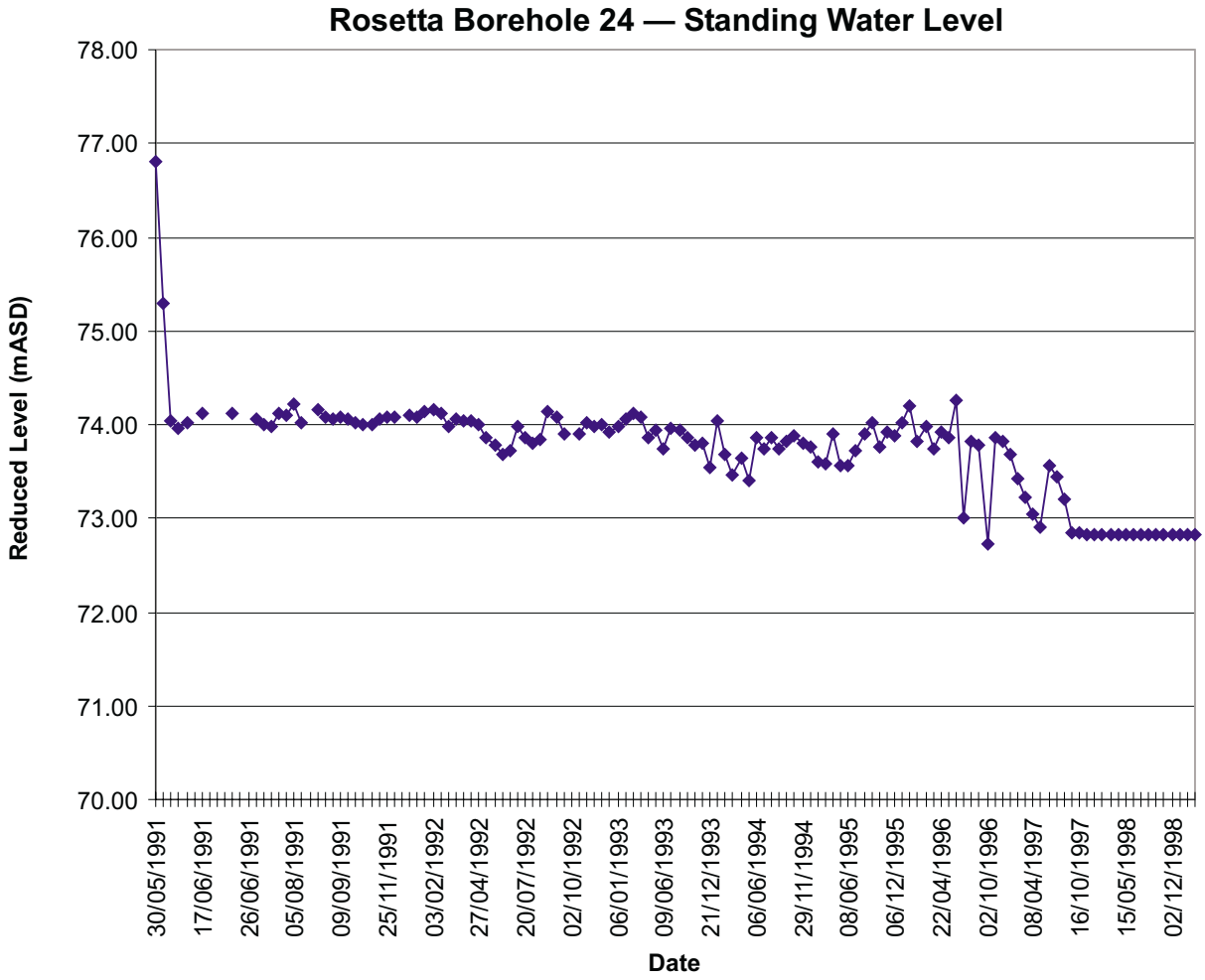
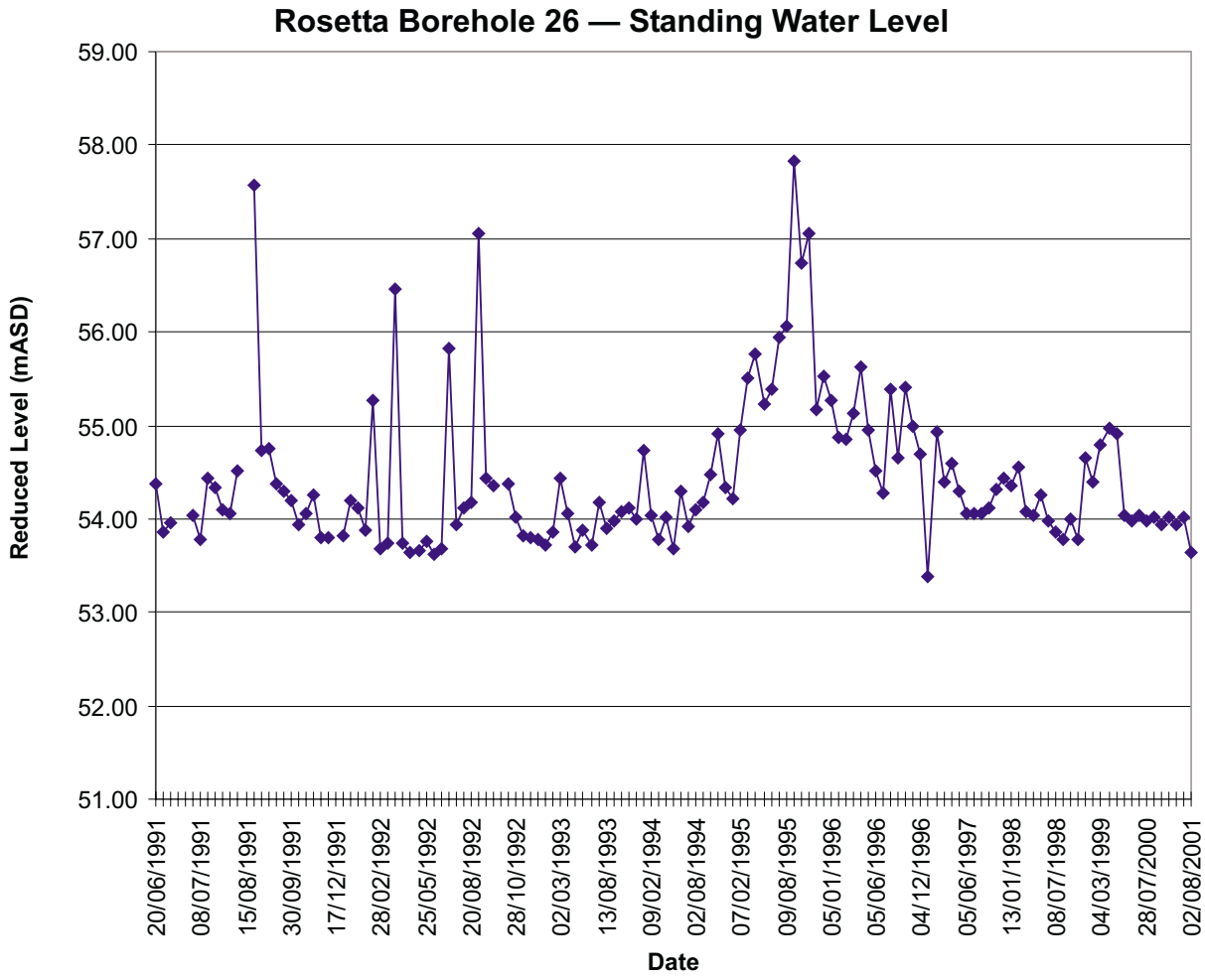
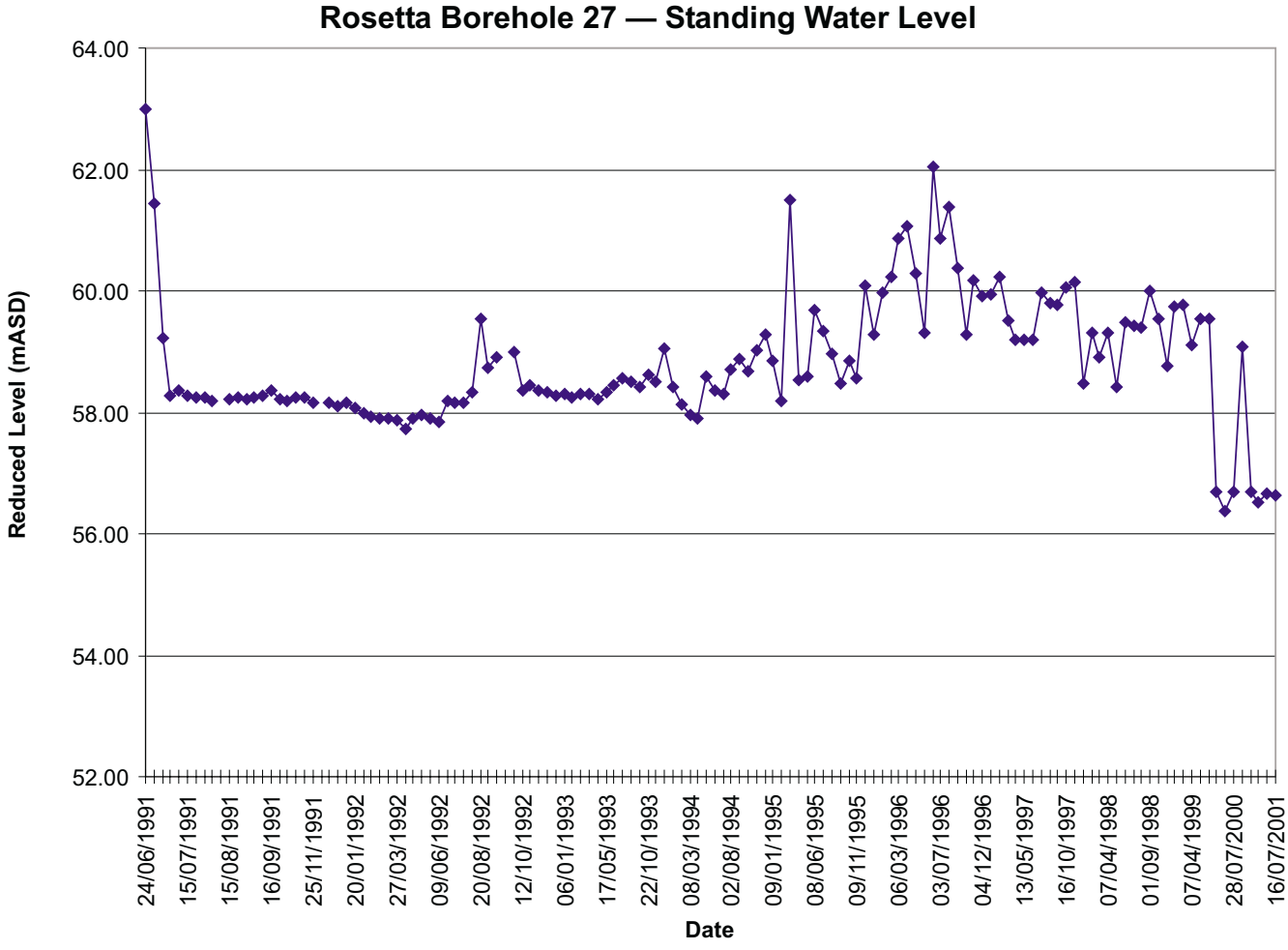
04/03/1998
05/10/1998
15/02/2000
16/07/2001
Date


Rosetta Borehole 24 — Standing Water Level
Reduced Level (mASD)
78.00
77.00
76.00
75.00
74.00
73.00
72.00
71.00
70.00
30/05/1991
17/06/1991
26/06/1991
05/08/1991
09/09/1991
25/11/1991
03/02/1992
27/04/1992
20/07/1992
02/10/1992
06/01/1993
09/06/1993
21/12/1993
06/06/1994
29/11/1994
08/06/1995
06/12/1995
22/04/1996
02/10/1996
08/04/1997
16/10/1997
15/05/1998
02/12/1998
Date


Rosetta Borehole 26 — Standing Water Level
Reduced Level (mASD)
59.00
58.00
57.00
56.00
55.00
54.00
53.00
52.00
51.00
20/06/1991
08/07/1991
15/08/1991
30/09/1991
17/12/1991
28/02/1992
25/05/1992
20/08/1992
28/10/1992
02/03/1993
13/08/1993
09/02/1994
02/08/1994
07/02/1995
09/08/1995
05/01/1996
05/06/1996
04/12/1996
05/06/1997
13/01/1998
08/07/1998
04/03/1999
28/07/2000
02/08/2001
Date


Rosetta Borehole 27 — Standing Water Level
Reduced Level (mASD)
64.00
62.00
60.00
58.00
56.00
54.00
52.00
24/06/1991
15/07/1991
15/08/1991
16/09/1991
25/11/1991
20/01/1992
27/03/1992
09/06/1992
20/08/1992
12/10/1992
06/01/1993
17/05/1993
22/10/1993
08/03/1994
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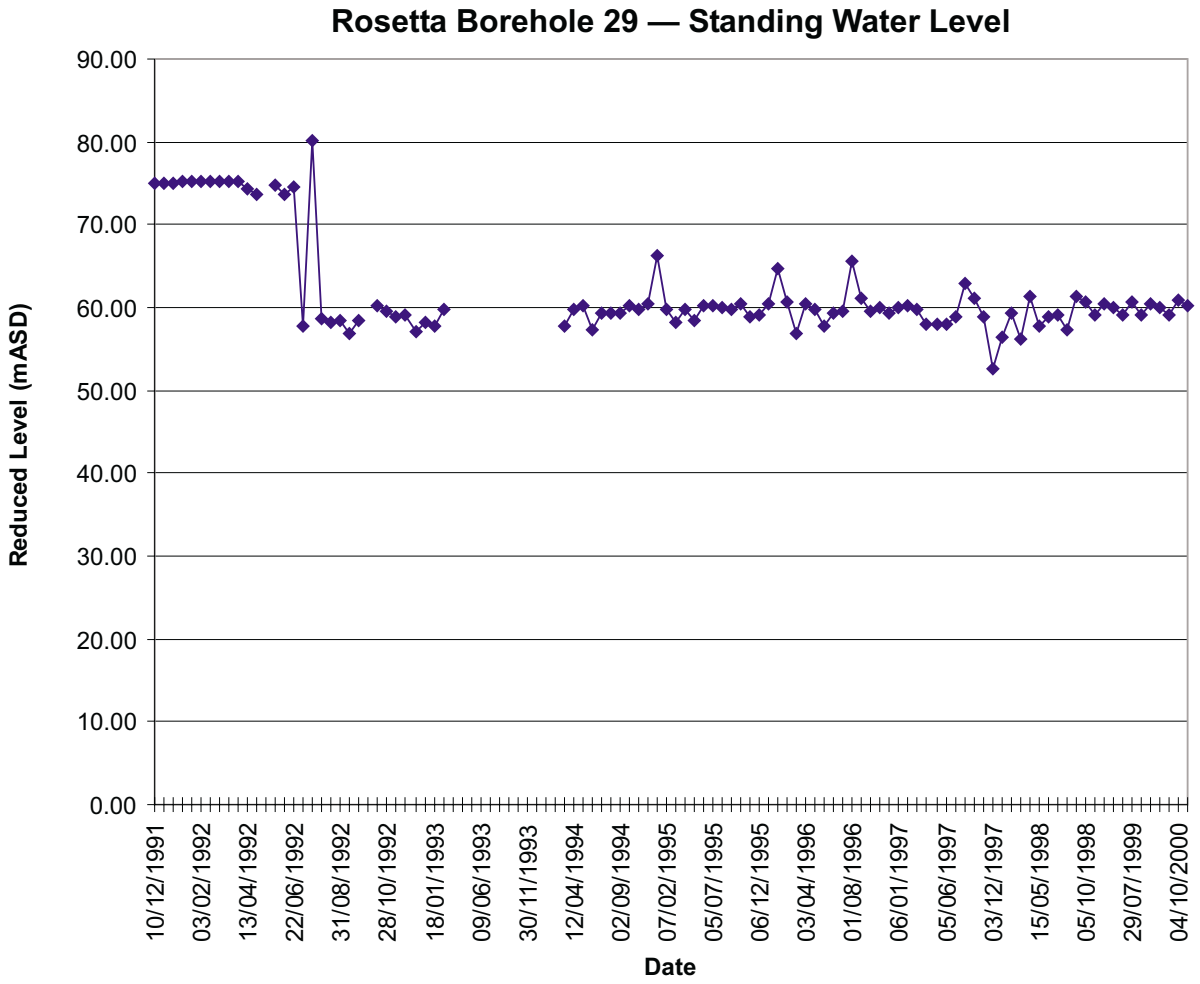
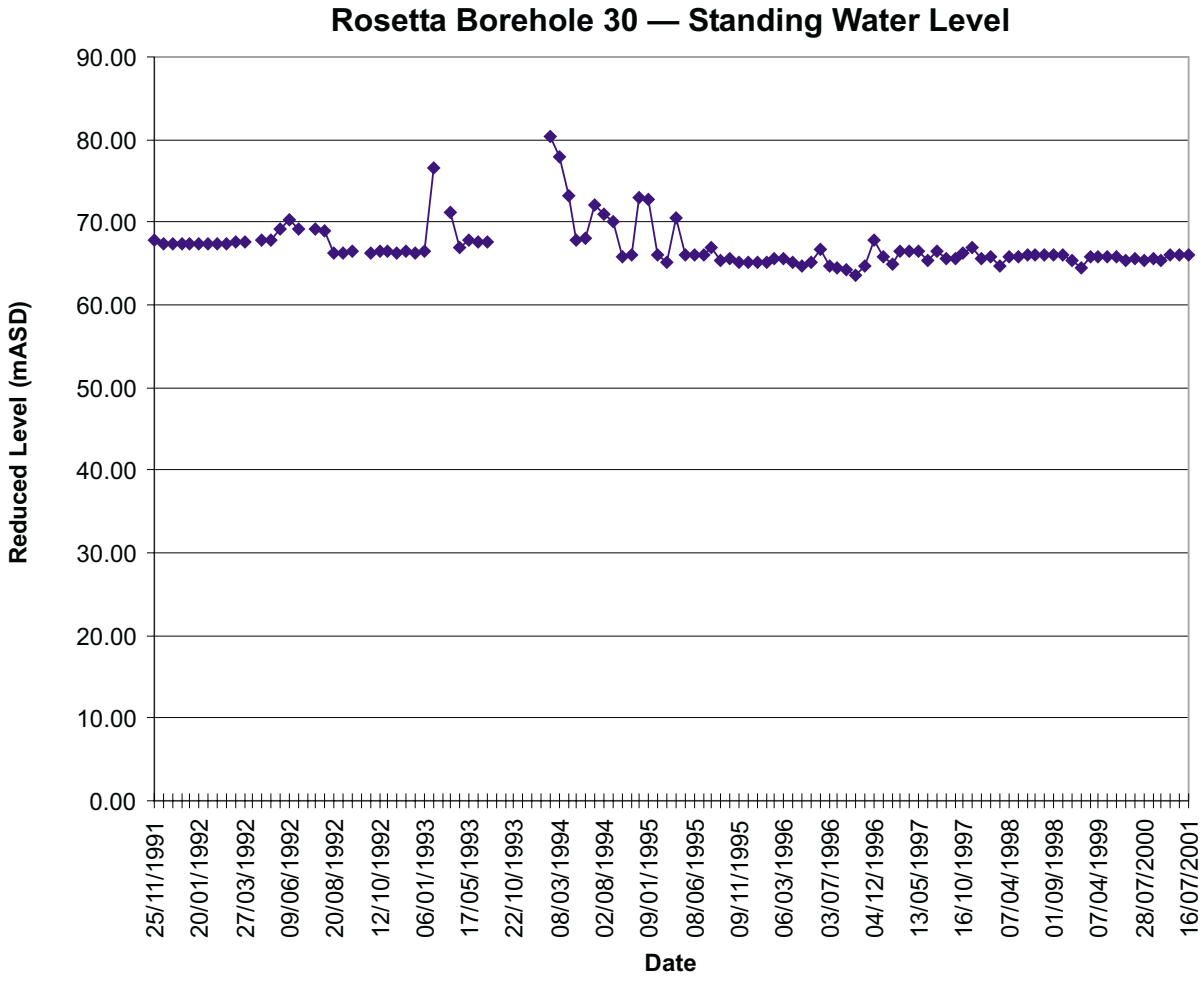
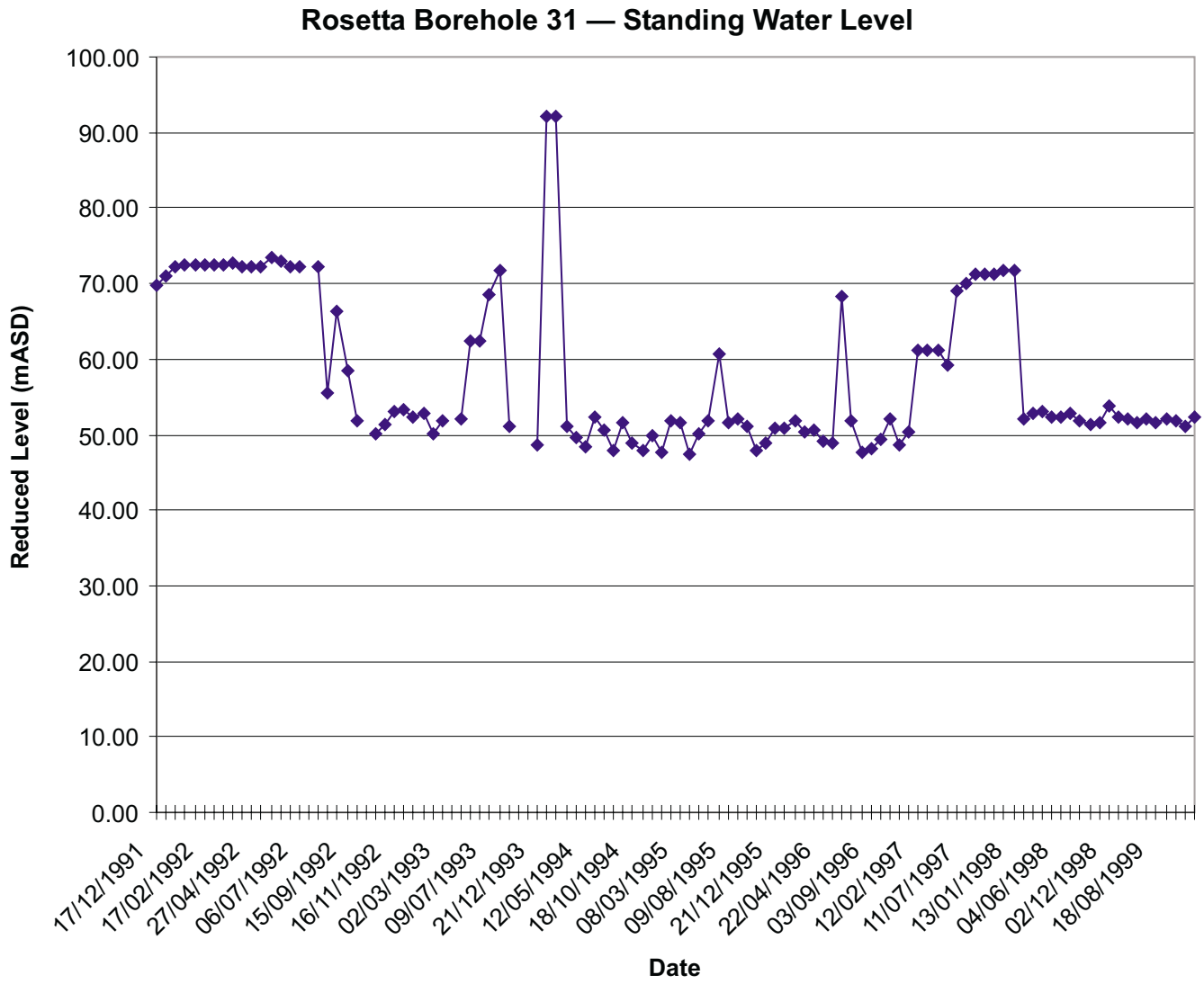
04/12/1996
13/05/1997
16/10/1997
07/04/1998
01/09/1998
07/04/1999
28/07/2000
16/07/2001
Date


Rosetta Borehole 29 — Standing Water Level
Reduced Level (mASD)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
10/12/1991
03/02/1992
13/04/1992
22/06/1992
31/08/1992
28/10/1992
18/01/1993
09/06/1993
30/11/1993
12/04/1994
02/09/1994
07/02/1995
05/07/1995
06/12/1995
03/04/1996
01/08/1996
06/01/1997
05/06/1997
03/12/1997
15/05/1998
05/10/1998
29/07/1999
04/10/2000
Date

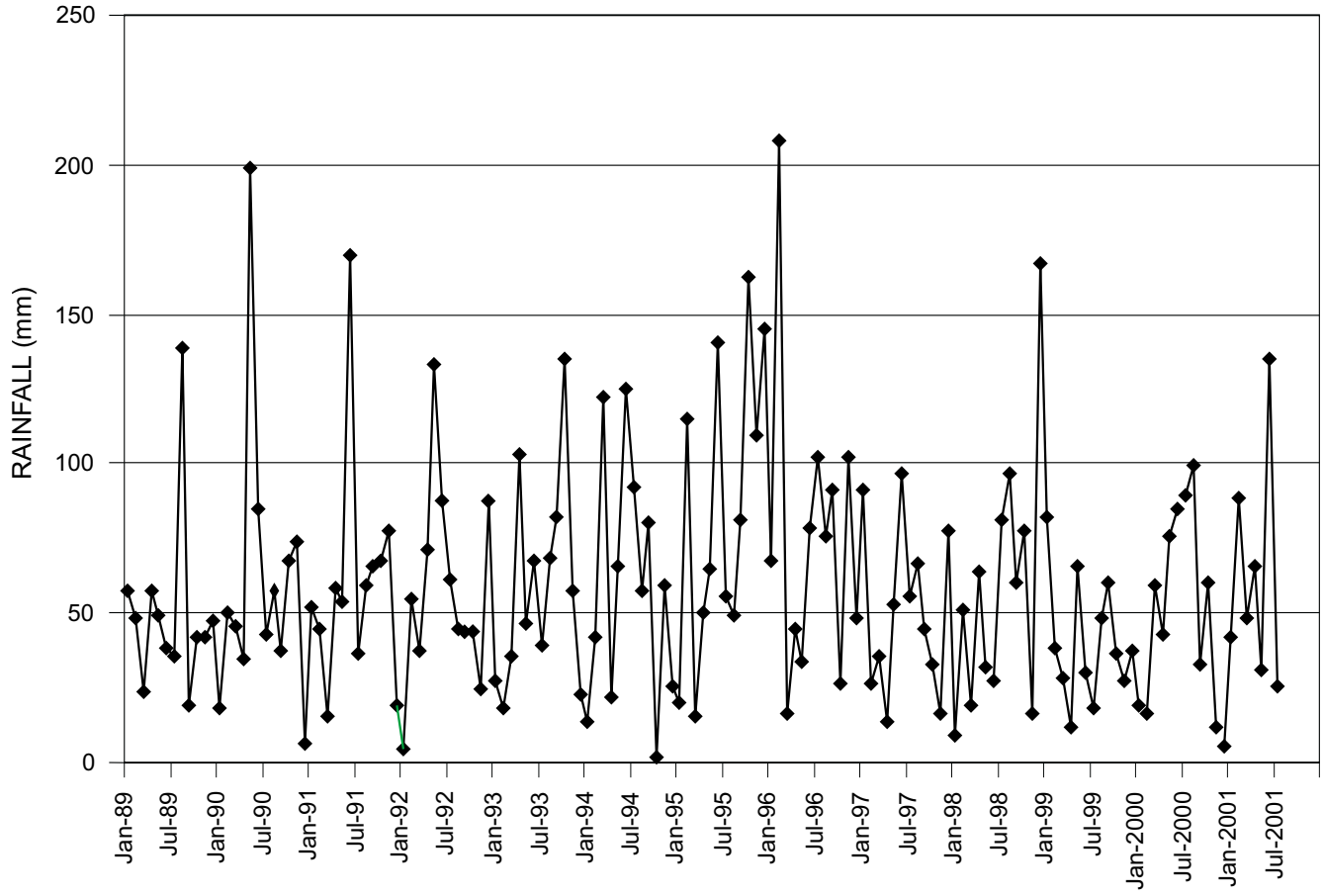

Rosetta Borehole 30 — Standing Water Level
Reduced Level (mASD)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
25/11/1991
20/01/1992
27/03/1992
09/06/1992
20/08/1992
12/10/1992
06/01/1993
17/05/1993
22/10/1993
08/03/1994
02/08/1994
09/01/1995
08/06/1995
09/11/1995
06/03/1996
03/07/1996
04/12/1996
13/05/1997
16/10/1997
07/04/1998
01/09/1998
07/04/1999
28/07/2000
16/07/2001
Date


Rosetta Borehole 31 — Standing Water Level
Reduced Level (mASD)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
17/12/1991
17/02/1992
27/04/1992
06/07/1992
15/09/1992
16/11/1992
02/03/1993
09/07/1993
21/12/1993
12/05/1994
18/10/1994
08/03/1995
09/08/1995
21/12/1995
22/04/1996
03/09/1996
12/02/1997
11/07/1997
13/01/1998
04/06/1998
02/12/1998
18/08/1999
Date

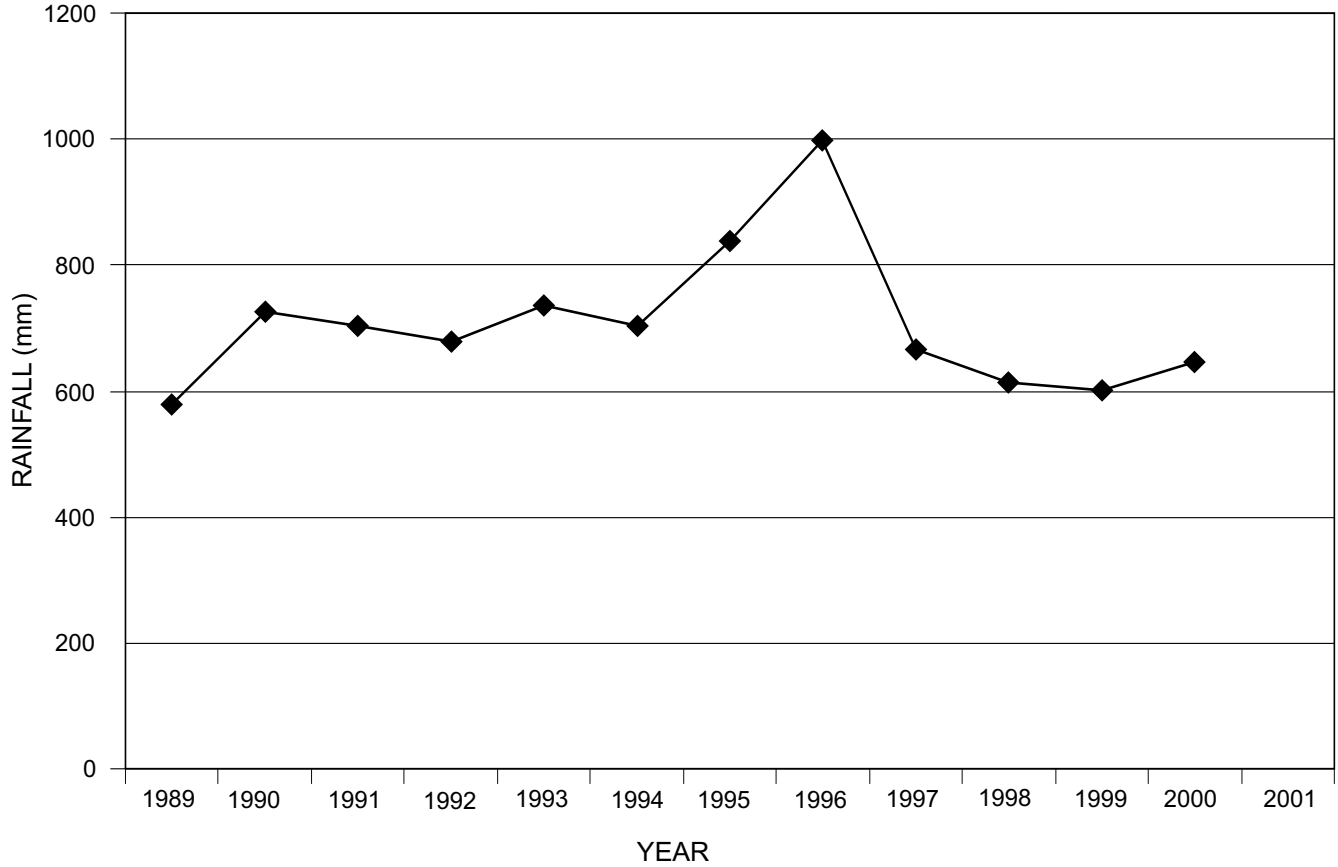
APPENDIX 2

Rainfall Data

MONTHLY RAINFALL AT ROSETTA, JANUARY 1989–JULY 2001

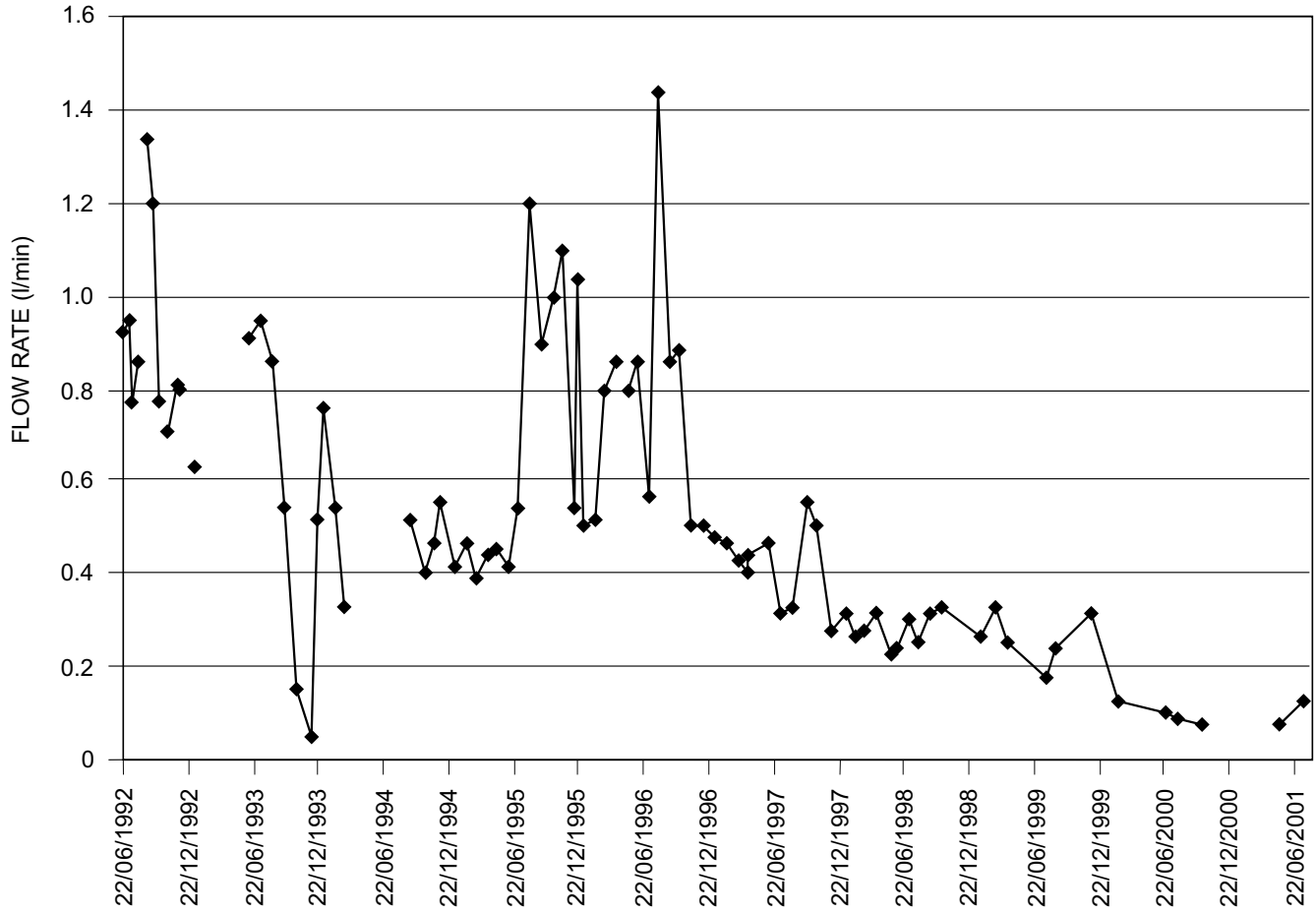


ANNUAL RAINFALL AT ROSETTA, 1989–2001



APPENDIX 3

Flow rates from horizontal drains



APPENDIX 4

Conductivity of water from horizontal drains