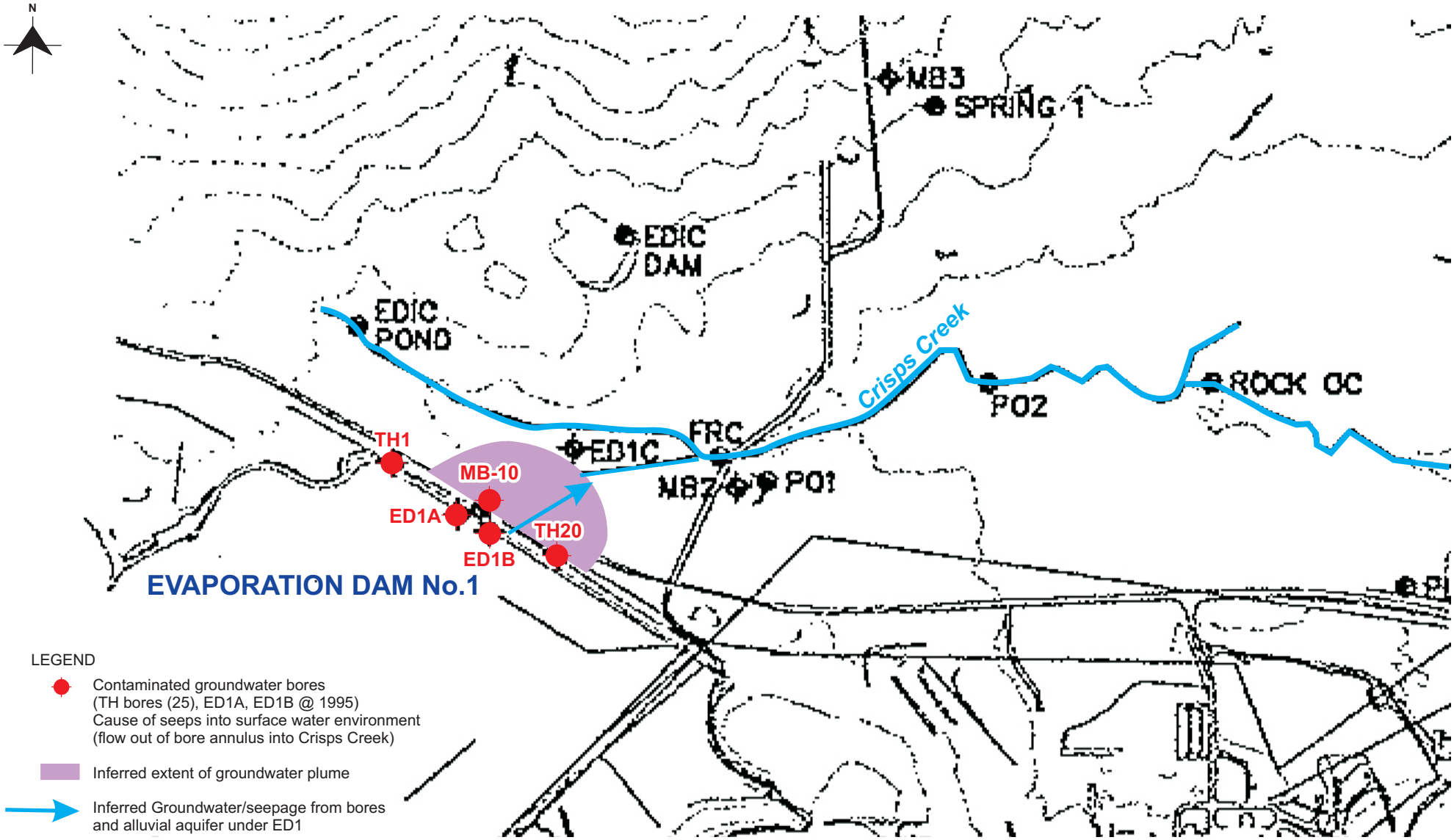
earth2water Pty Ltd
Environmental & Groundwater Consulting



Base plan source: Woodward Clyde 1997

AREA OF FURTHER INVESTIGATION (ED-1, 1997)

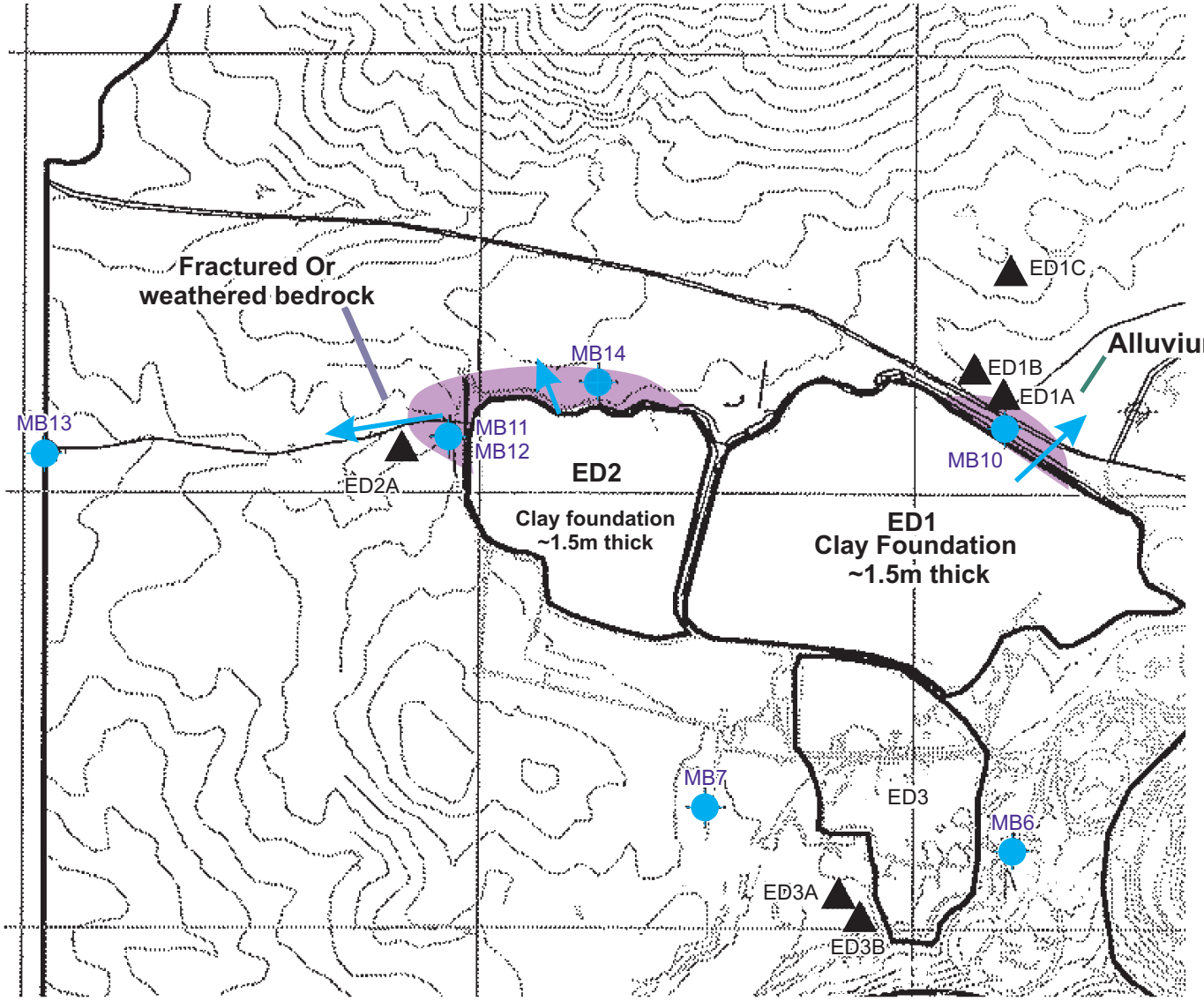
Date: *16 July 2016*

Reference: *E2W_243_14.cdr*

VEOLIA - ED1& 2 Integrity Assessment

Figure 3

earth2water Pty Ltd
Environmental & Groundwater Consulting



LEGEND

- Groundwater monitoring bores (Dec 96 & Jun 97 -Woodward Clyde)
- Inferred extent of leakage & groundwater plume
- Migration pathway -inferred by E2W

Note: ED1A,ED1B, ED2A decommissioned

Base plan source: Woodward Clyde 1997

ED-1& 2 Layout & Inferred Leakage

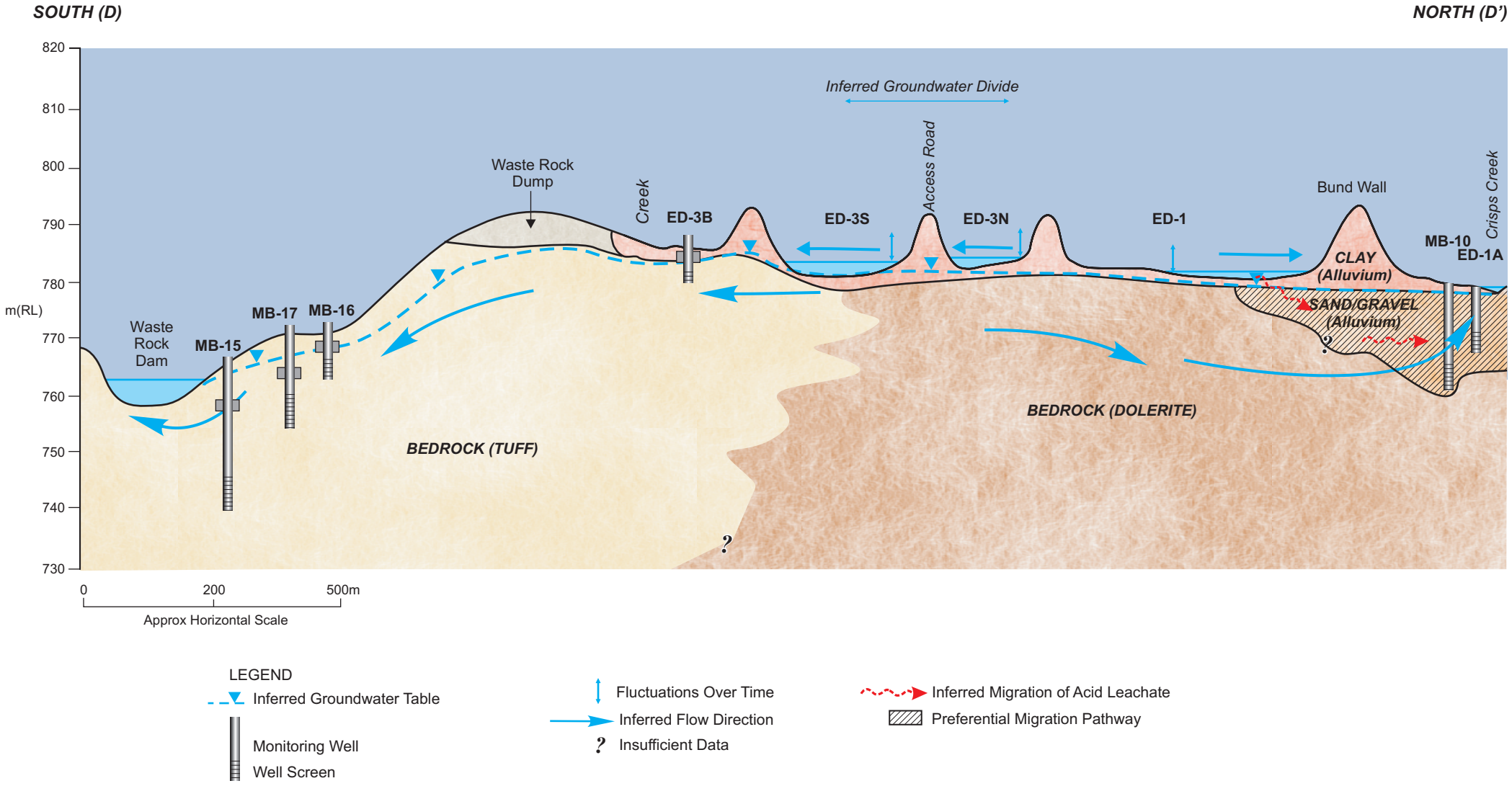
Date: *16 July 2016*

Reference: *E2W_243_15.cdr*

Veolia - ED1& 2 Integrity Assessment

Figure 4

earth2water Pty Ltd
Environmental & Groundwater Consulting



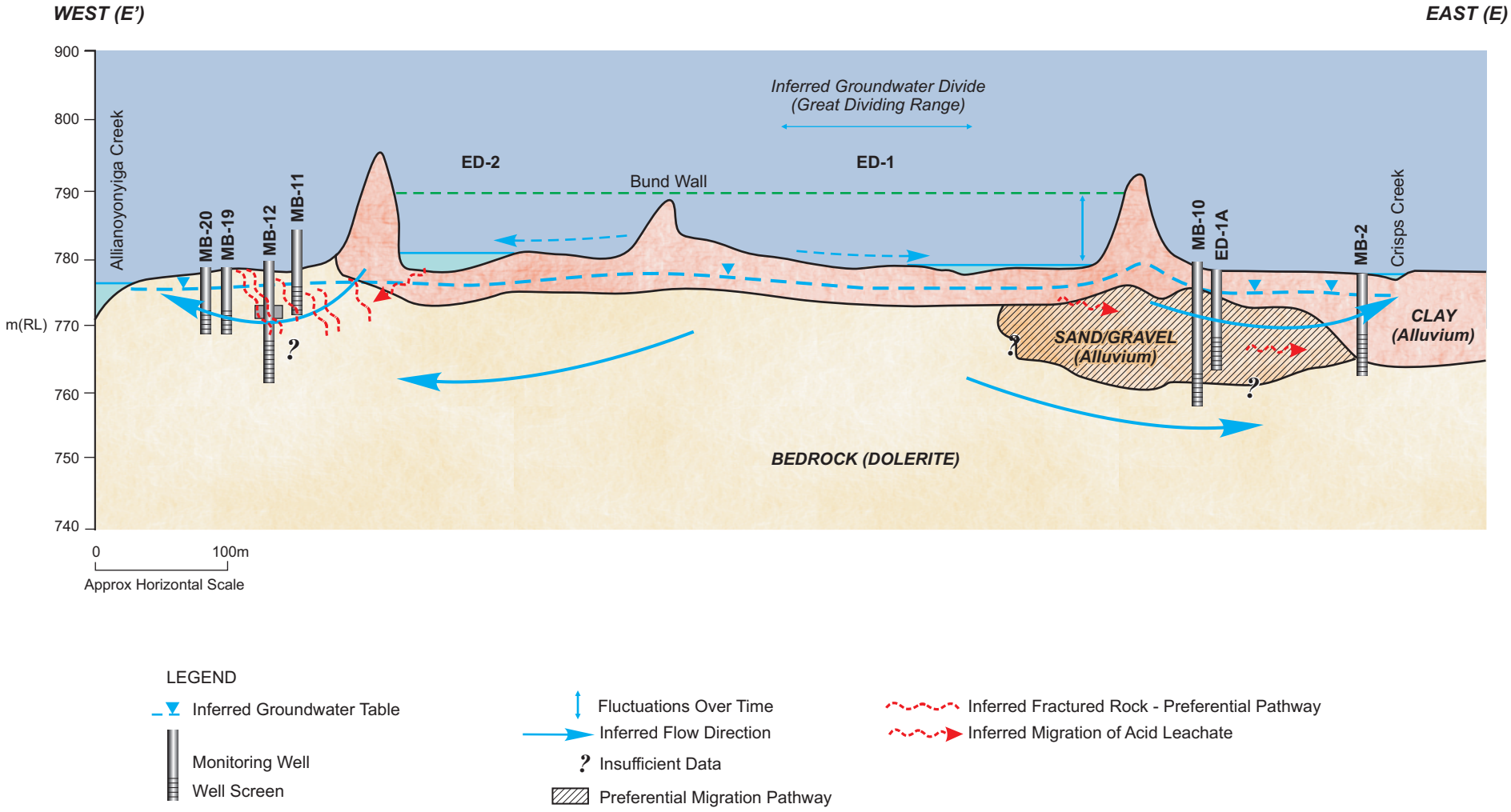
INFERRED HYDROGEOLOGICAL SECTION - ED1 TO WRD

VEOLIA - ED1 & 2 Integrity Assessment

Figure 5

Date: *16 July 2016*

Reference: *E2W_243_11.cdr*



INFERRED HYDROGEOLOGICAL SECTION: ED1 &2

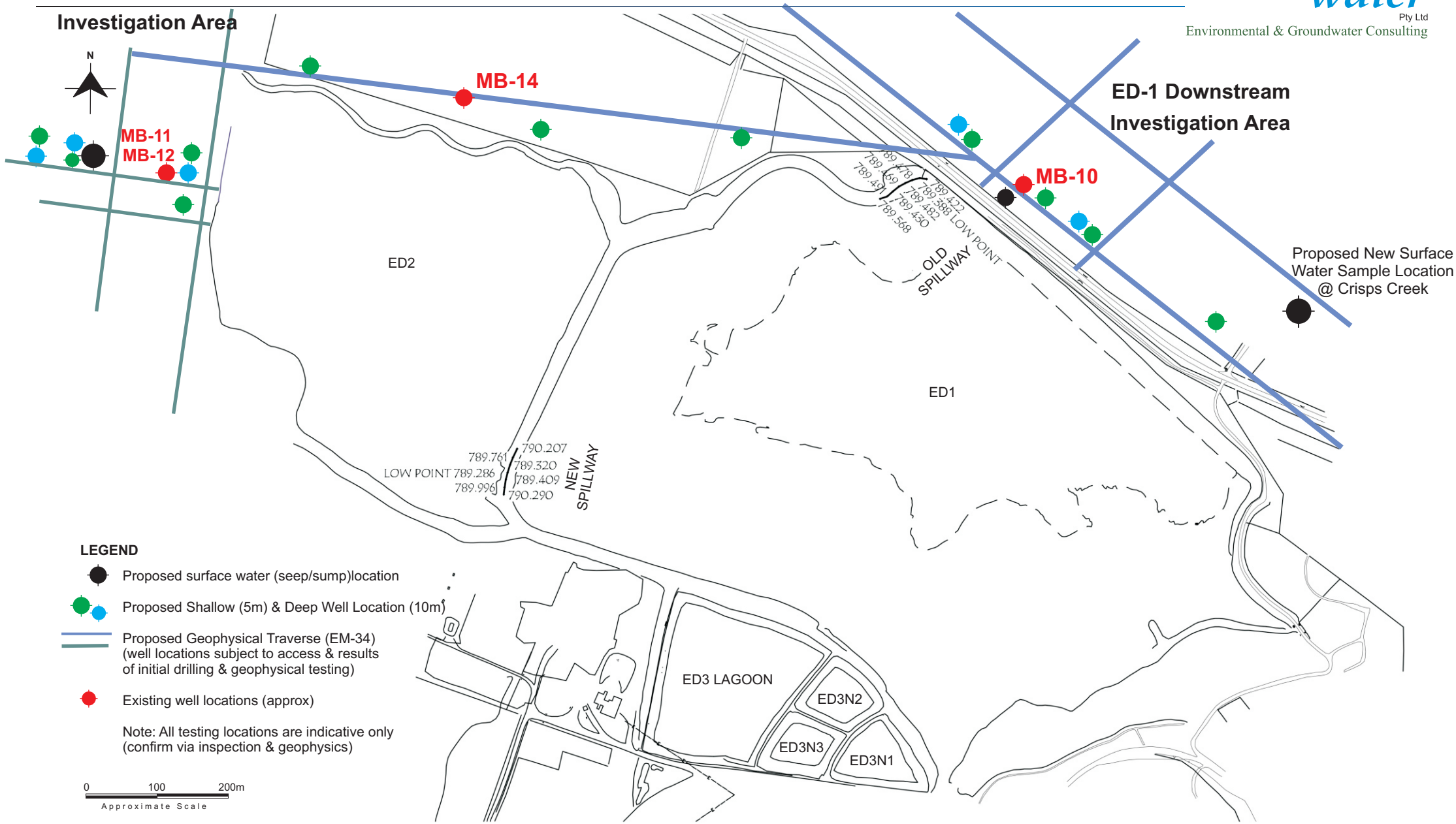
VEOLIA - ED1 &2 INTEGRITY ASSESSMENT

Date: *16 July 2016*

Reference: *E2W_243_12.cdr*

Figure 6

earth2water Pty Ltd
Environmental & Groundwater Consulting



Baseplan source: Kells Land Development Solutions

ED1& 2 Proposed Geophysical & Preliminary Monitoring Locations

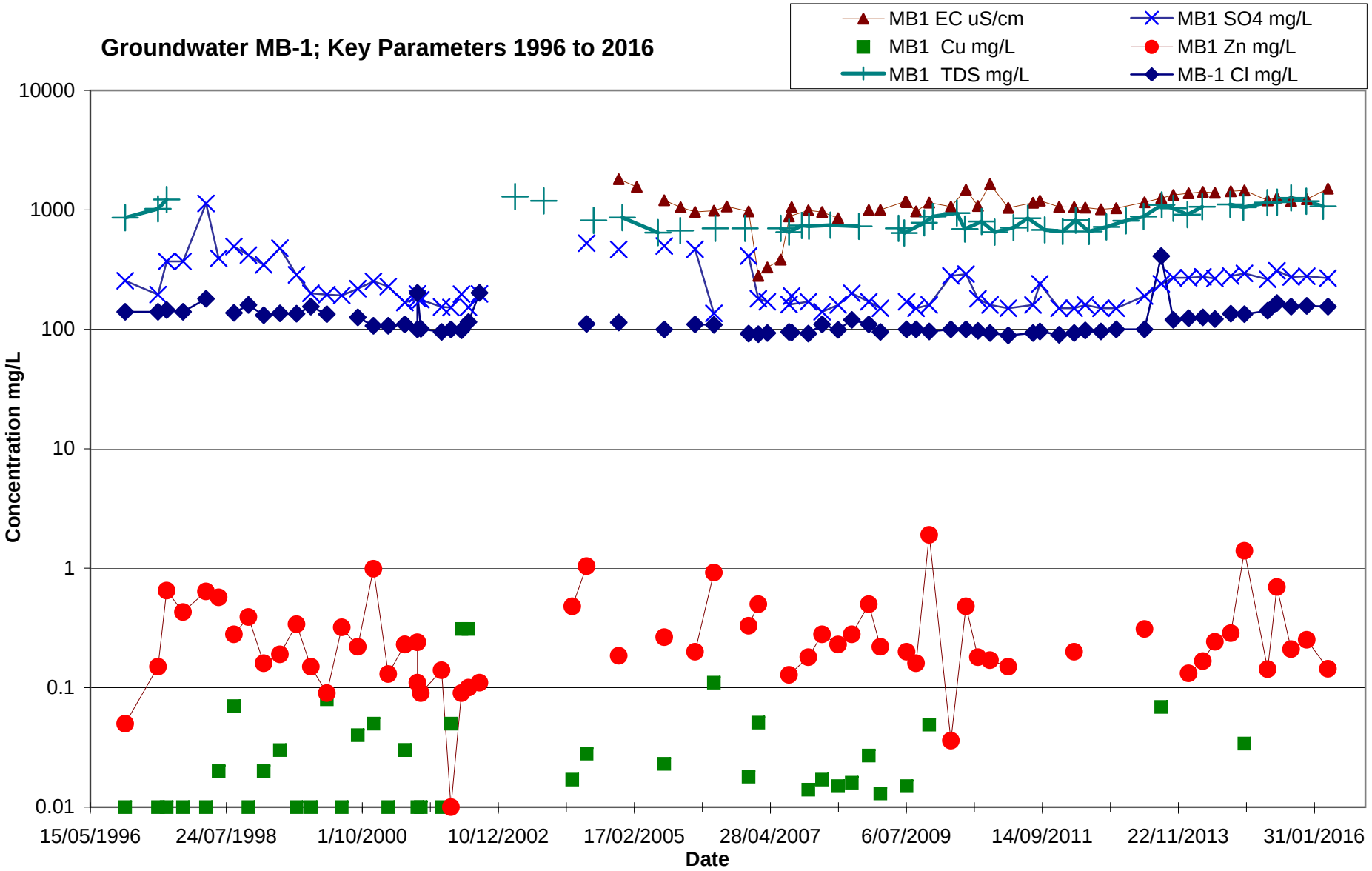
Date: *16 July 2016*

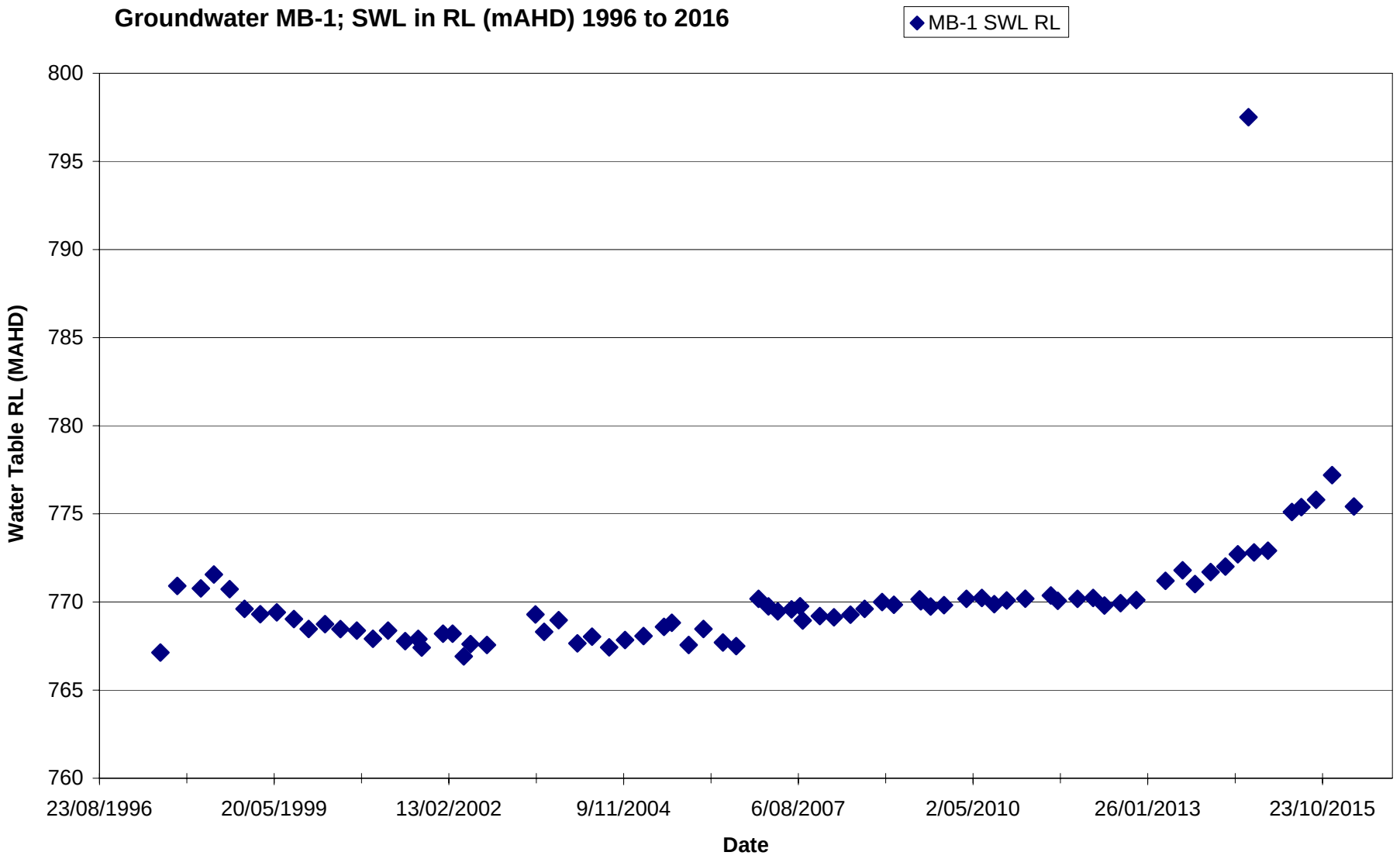
Reference: *E2W_243_13.cdr*

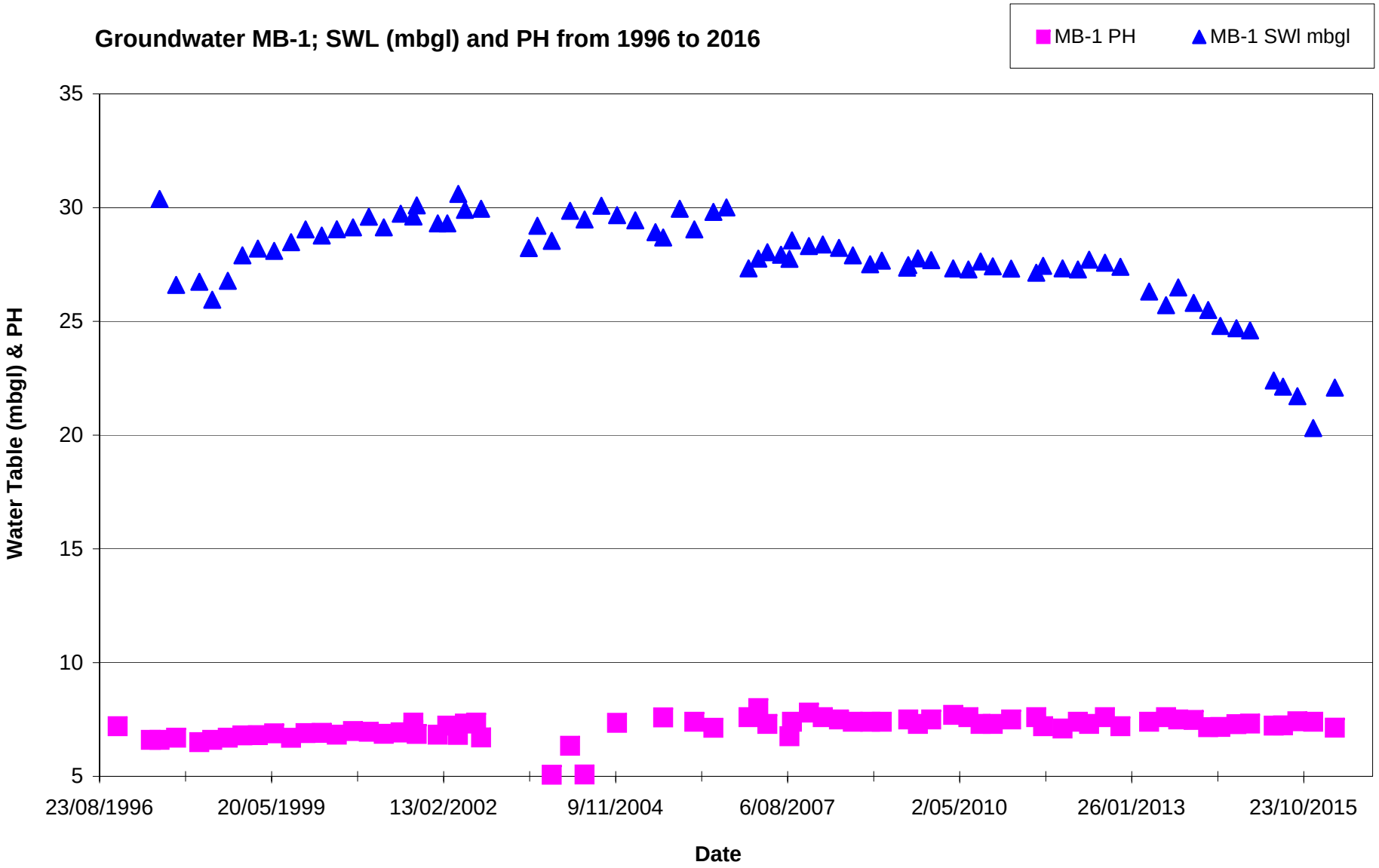
Veolia- ED1& 2 Integrity Assessment

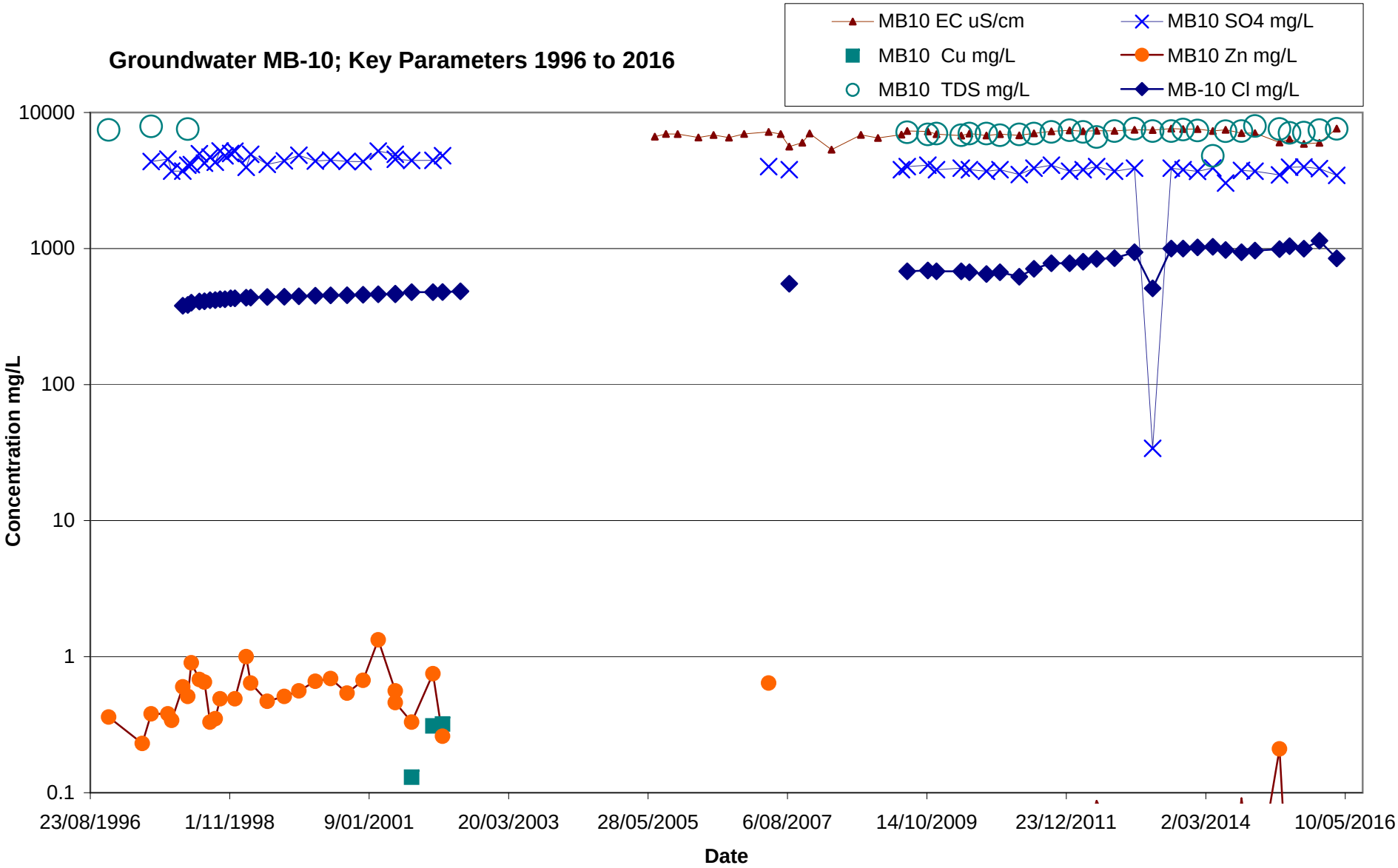
Figure 7

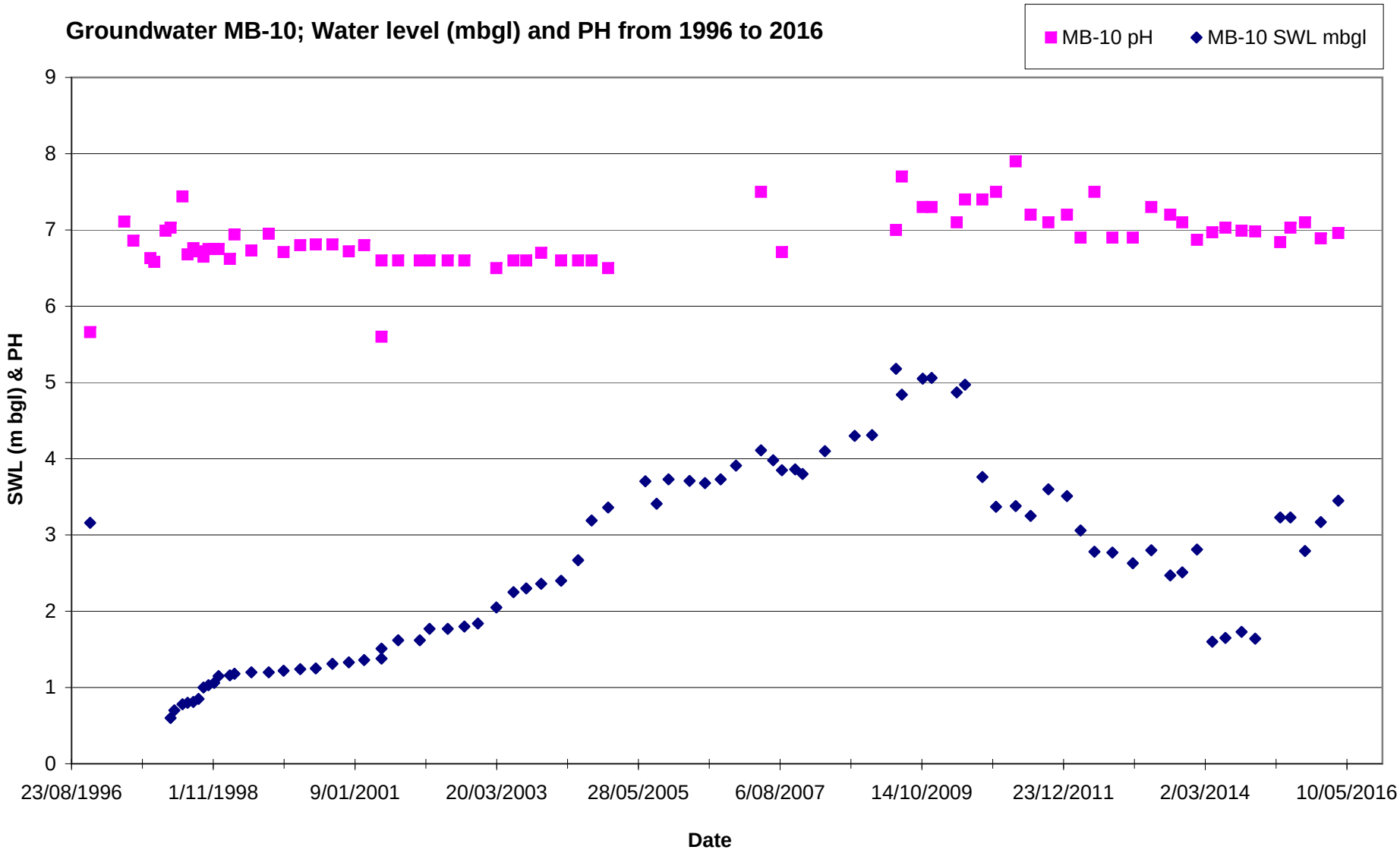
Time Series Graphs

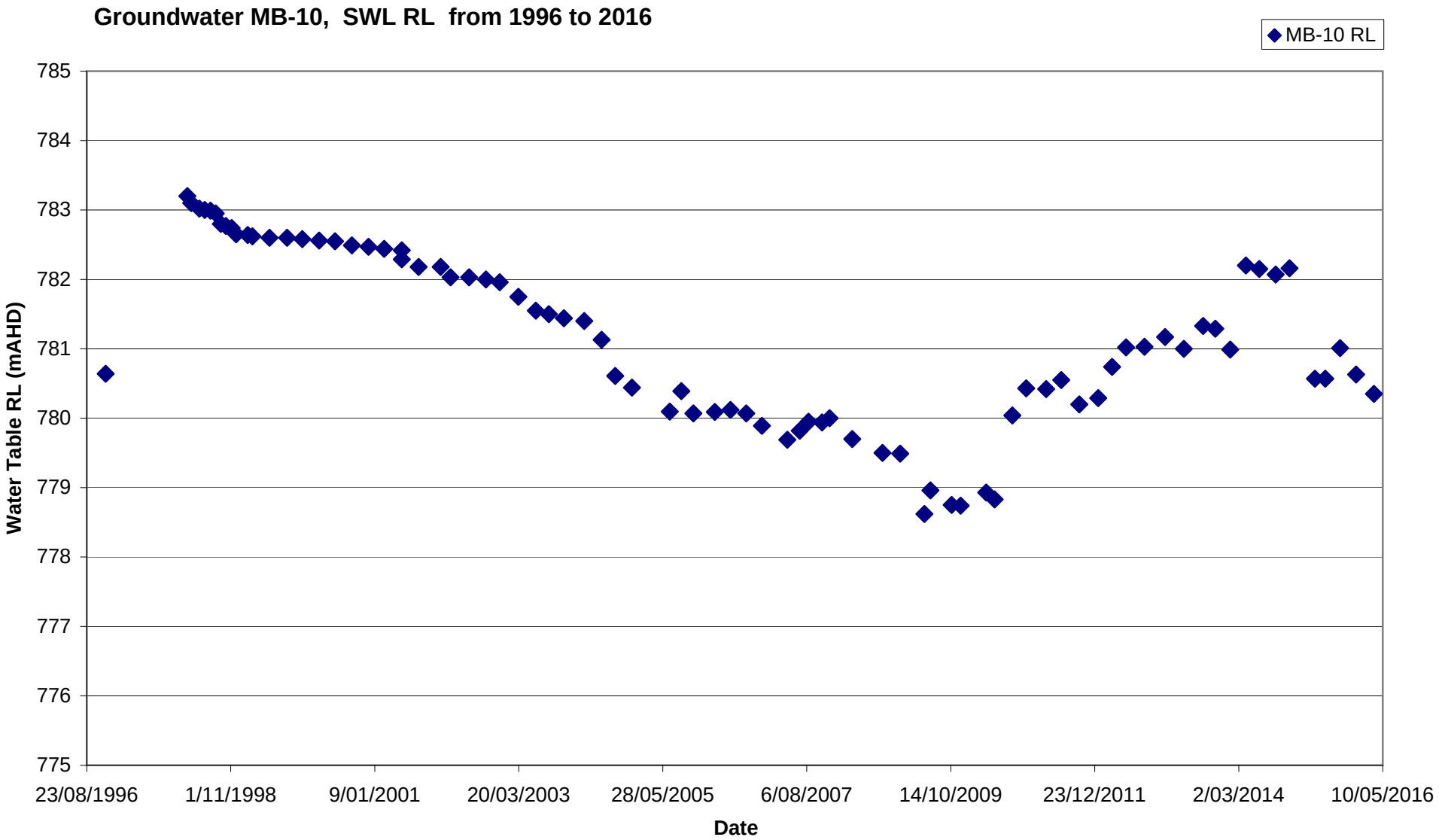

Groundwater MB-1; Key Parameters 1996 to 2016
MB1 EC uS/cm
MB1 SO4 mg/L
MB1 Cu mg/L
MB1 Zn mg/L
MB1 TDS mg/L
MB-1 Cl mg/L
Concentration mg/L
10000
1000
100
10
1
0.1
0.01
15/05/1996
24/07/1998
1/10/2000
10/12/2002
17/02/2005
28/04/2007
6/07/2009
14/09/2011
22/11/2013
31/01/2016
Date

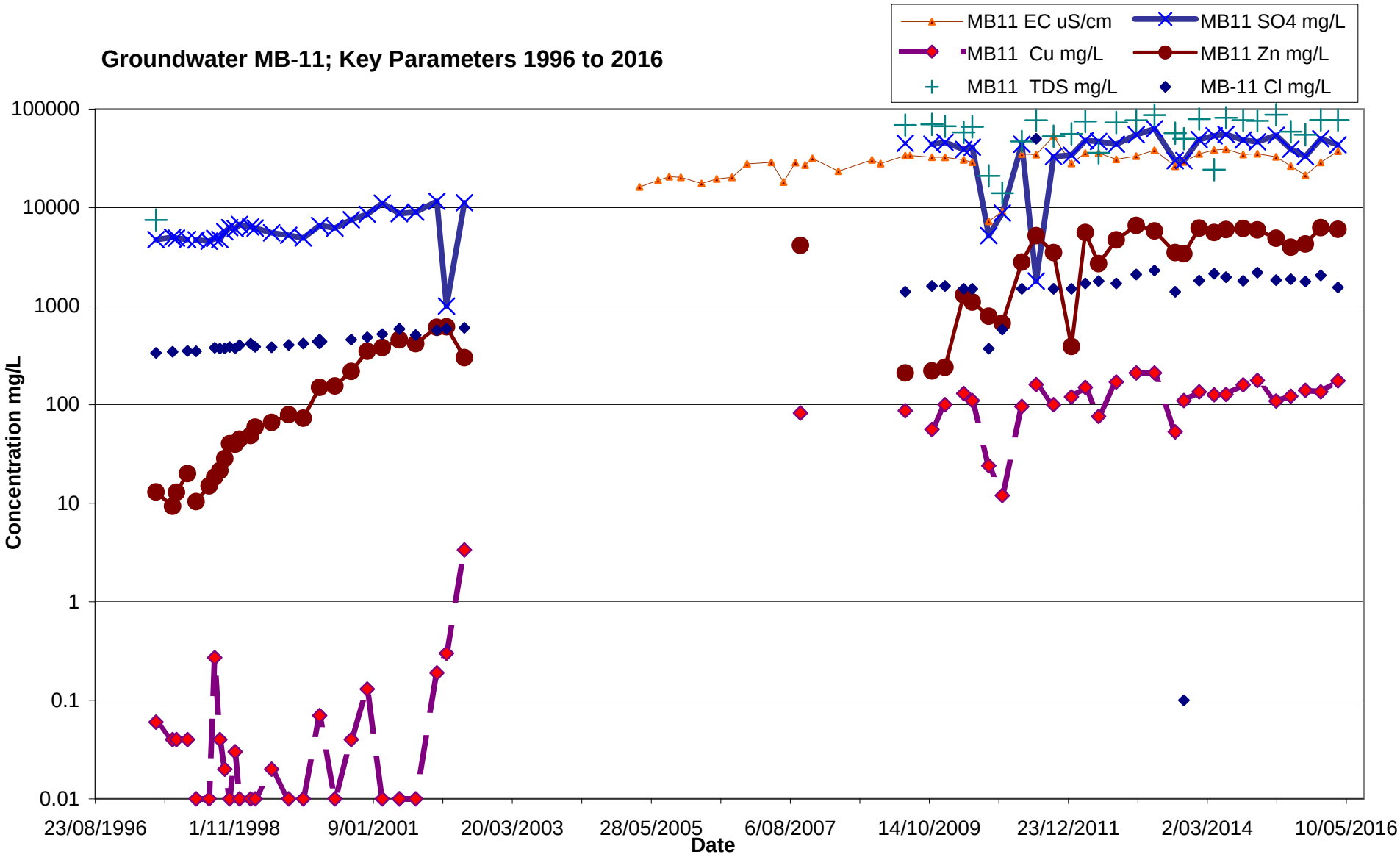

Groundwater MB-1; SWL in RL (mAHD) 1996 to 2016
MB-1 SWL RL
Water Table RL (MAHD)
800
795
790
785
780
775
770
765
760
23/08/1996
20/05/1999
13/02/2002
9/11/2004
6/08/2007
2/05/2010
26/01/2013
23/10/2015
Date

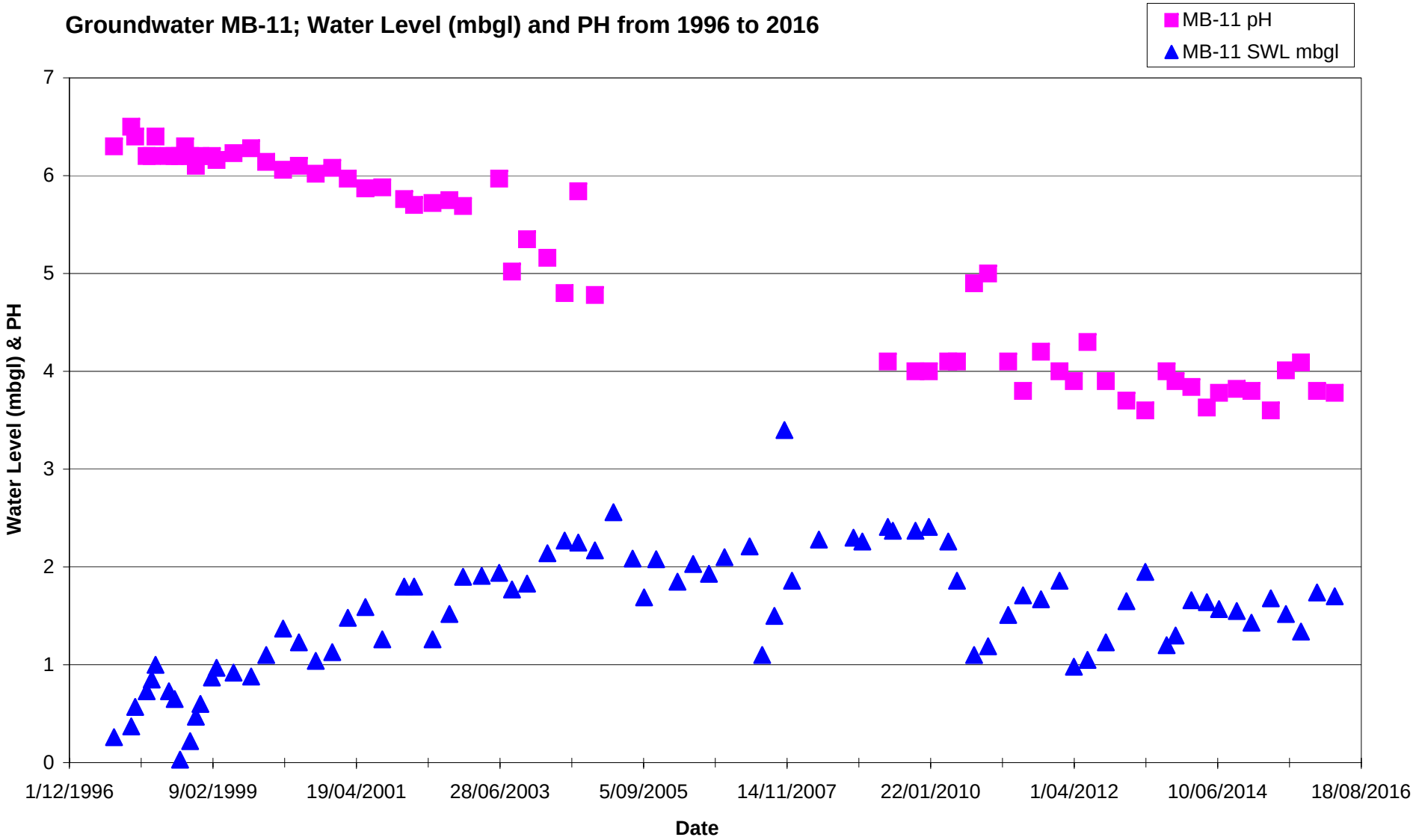

Groundwater MB-1; SWL (mbgl) and PH from 1996 to 2016
MB-1 PH
MB-1 SWl mbgl
Water Table (mbgl) & PH
35
30
25
20
15
10
5
23/08/1996
20/05/1999
13/02/2002
9/11/2004
6/08/2007
2/05/2010
26/01/2013
23/10/2015
Date

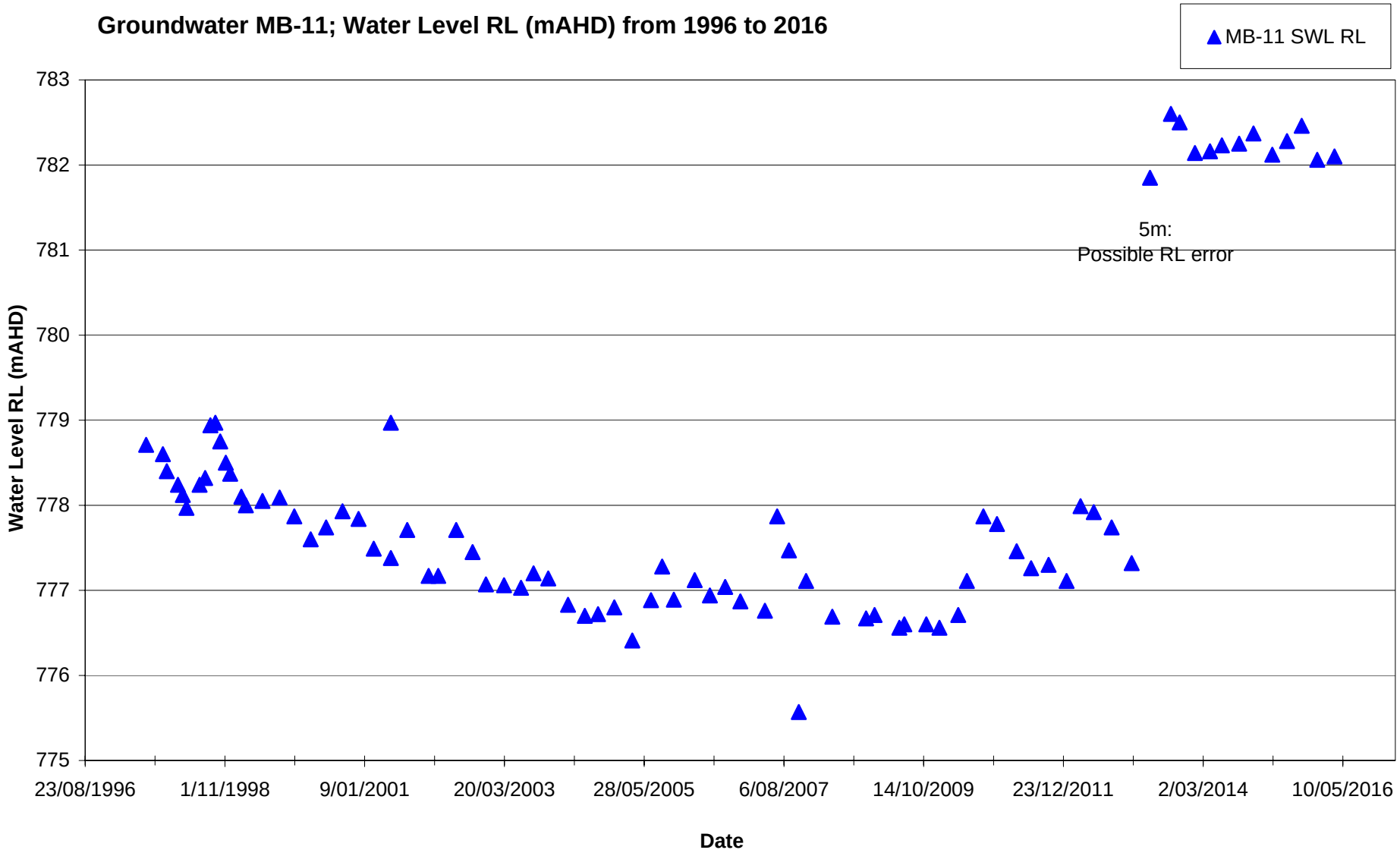

Groundwater MB-10; Key Parameters 1996 to 2016
MB10 EC uS/cm
MB10 SO4 mg/L
MB10 Cu mg/L
MB10 Zn mg/L
MB10 TDS mg/L
MB-10 Cl mg/L
10000
1000
100
10
1
0.1
Concentration mg/L
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

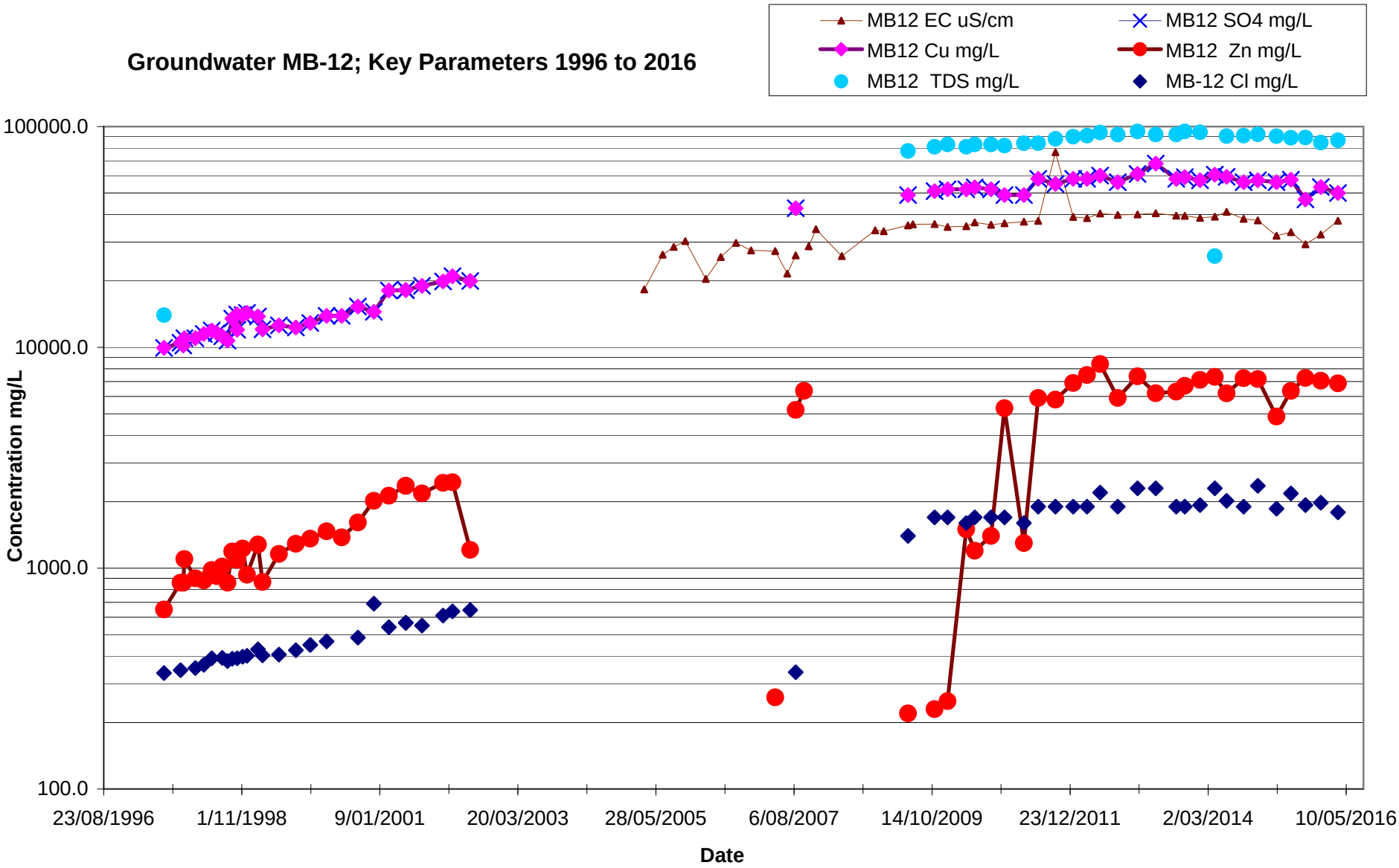

Groundwater MB-10; Water level (mbgl) and PH from 1996 to 2016
MB-10 pH
MB-10 SWL mbgl
SWL (m bgl) & PH
0
1
2
3
4
5
6
7
8
9
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

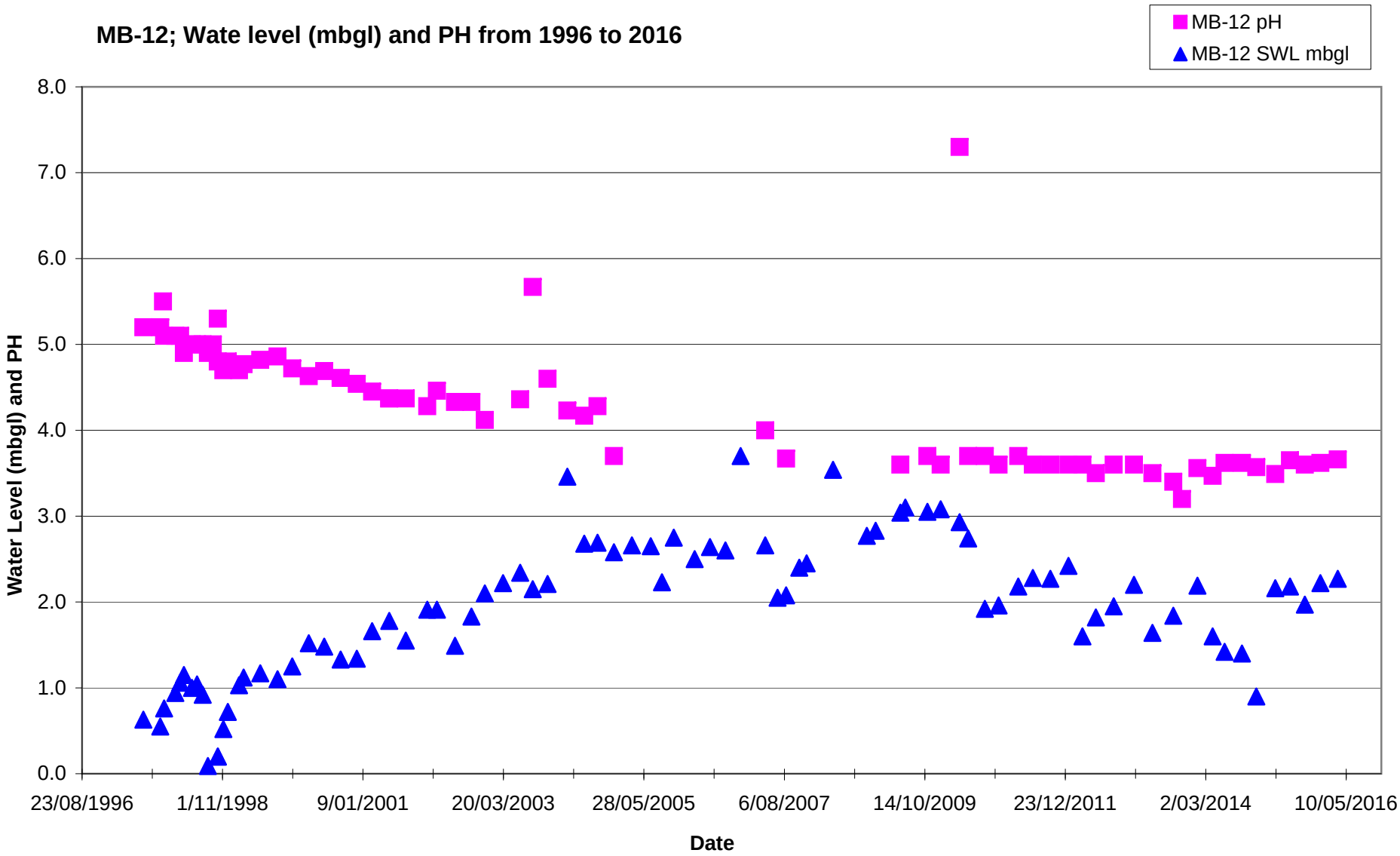

Groundwater MB-10, SWL RL from 1996 to 2016
MB-10 RL
Water Table RL (mAHD)
785
784
783
782
781
780
779
778
777
776
775
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

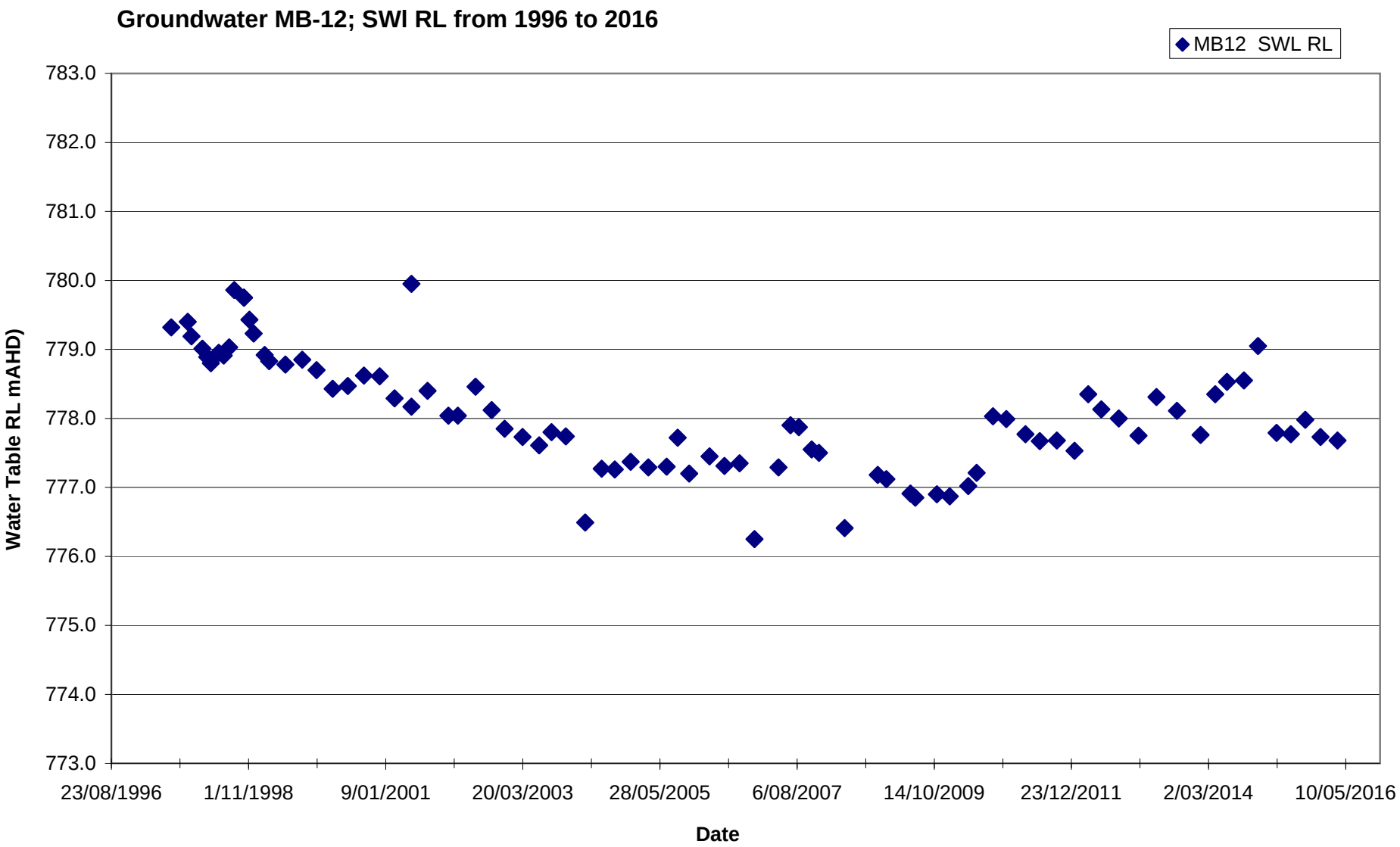

Groundwater MB-11; Key Parameters 1996 to 2016
MB11 EC uS/cm
MB11 SO4 mg/L
MB11 Cu mg/L
MB11 Zn mg/L
MB11 TDS mg/L
MB-11 Cl mg/L
Concentration mg/L
100000
10000
1000
100
10
1
0.1
0.01
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

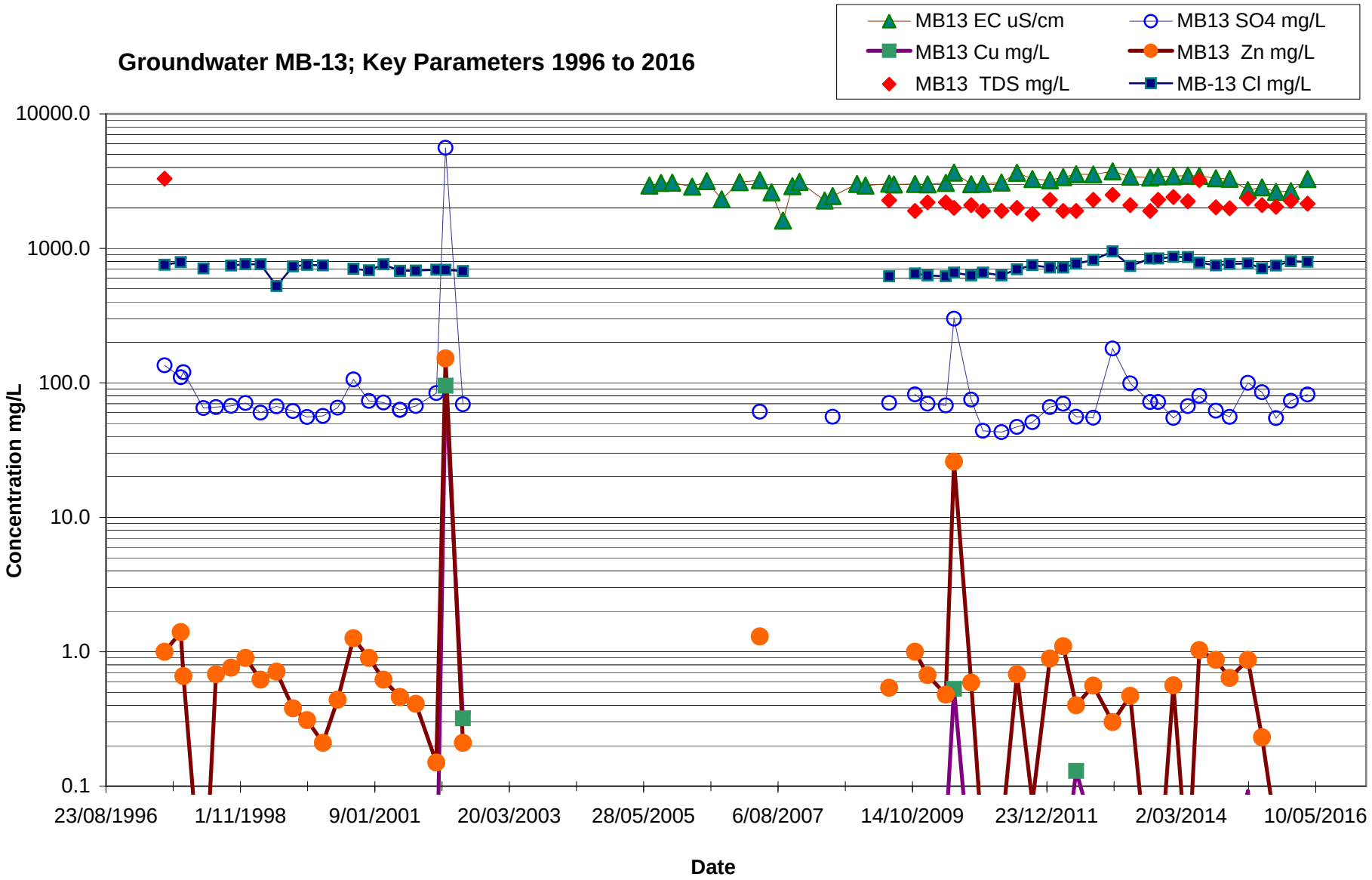

Groundwater MB-11; Water Level (mbgl) and PH from 1996 to 2016
MB-11 pH
MB-11 SWL mbgl
Water Level (mbgl) & PH
0
1
2
3
4
5
6
7
1/12/1996
9/02/1999
19/04/2001
28/06/2003
5/09/2005
14/11/2007
22/01/2010
1/04/2012
10/06/2014
18/08/2016
Date

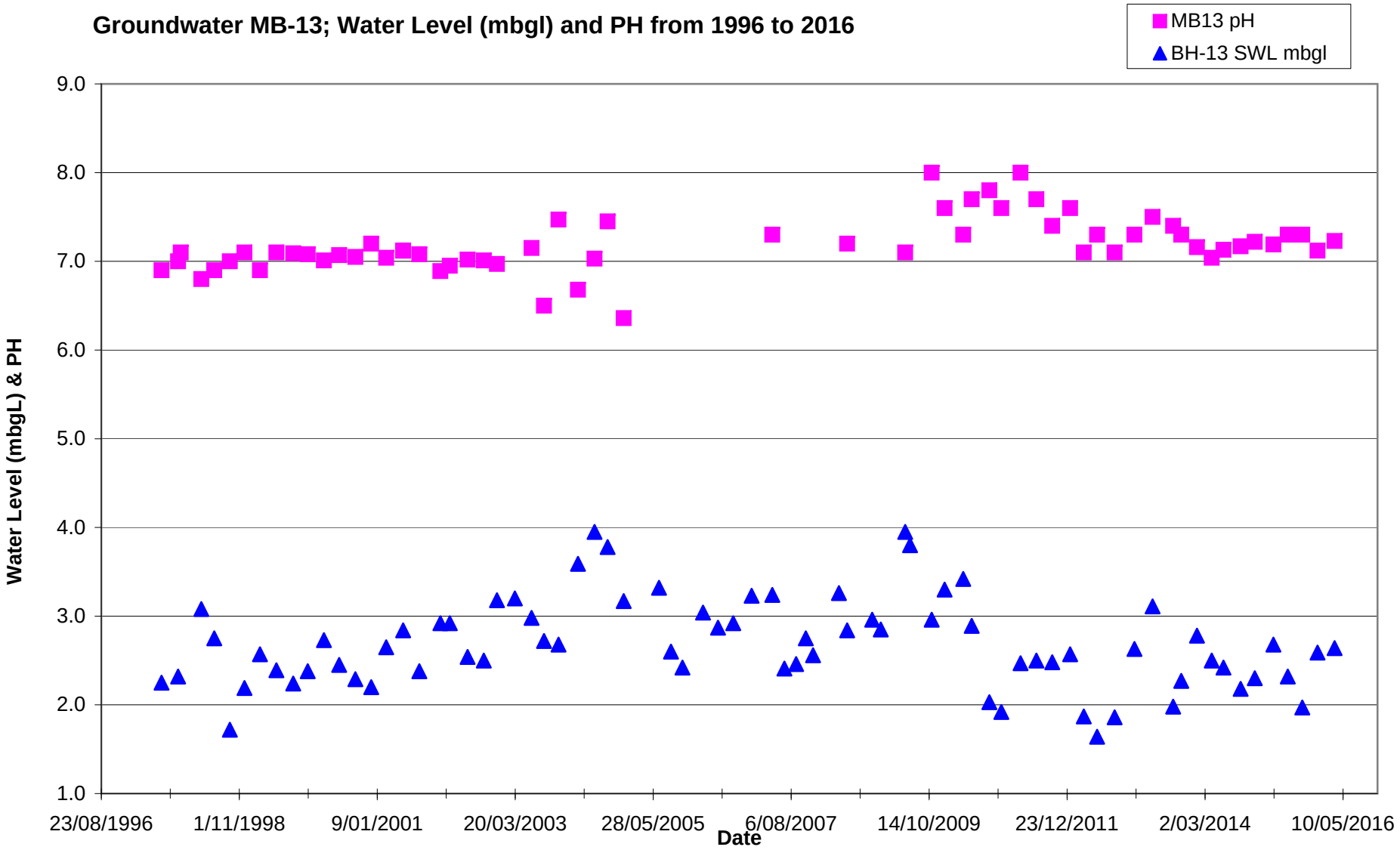

Groundwater MB-11; Water Level RL (mAHD) from 1996 to 2016
MB-11 SWL RL
5m:
Possible RL error
Water Level RL (mAHD)
783
782
781
780
779
778
777
776
775
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

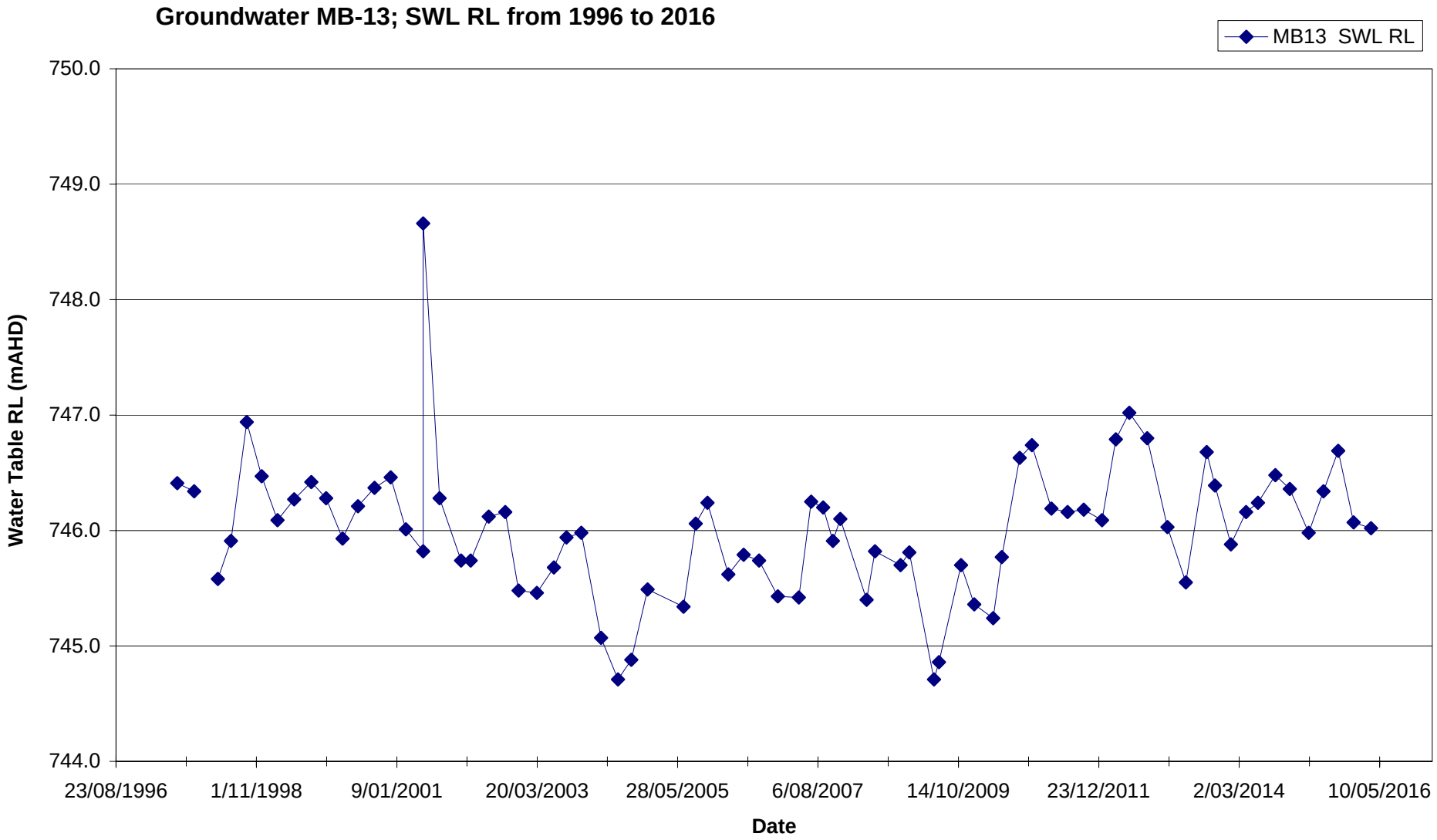

Groundwater MB-12; Key Parameters 1996 to 2016
MB12 EC uS/cm
MB12 SO4 mg/L
MB12 Cu mg/L
MB12 Zn mg/L
MB12 TDS mg/L
MB-12 Cl mg/L
100000.0
10000.0
1000.0
100.0
Concentration mg/L
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

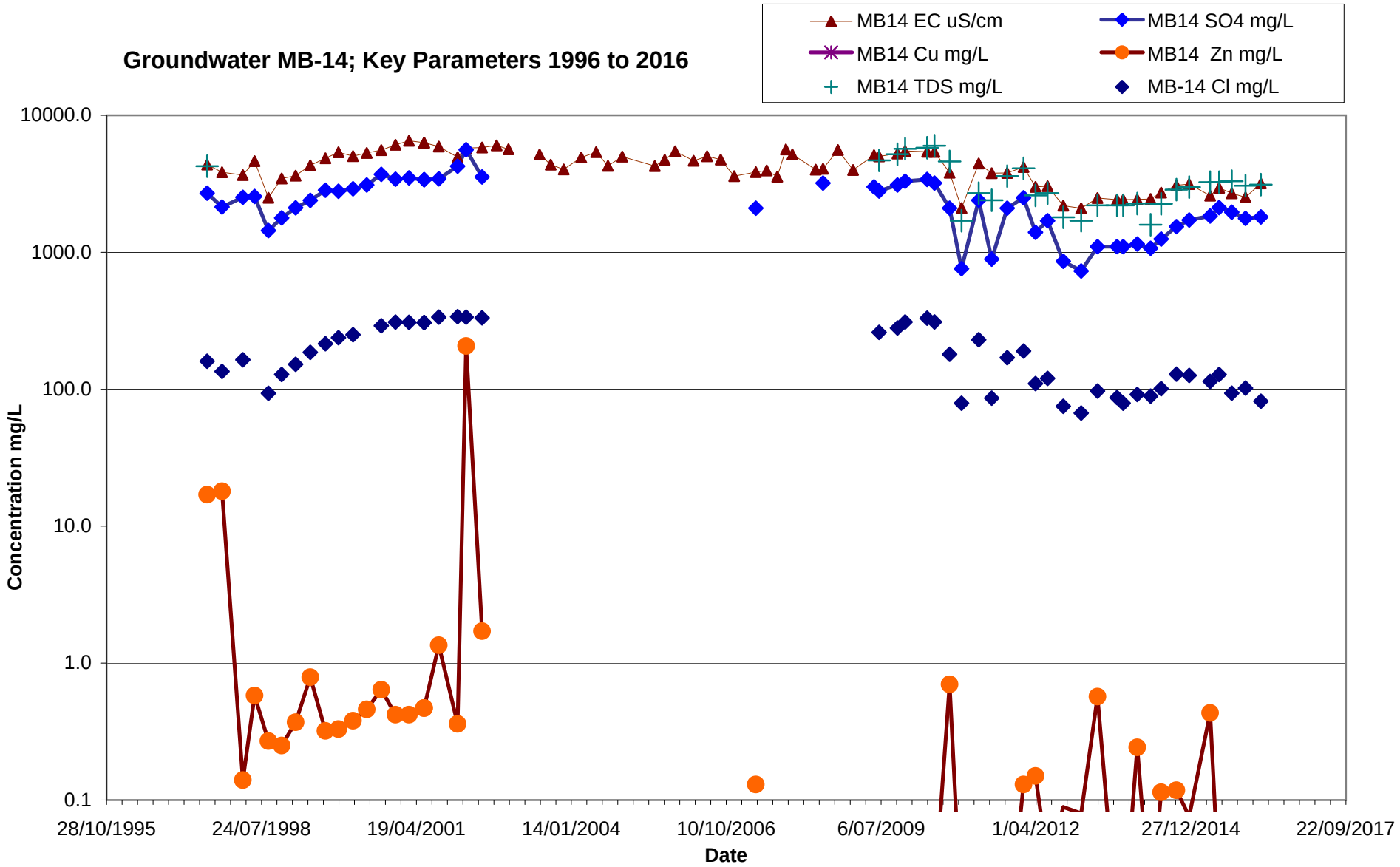

MB-12; Wate level (mbgl) and PH from 1996 to 2016
MB-12 pH
MB-12 SWL mbgl
Water Level (mbgl) and PH
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

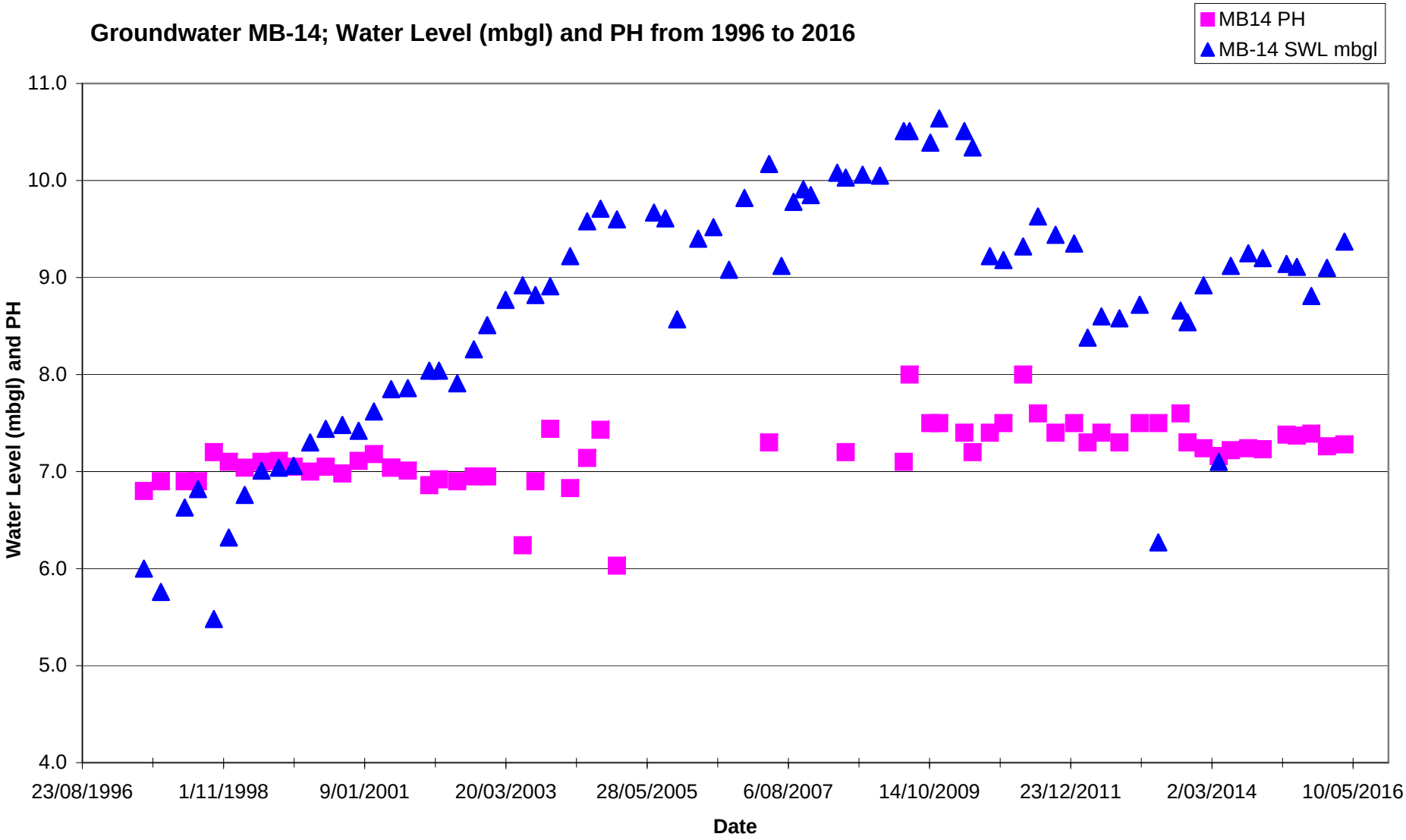

Groundwater MB-12; SWl RL from 1996 to 2016
MB12 SWL RL
783.0
782.0
781.0
780.0
779.0
778.0
777.0
776.0
775.0
774.0
773.0
Water Table RL mAHD)
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

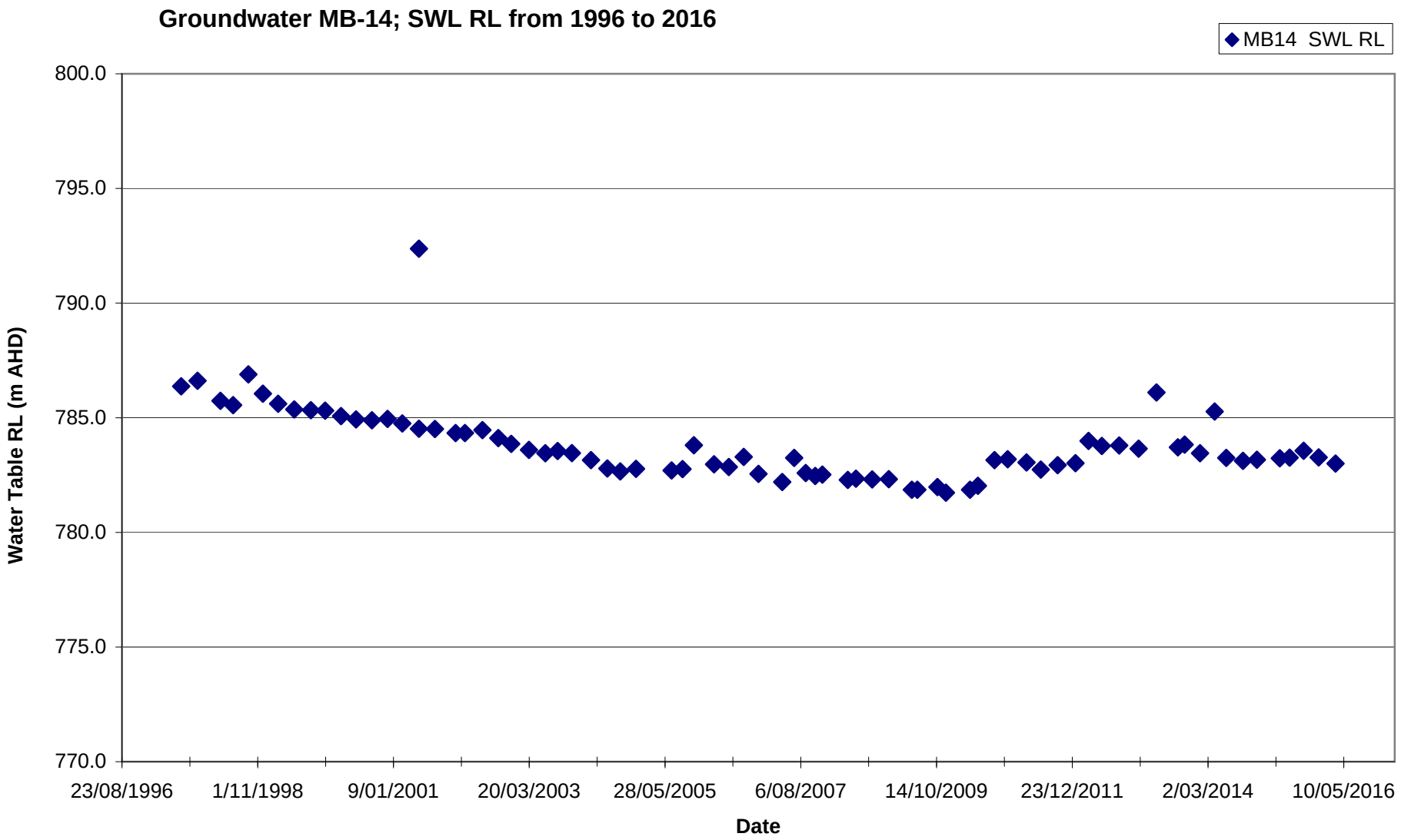

Groundwater MB-13; Key Parameters 1996 to 2016
MB13 EC uS/cm
MB13 SO4 mg/L
MB13 Cu mg/L
MB13 Zn mg/L
MB13 TDS mg/L
MB-13 Cl mg/L
10000.0
1000.0
100.0
10.0
1.0
0.1
Concentration mg/L
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

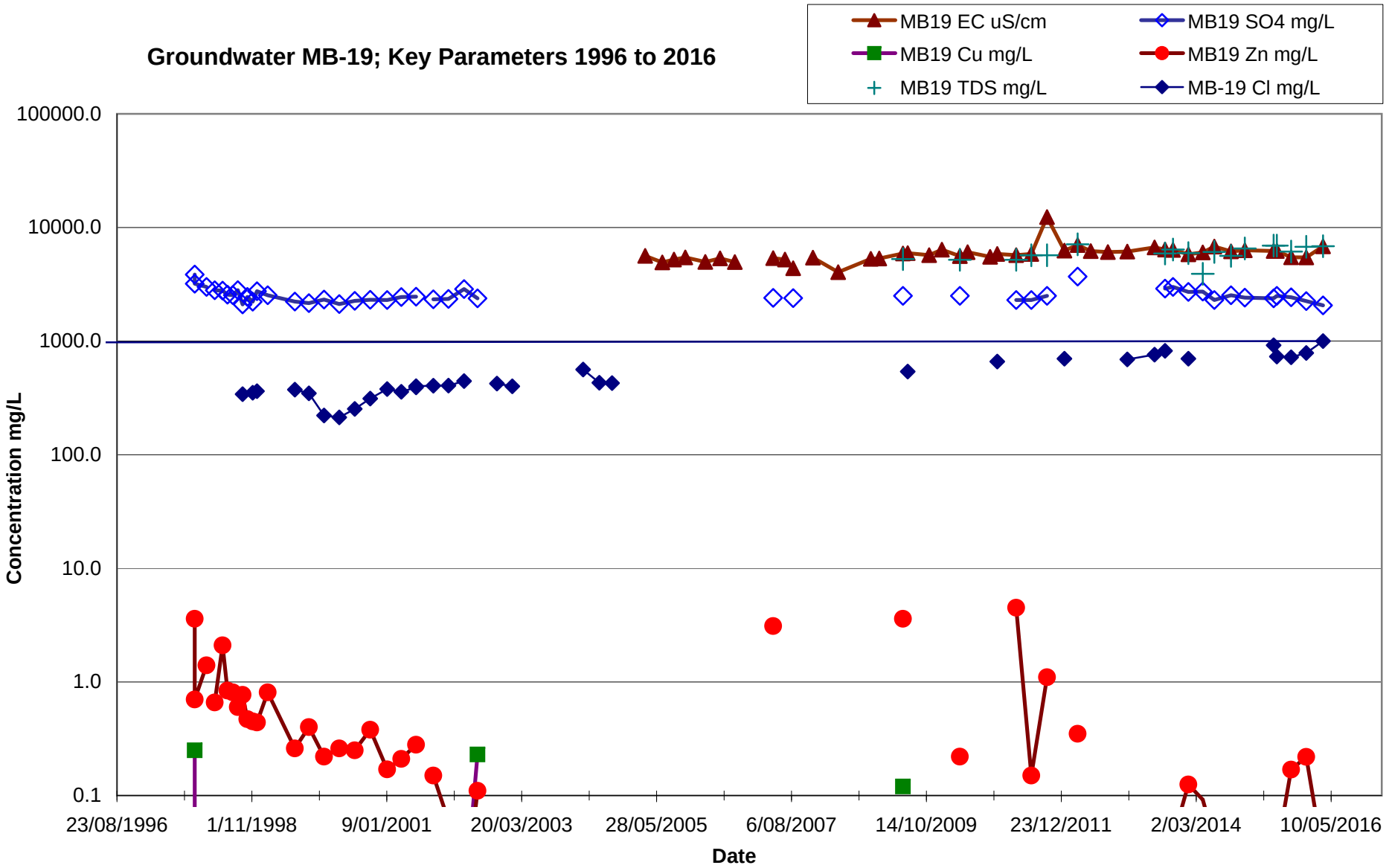

Groundwater MB-13; Water Level (mbgl) and PH from 1996 to 2016
MB13 pH
BH-13 SWL mbgl
Water Level (mbgL) & PH
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

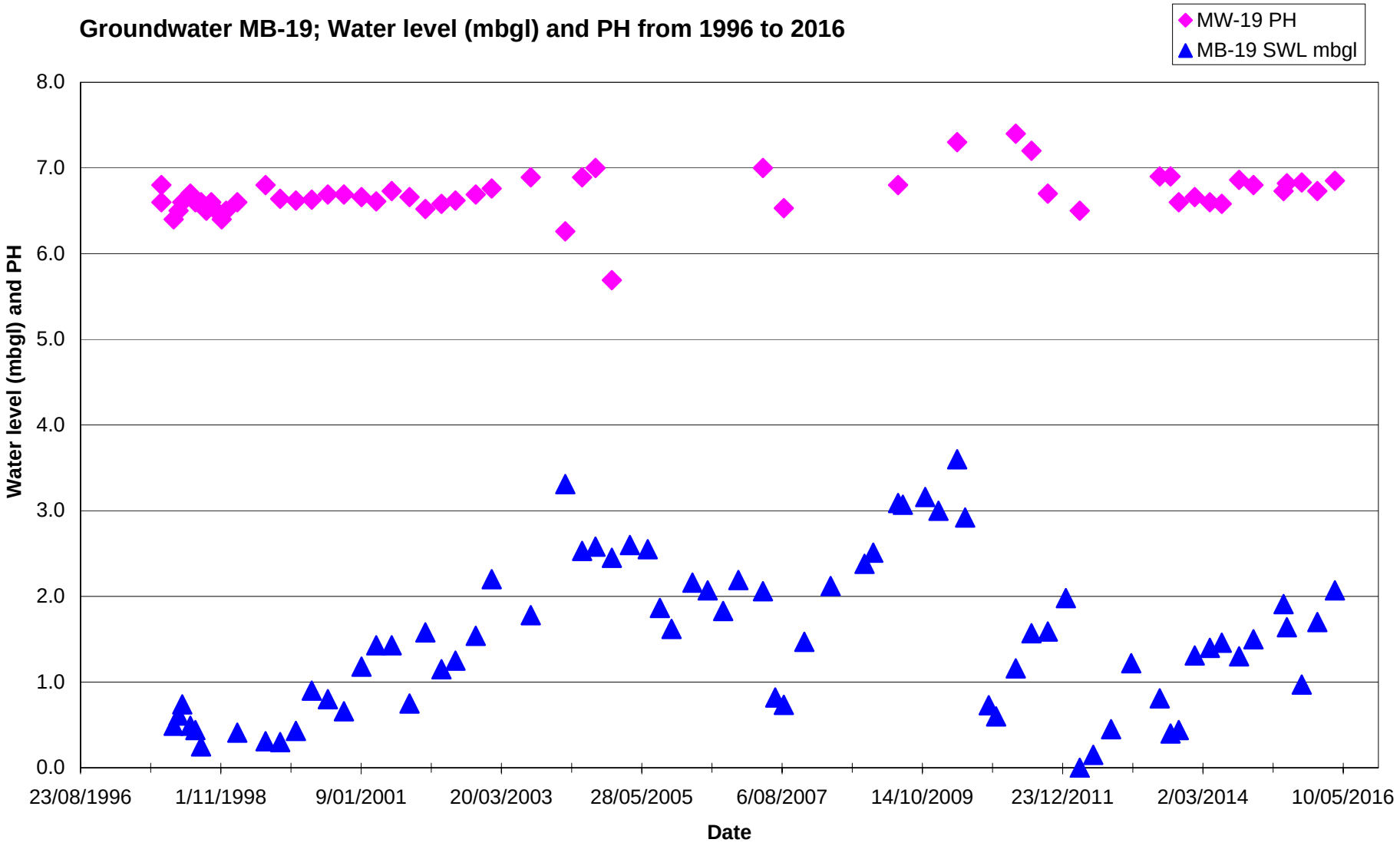

Groundwater MB-13; SWL RL from 1996 to 2016
MB13 SWL RL
750.0
749.0
748.0
747.0
746.0
745.0
744.0
Water Table RL (mAHD)
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

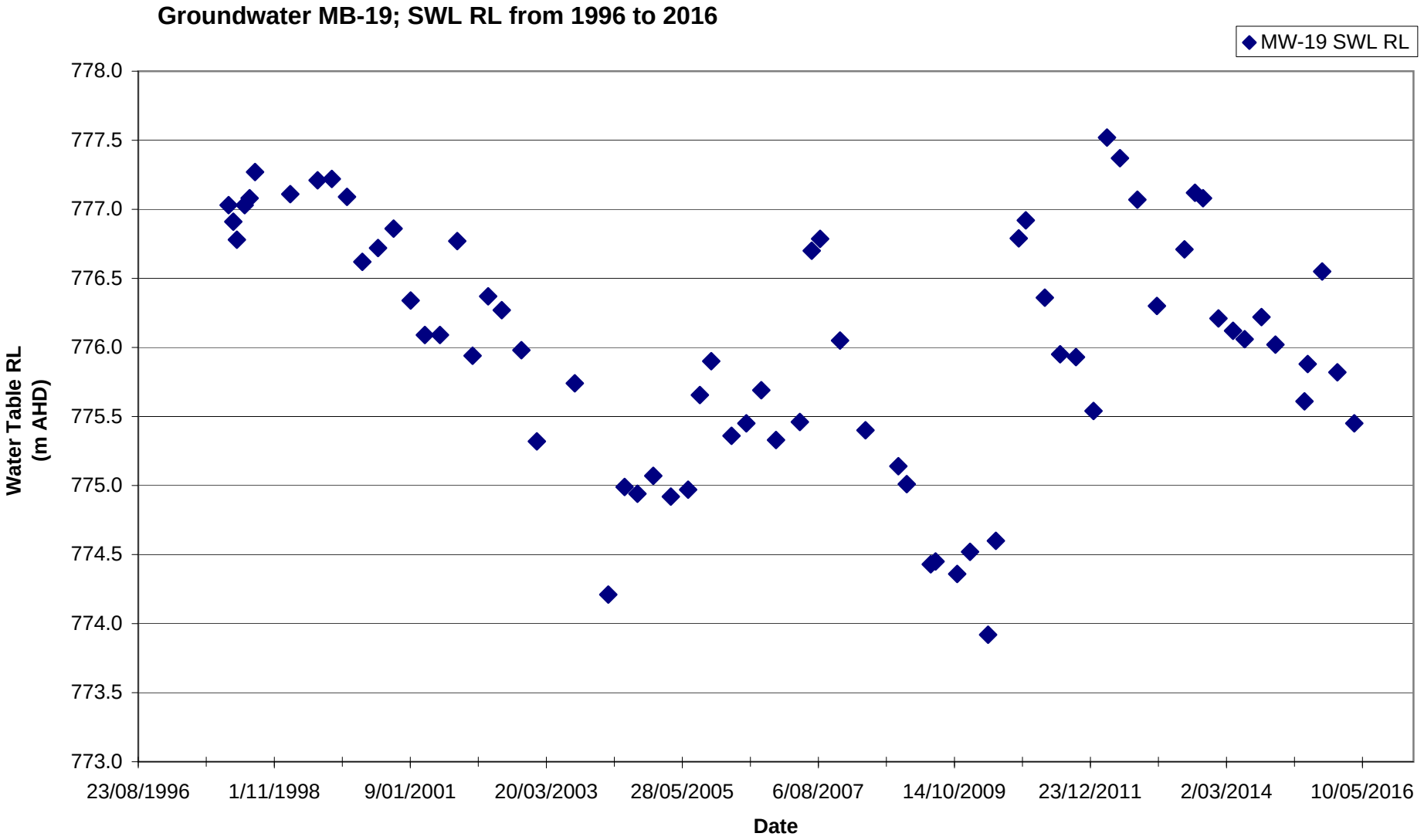

Groundwater MB-14; Key Parameters 1996 to 2016
MB14 EC uS/cm
MB14 SO4 mg/L
MB14 Cu mg/L
MB14 Zn mg/L
MB14 TDS mg/L
MB-14 Cl mg/L
10000.0
1000.0
100.0
10.0
1.0
0.1
Concentration mg/L
28/10/1995
24/07/1998
19/04/2001
14/01/2004
10/10/2006
6/07/2009
1/04/2012
27/12/2014
22/09/2017
Date

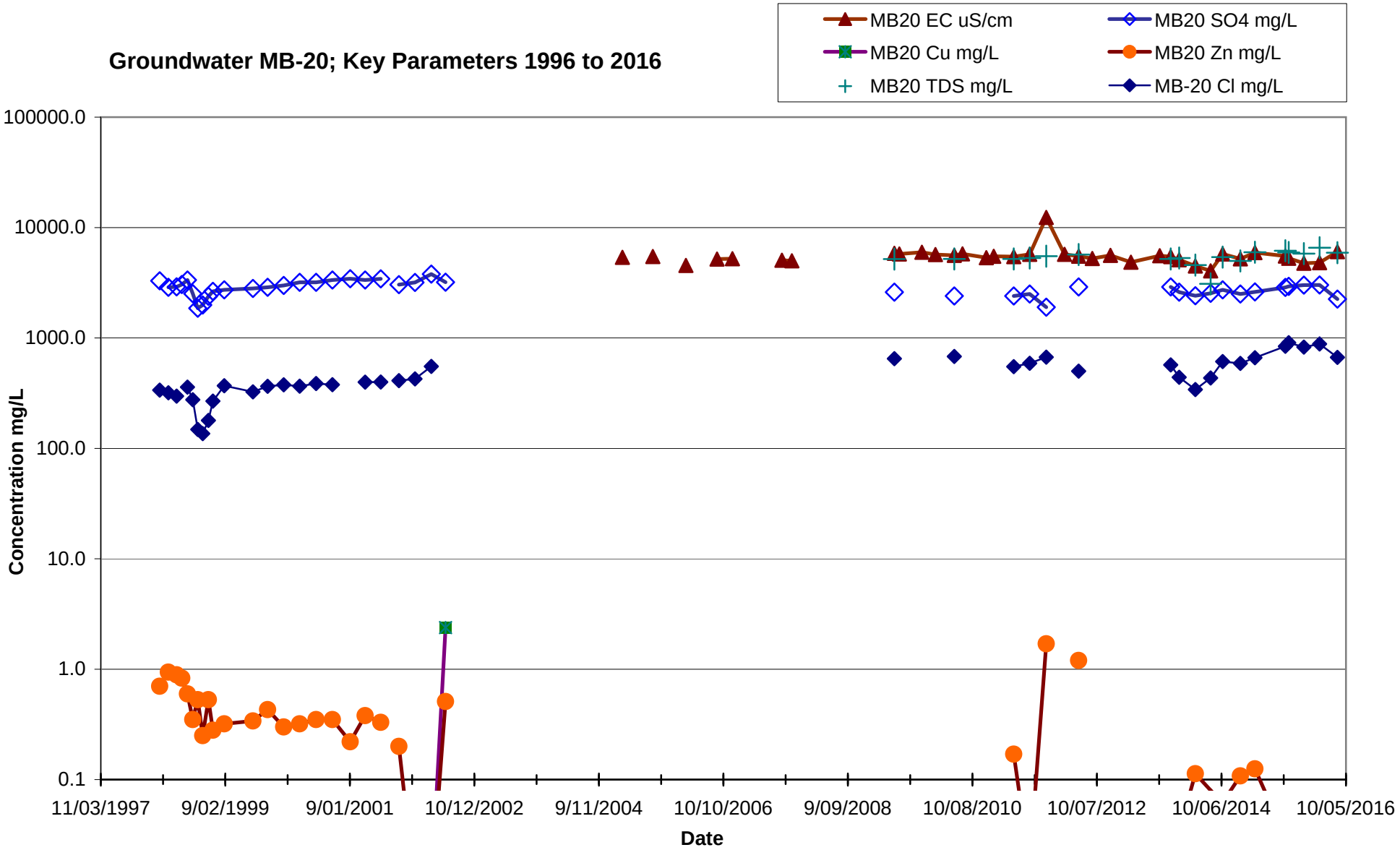

Groundwater MB-14; Water Level (mbgl) and PH from 1996 to 2016
MB14 PH
MB-14 SWL mbgl
Water Level (mbgl) and PH
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date


Groundwater MB-14; SWL RL from 1996 to 2016
MB14 SWL RL
800.0
795.0
790.0
785.0
780.0
775.0
770.0
Water Table RL (m AHD)
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

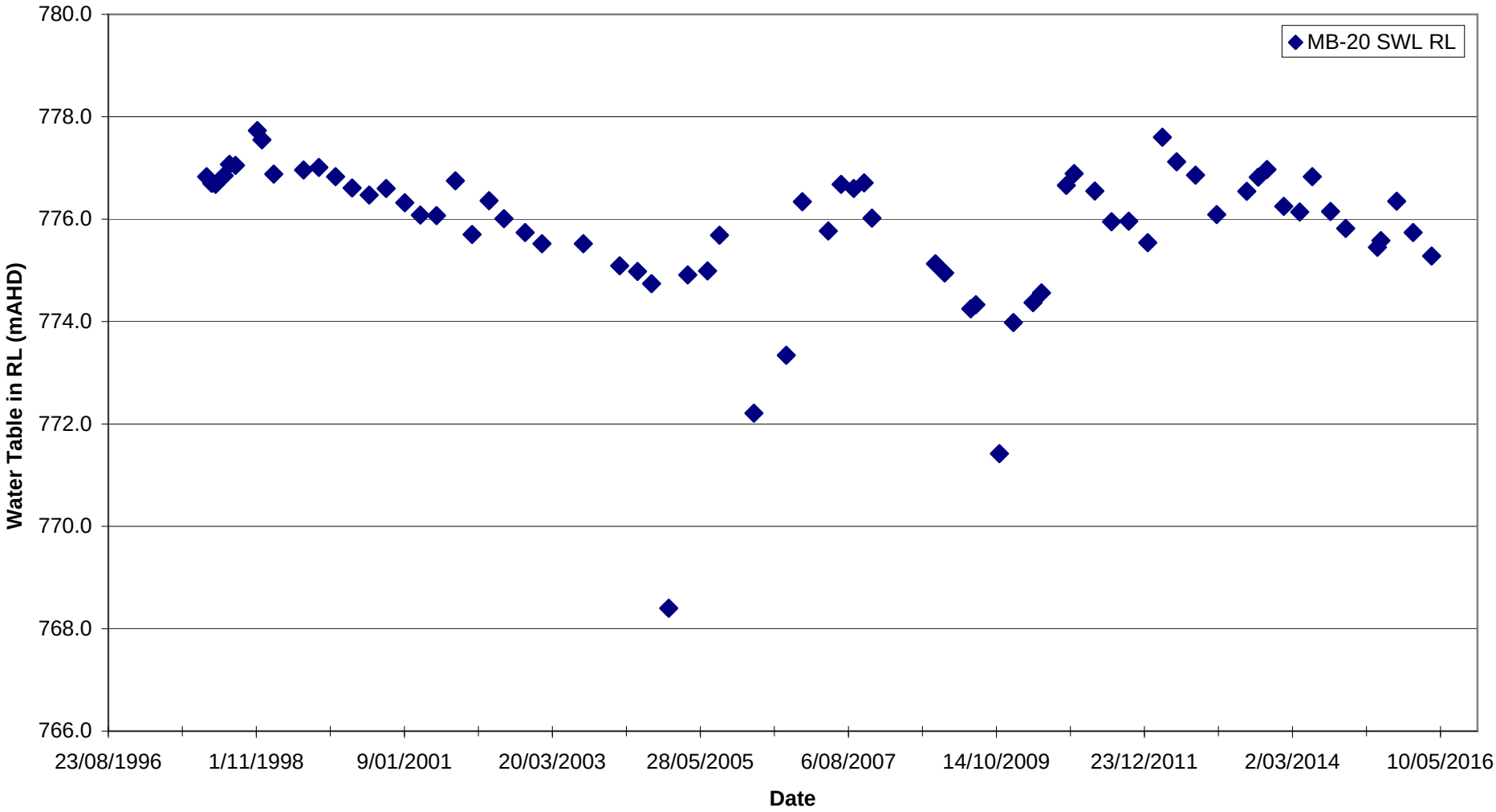

Groundwater MB-19; Key Parameters 1996 to 2016
MB19 EC uS/cm
MB19 SO4 mg/L
MB19 Cu mg/L
MB19 Zn mg/L
MB19 TDS mg/L
MB-19 Cl mg/L
100000.0
10000.0
1000.0
100.0
10.0
1.0
0.1
Concentration mg/L
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

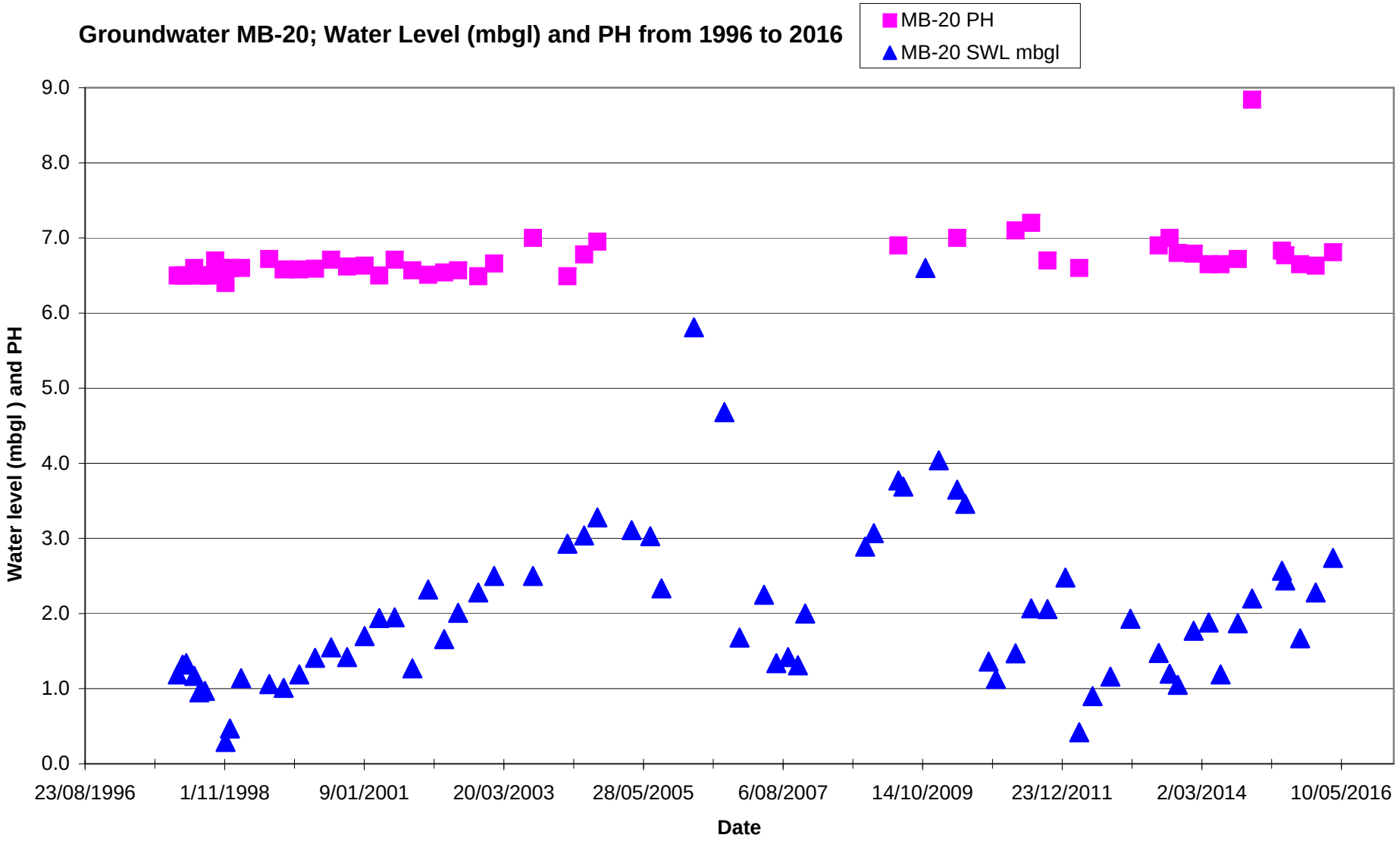

Groundwater MB-19; Water level (mbgl) and PH from 1996 to 2016
MW-19 PH
MB-19 SWL mbgl
Water level (mbgl) and PH
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

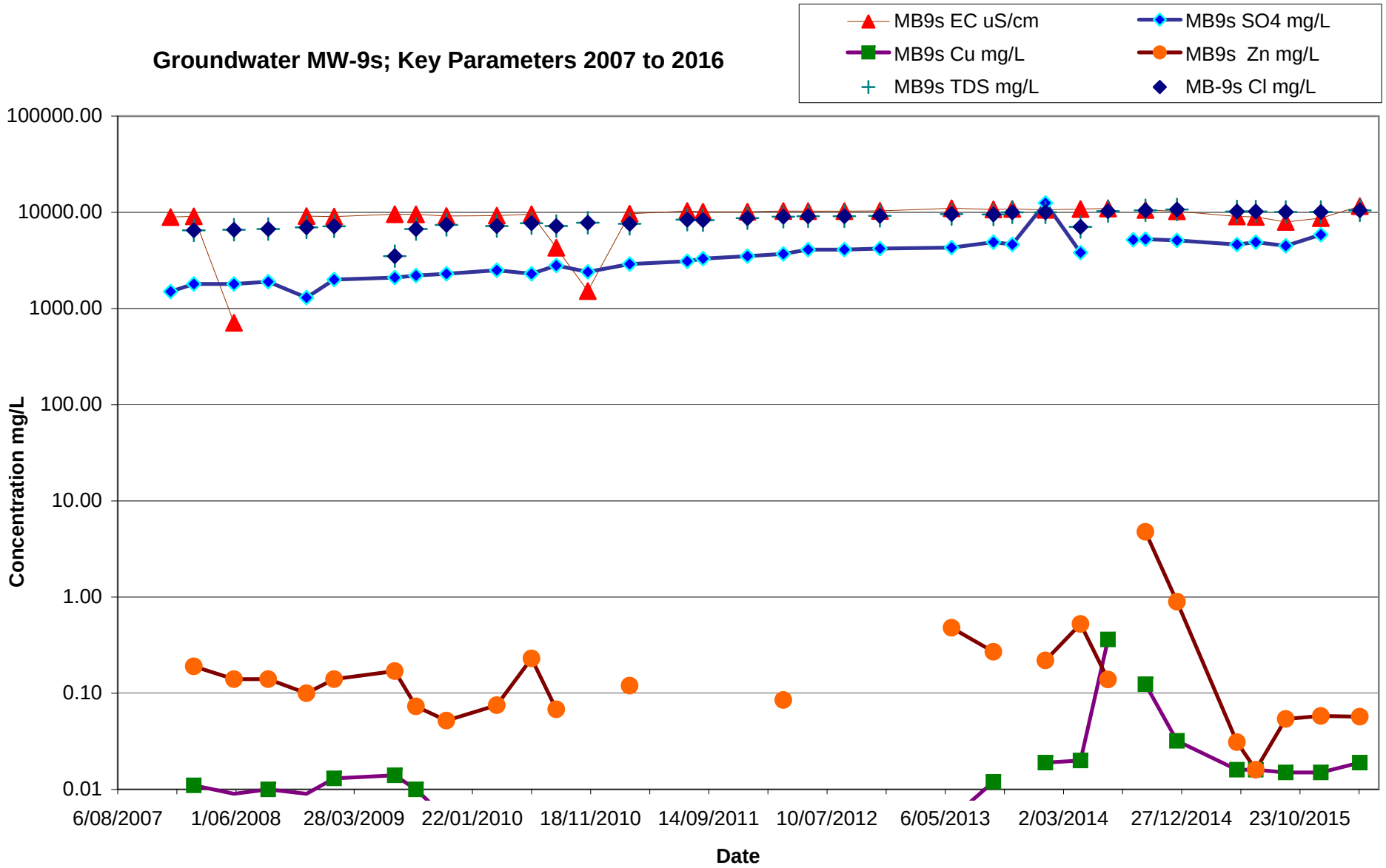

Groundwater MB-19; SWL RL from 1996 to 2016
MW-19 SWL RL
Water Table RL (m AHD)
778.0
777.5
777.0
776.5
776.0
775.5
775.0
774.5
774.0
773.5
773.0
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date

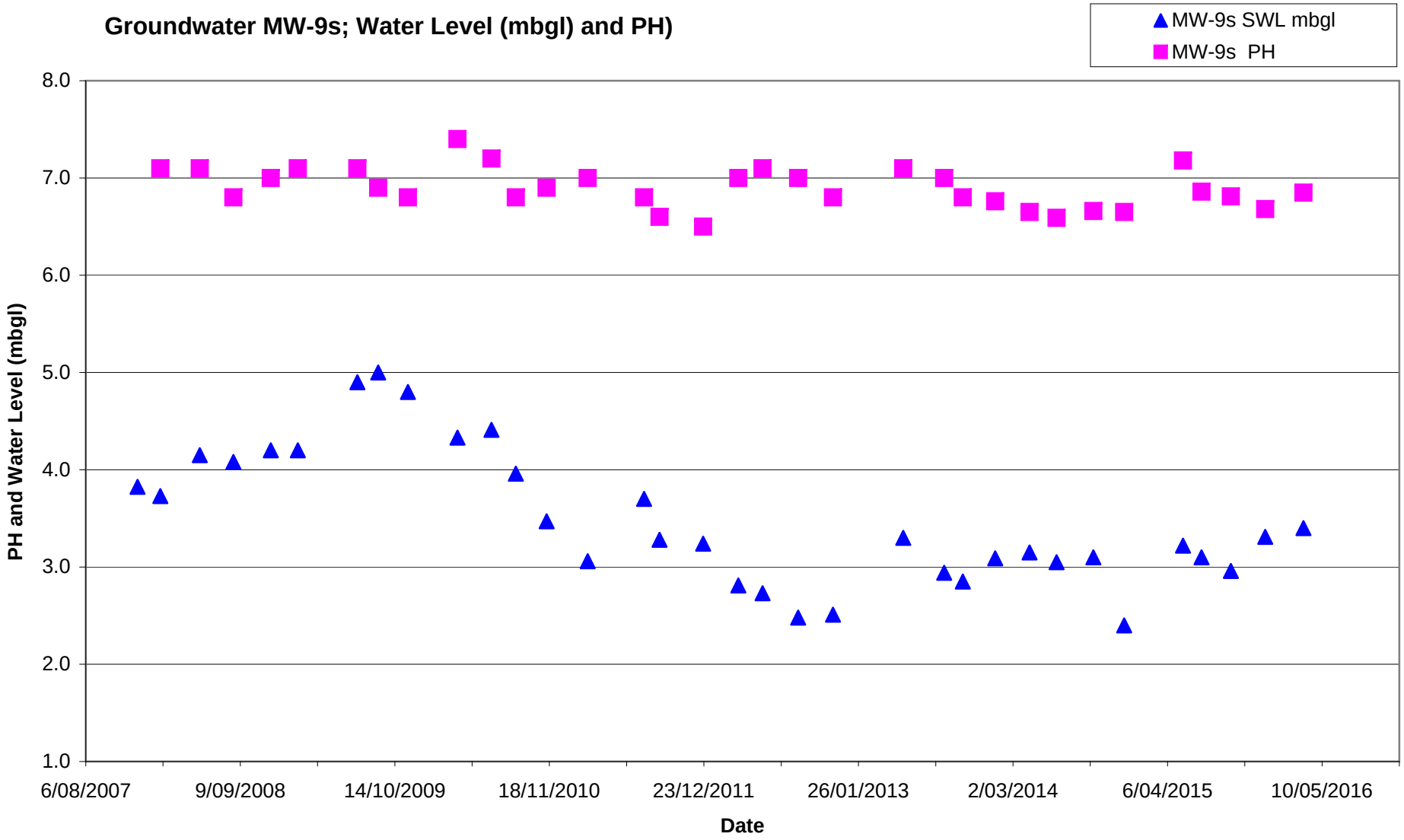

Groundwater MB-20; Key Parameters 1996 to 2016
MB20 EC uS/cm
MB20 SO4 mg/L
MB20 Cu mg/L
MB20 Zn mg/L
MB20 TDS mg/L
MB-20 Cl mg/L
100000.0
10000.0
1000.0
100.0
10.0
1.0
0.1
Concentration mg/L
11/03/1997
9/02/1999
9/01/2001
10/12/2002
9/11/2004
10/10/2006
9/09/2008
10/08/2010
10/07/2012
10/06/2014
10/05/2016
Date

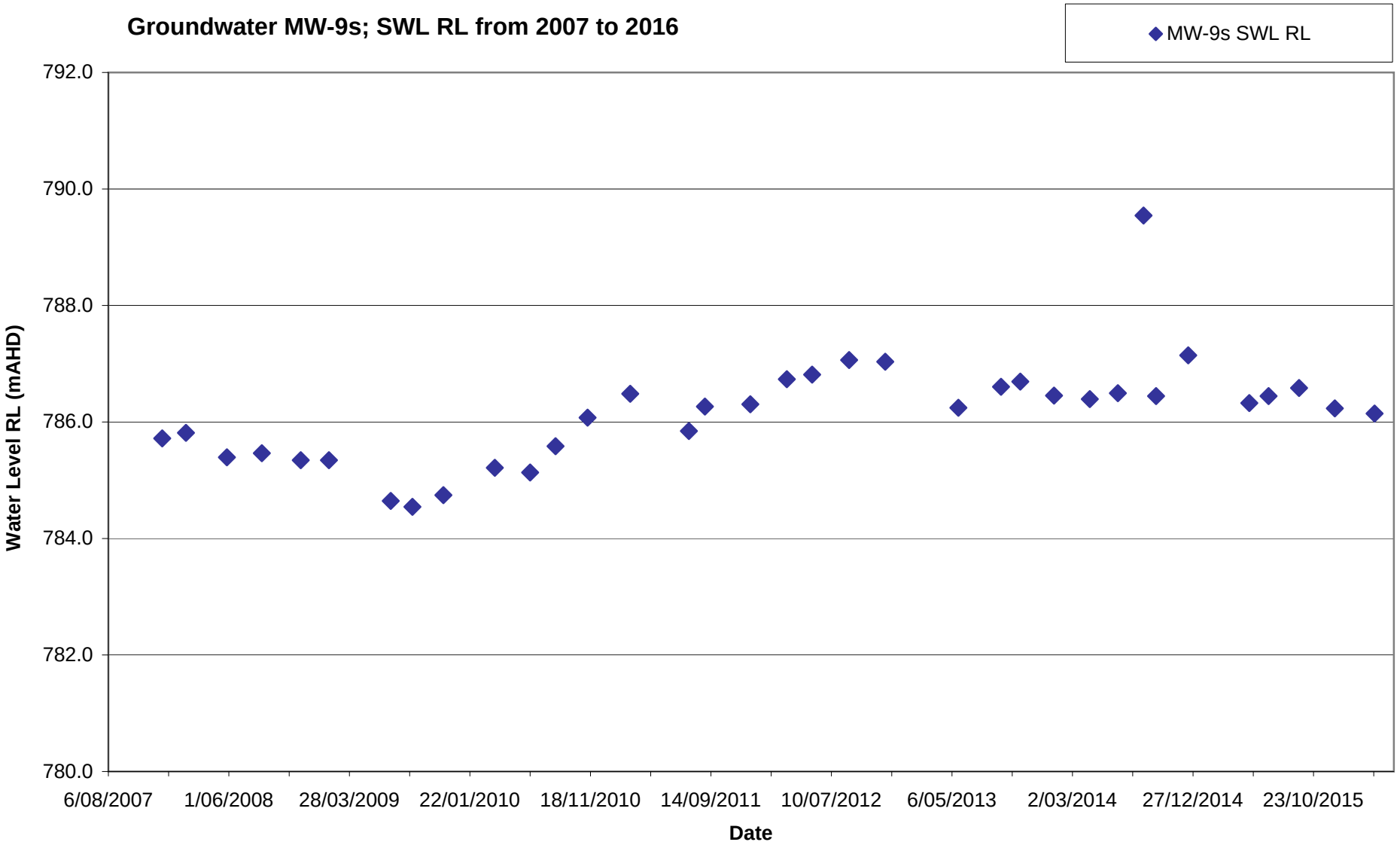
Groundwater MB-20; SWL RL from 1996 to 2016




Groundwater MB-20; Water Level (mbgl) and PH from 1996 to 2016
MB-20 PH
MB-20 SWL mbgl
Water level (mbgl) and PH
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
23/08/1996
1/11/1998
9/01/2001
20/03/2003
28/05/2005
6/08/2007
14/10/2009
23/12/2011
2/03/2014
10/05/2016
Date


Groundwater MW-9s; Key Parameters 2007 to 2016
MB9s EC uS/cm
MB9s SO4 mg/L
MB9s Cu mg/L
MB9s Zn mg/L
MB9s TDS mg/L
MB-9s Cl mg/L
100000.00
10000.00
1000.00
100.00
10.00
1.00
0.10
0.01
Concentration mg/L
6/08/2007
1/06/2008
28/03/2009
22/01/2010
18/11/2010
14/09/2011
10/07/2012
6/05/2013
2/03/2014
27/12/2014
23/10/2015
Date


Groundwater MW-9s; Water Level (mbgl) and PH)
MW-9s SWL mbgl
MW-9s PH
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
PH and Water Level (mbgl)
6/08/2007
9/09/2008
14/10/2009
18/11/2010
23/12/2011
26/01/2013
2/03/2014
6/04/2015
10/05/2016
Date


Groundwater MW-9s; SWL RL from 2007 to 2016
MW-9s SWL RL
792.0
790.0
788.0
786.0
784.0
782.0
780.0
Water Level RL (mAHD)
6/08/2007
1/06/2008
28/03/2009
22/01/2010
18/11/2010
14/09/2011
10/07/2012
6/05/2013
2/03/2014
27/12/2014
23/10/2015
Date

Tables

Table 1: Summary of Aquifer Testing Results

Wel ID	Transmissivity (m2/day)	Geology	Comments
MB-11	0.1	clay, weathered dolerite/shale	low permeability
MB-12	5.56	clay, weathered dolerite/shale	low-moderate permeability
MB-13	4.53	clay, sandyclay, weathered dolerite/shale	low-moderate permeability
MB-14	8.59	clay, with weathered dolerite (fractures)	low-moderate permeability
MB-15	0.01	NI	low permeability
MB-16	9.69	NI	low-moderate permeability

Note: Woodward Clyde (1996 and 1997)
NI= no information

Table 2: Summary of Water Quality Trends (ED1 & 2)

Well ID	Water Quality Impacts	Hydrochemical Trends	Water Level	PH	Hydrogeological Setting	Comments
MW-9s	Low & Stable Cu, Zn impact (<1 mg/L)	rising Cl, SO4	water fluctuating 2-5m, becoming stable from 2012 (3m)	PH neutral	ED-1 - upgradient in bedrock-dolerite	Likely to reflect ED-3 Lagoons water quality-precurser to plume migration-potential risk? (flow to Void)
MB-1	Low & Stable Zn impact (<1 mg/L)	Fluctuating to increasing trends-TDS, SO4, Cl	deep water level becoming shallower (30m to 20 m)	PH neutral	ED-1 downgradient in bedrock-dolerite	
MB-10	Decreasing Zn, Cu (<1 mg/L)	rising Cl trend, decreasing SO4	water fluctuating 0-5m, becoming shallower from 2010 (3m)	PH neutral	ED-1 downgradient in alluvials	precurser to plume migration-potential risk?
MB-11	Increasing Cu& Zn impact (>100 mg/L)	rising Cl,TDS, SO4 trend	water deepening; 0 to 2m	becoming acidic (PH 6.5 to 3.5)	ED-2 downgradient in fractured dolerite	Actual Preferential Pathway-plume migration
MB-12	Increasing Cu& Zn impact (>1,000 mg/L)	rising Cl,TDS, SO4 trend	water deepening; 0 to 2.5m	becoming acidic (PH 5.5 to 3.5)	ED-2 downgradient in weathered dolerite	Actual Preferential Pathway-plume migration
MB-13	Variable Zn impact	fluctuating Cl & SO4 trend	water fluctuates; 2 to 3m	PH neutral	ED-2 downgradient in fractured dolerite	Potential Preferential Pathway- plume fringe ?
MB-14	decreasing to low Zn impact (<1 mg/l)	fluctuating to decreasing trends	deepening of water table (7 <9m)	PH neutral	ED-2 downgradient in fractured dolerite	Historical impact (Zn ~100 mg/L) diminishing- plume retraction due to ED1 low levels.
MB-19	fluctuating / low Cu, Zn impact (<1 mg/l)	rising Cl,TDS/EC trend	water fluctuating 0-3m, becoming shallower from 2010 (1-2m)	PH neutral	ED-2 downgradient (borelog not available)	Potential Preferential Pathway- plume fringe ?
MB-20	fluctuating/ low Cu, Zn impact (<1 mg/l)	rising Cl trend	water fluctuating 0-4m, becoming shallower from 2010 (1-3m)	PH neutral	ED-2 downgradient (borelog not available)	Potential Preferential Pathway- plume fringe ?

Table 3: Summary of Evaporation Dam Surveillance Assessments (URS: 2008, 2012, 2015)

Date of Inspection	Inspection Personnel	Report	Embankment Conditions-ED1	Embankment Conditions - ED2	Water Level in ED1 & 2	Recommendations
15 May 2015	Dr Neil Mattes of URS	Surveillance Report by URS, June 2015	Good	Good	ED1 @ 4.7m below crest level. ED2 @ 6.5m below crest level	Trigger points for water level in ED-1 (2.5m below wave crest) & ED-2 (3m below wave crest) not exceeded. Continue to maintain embankments. Remove trees at downstream embankment faces. If water levels rise to within 2m of ED-1 spillway, then create new spillway between ED1 & 2
14 September 2012	Dr Neil Mattes of URS	Surveillance Report by URS, October 2012	Good	Good	ED1 @ 3.5m below crest level. ED2 @ 7m below crest level	Trigger points for water level in ED-1 & 2 not exceeded. Continue to maintain embankments. Remove trees at downstream embankment faces. If water levels rise to within 2m of ED-1 spillway, then create new spillway between ED1 & 2
26 October 2007	Dr Neil Mattes of URS	Surveillance Report by URS, January 2008	Good	Good	ED1 @ 4.5m below crest level. ED2 @ 6.5 m below crest level	Trigger points for water level in ED-1 & 2 not exceeded. Continue to maintain embankments. Remove trees at downstream embankment faces. Survey recommended of spillway at ED-1 and depression between ED1& 2 to confirm adequate provisions & lowest points.

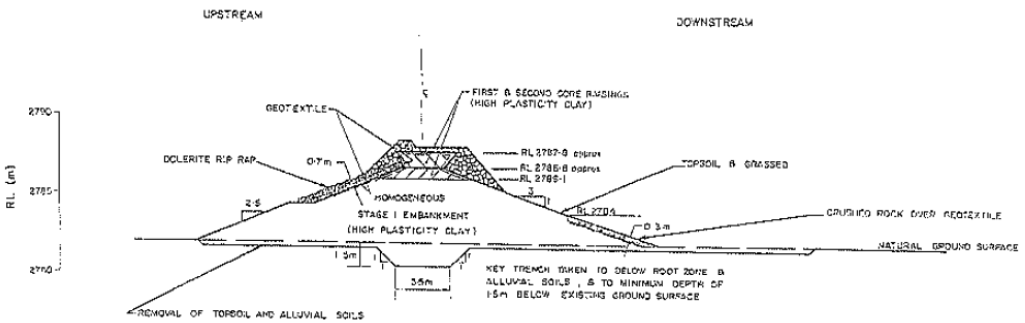
Table 4 - E2W Preliminary Geotechnical Investigation Results (2015 to 2016)

Woodlawn Bioreactor - Evaporation Dam ED3SS

Sample ID	Date	Sample Depth (m)	Sample Description	Inferred Cap Quality (E2W interpretation from logging)	Permeability (m/sec)	Sampling Area	Comments
Floor of Evaporation Dam ED3SS (section completed area of 0.9m thick , 2500 m2)							
FFK-1 @0.9m	12/01/2016	0-0.18m	Silty clay with fine gravel (tuff ~10%)- light brown (u50 tube)	B	4.0 E-08	Floor completed with 0.9m rerworked insitu	not meeting criteria for clay liner (E-9 m/sec)
FFK-2 @0.9m	12/01/2016	0.05-0.15m	Silty clay with fine gravel (tuff ~10%)- light brown (u50 tube)	B	2.0 E-08	Floor completed with 0.9m rerworked insitu	not meeting criteria for clay liner (E-9 m/sec)
FFK-3 @0.9m	12/01/2016	0.05-0.15m	Silty clay with fine gravel (tuff ~10%)- light brown (u50 tube)	B	5.0 E-08	Floor completed with 0.9m rerworked insitu	not meeting criteria for clay liner (E-9 m/sec)
Floor of Evaporation Dam ED3ss (in progress- 1 to 2m higher)							
NFK-1	15/12/2015	0-0.15m	Silty clay with fine gravel (tuff ~10%)- light brown	A	3.2 E-09	Floor not completed within ~1m of final level	meets criteria for clay liner (E-9 m/sec)
SFK-2	15/12/2015	0-0.15m	Silty clay with fine gravel (tuff ~10%)- light brown	B	1.3 E-08	Floor not completed within ~1m of final level	not meeting criteria for clay liner (E-9 m/sec)
SFK-2 Rock	15/12/2015	0-0.3m	Tuff- light brown, fine grained, massive-clay matrix, poorly cemented, weathered.	B	2.0 E-08	Floor not completed within ~1m of final level	not meeting criteria for clay liner (E-9 m/sec)
SFK-3	15/12/2015	BH-6 (0.1-0.6m)	Silty clay with fine gravel (tuff ~10%)- light grey/white	B	1.0 E-08	Floor not completed within ~1m of final level	not meeting criteria for clay liner (E-9 m/sec)
MSFK-4	15/12/2015	BH9B (0.2-0.8m)	Silty clay with fine gravel (tuff ~10%)- light brown	B	1.7 E-08	Floor not completed within ~1m of final level. Predominant material type at centre of liner	not meeting criteria for clay liner (E-9 m/sec)
Floor & Walls of Evaporation Dam ED3ss (completed layers with insitu 1.2m & 0.3m clay cap -MBT stockpile)							
ED3SS- Fl	10/03/2016	0-0.15m	Silty clay with fine gravel (siltstone)- medium brown	A+	5.2 E-11	Floor completed with 1.2m reworked insitu & capped with 0.3m MBT clay.	meets criteria for clay liner (E-9 m/sec). Needs to be covered by gravel for protection
ED3SS- Wl	10/03/2016	0-0.15m	Silty clay with fine gravel (siltstone)- medium brown	A+	2.4 E-11	Walls completed with ~2m reworked insitu & capped with 0.3m MBT clay. Gravel layer not installed as ye	meets criteria for clay liner (E-9 m/sec). Needs to be covered by gravel for protection
Batter Slope of Evaporation Dam (completed)							
u50TP-5 @0.2m	15/12/2015	0.2-0.35m	Silty clay with fine gravel (tuff ~10%)- light brown	B	2.0 E-08	sample collected from batter slope. Testpit excavated to 0.2m depth. Sample collected with steel u50 tube for insitu sample. Slopes completed and compacted	not meeting criteria for clay liner (E-9 m/sec)
u50TPx @0.5m	15/12/2015	0.5-0.65m	Silty clay with fine gravel (tuff ~10%)- light brown	B	5.0 E-08	sample collected from batter slope. Testpit excavated to 0.5m depth. Sample collected with steel u50 tube for insitu sample.Slopes completed and compacted	not meeting criteria for clay liner (E-9 m/sec)
ED-1 Evaporation Dam (burrow pit)							
ED-1 Clay	12/01/2016	0-1 m (stockpile)	Clay with sand and gravel	A	4.0 E-09	sample collected from a stockpile excavated from ED-1 floor (1m depth)	meets criteria for clay liner (E-9 m/sec)
MBT Stockpile (adjacent haul road near ED-2)- Source of Clay cap (0.3m)							
Lipmans Exacavated Material	16/10/2015	Grab	Silty clay with fine gravel (siltstone)- medium brown	A+	4.0 E-11	material collected at source	meets criteria for clay liner (E-9 m/sec)
Top Of Void	17/10/2015	Grab	Silty clay with fine gravel (siltstone)- medium brown	A+	4.0 E-11	material collected at stockpile area (top of void)	meets criteria for clay liner (E-9 m/sec)
MBT SP-2	12/01/2016	0.1-0.4m	Silty clay with fine gravel (siltstone)- medium brown	A+	7.0 E-11	Large stockpile situated next to Void-	meets criteria for clay liner (E-9 m/sec)
MBT SP	15/12/2015	0-0.2m	Silty clay with fine gravel (siltstone)- medium brown	A+	7.0 E-11	Large stockpile situated next to Void- other samples collected by Testright	meets criteria for clay liner (E-9 m/sec)

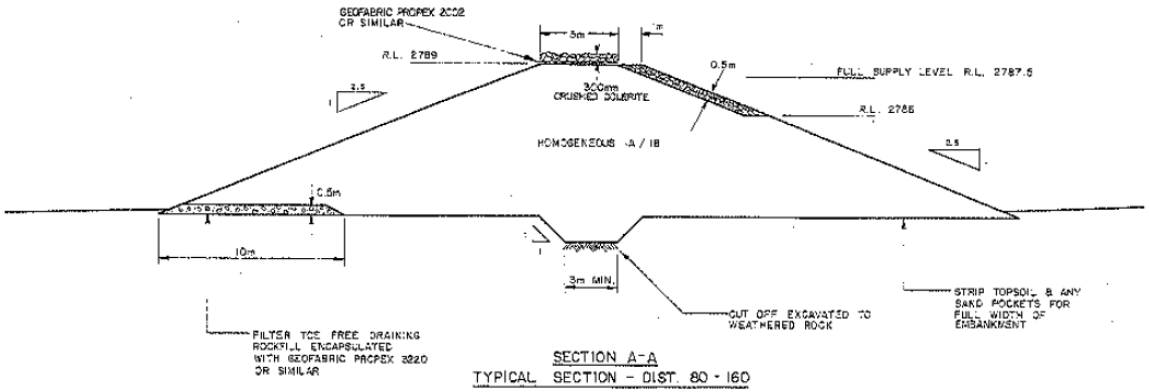
Notes:

Appendix A: ED1 & 2 construction design



From Coffey Partners International Report S10200/2-AE

WOODLAWN EVAPORATION DAM 1
TYPICAL SECTION
Figure 6



From Coffey & Partners Report S8381/5-AB, May 1989

WOODLAWN EVAPORATION DAM 2
TYPICAL SECTION

Figure 7

Appendix B: Borelogs & Aquifer Tests

Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB1**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100321/0002**
PROJECT:	**Hydrogeological Assesment**	DATE COMMENCED:	**2 DEC 96**
LOCATION:	**Woodlawn Mines**	DATE COMPLETED:	**3 DEC 96**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**BRC**

Drill Model:	**NA**	Hole Angle:	**Vert** deg.	Bore Size:	**129 mm**
Drilling Fluid:	**NA**	Orientation:	**NA** deg.	Co-ords: E	**9735.00** N **9752.10**

RL: **2797.512 TOC**

Drilling Info.

Method	Casing	Low resistance Penetration Refusal	Water	Depth (m)
Air Hammer	50mm PVC Class 12 Caisng		WL at 29.26m on DEC 96	5, 10, 15, 20, 25, 30, 35

Material Properties

Graphic Log	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density
	Dol	DOLERITE, highly weathered, orange/brown, with clay, moderate plasticity.		S
		grades to moderately weathered, rusty brown dolerite.		
		DOLERITE, fresh, blue/grey.		
		fracture zone at 21.5m (approx 0.1 thick), slightly weathered.		
		DOLERITE, fresh blue/grey.		
		End of bore hole at 32.2m.		

Field Records/Construction Information

Scale	Sampling	Testing PID (ppm)	Comments/Construction	Well Diagram
			Protective steel casing	
			Top of PVC casing 0.34m AGL	
			Cement surface seal.	
			50mm PVC casing threaded Class 12	
			Backfill	
			Bentonite	
			Hole left over night, at 18m, no water made in hole	
			Gravel pack	
			Factory slotted casing.	

Produced By: MJC
Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB3.LOG:mjc

Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No:
MB2

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100321/0002**
PROJECT:	**Hydrogeological Assesment**	DATE COMMENCED:	**5 DEC 96**
LOCATION:	**Woodlawn Mines**	DATE COMPLETED:	**5 DEC 96**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**BRC**

Drill Model: **NA**	Hole Angle: **Vert** deg.	Bore Size: **129 mm**	RL: **2781.86 TOC**		
Drilling Fluid: **NA**	Orientation: **NA** deg.	Co-ords: E **9502.90**	N **10201.80**		

Drilling Info.
- Method: Blade Bit (0 to approx. 4 m); Air Hammer (approx. 4 to 13.2 m)
- Casing: 50mm PVC Class 12 Casing
- Water: WL at 1.14m on 5 DEC 96

Material Properties

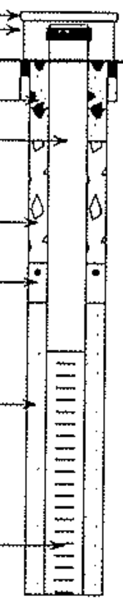
Depth (m)	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)
0	CM	CLAY, moderate to high plasticity, dark brown, stiff, minor of shale (<2mm in size).
~3.5	CH	CLAY, colour change brown/black, gravel material present, moderate to highly weathered dolerite.
~8.8	Dol	CLAY, low plasticity, dark brown, slightly moist.
		DOLERITE, slightly weathered to fresh.
13.2		End of bore hole at 13.2m.

Field Records/Construction Information

Comments/Construction:
- Protective steel casing
- Top of PVC casing 0.26m AGL.
- Cement surface seal.
- 50mm PVC casing threaded Class 12
- Backfill
- Bentonite
- Gravel pack
- Factory slotted casing.
- End of bore hole making 0.5-1 l/sec

Note: SWL 1.40m below top of casing, Dec 1996.

Well Diagram



Produced By: MJC
Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB3.LOG:mjc

Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB3**

Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100321/0002
PROJECT:	Hydrogeological Assesment	DATE COMMENCED:	5 DEC 96
LOCATION:	Woodlawn Mines	DATE COMPLETED:	5 DEC 96
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	BRC

Drill Model: **NA** Hole Angle: **Vert** deg. Bore Size: **129 mm** RL: **2793.20 TOC**

Drilling Fluid: **NA** Orientation: **NA** deg. Co-ords: E **9762.30** N **10850.50**

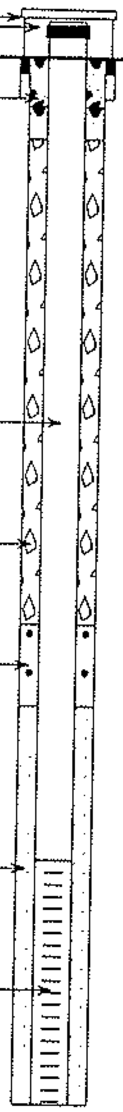
Drilling Info. — Method: Blade Bit; Casing: 50mm PVC Class 12 Casing; Penetration (no resistance / refusal); Water: WL at 3.01m on DEC 96

Depth (m)	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density
0	CM	FILL, dolerite road base.		HW
		CLAY, Silty, moderate plasticity, red/brown, moderately stiff.		
~3.5	Shl	SILTSTONE, highly weathered Shale, tan/brown, moist.	M	S
~6	CH	CLAY, high plasticity, clean, soft, moist. highly weathered Shale, with minor quratz in a clay matrix.	W	
~18.5	GP	GRAVEL, angular of quartz/shale and tuff, unsorted 1-50mm, generally 2-8mm in size, very minor silt content, clean.	W	
25.8		End of bore hole at 25.8m.		

Field Records/Construction Information — Comments/Construction:

- Protective steel casing
- Top of PVC casing 0.30m AGL
- Cement surface seal.
- at 7m returns to very wet.
- 50mm PVC casing threaded Class 12
- Backfill
- Bentonite
- making approx. 1L/sec
- Gravel pack
- Factory slotted casing.
- at 25m bore making 2-3L/sec, hole begining to collapse

Well Diagram



Produced By: MC

Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB3.LOG:mc

Borehole/Monitoring Bore ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB4**

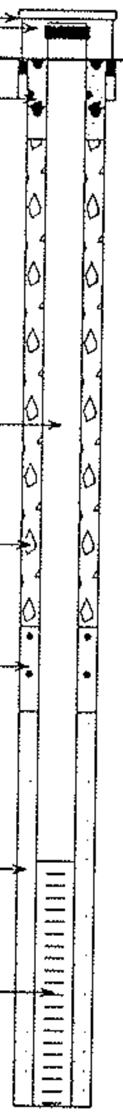
Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100321/0002**
PROJECT:	**Hydrogeological Assesment**	DATE COMMENCED:	**3 DEC 96**
LOCATION:	**Woodlawn Mines**	DATE COMPLETED:	**3 DEC 96**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**BRC**

Drill Model: **NA**	Hole Angle: **Vert** deg.	Bore Size: **129 mm**	RL: **2786.50 TOC**
Drilling Fluid: **NA**	Orientation: **NA** deg.	Co-ords: E **10333.5**	N **9263.2**

Drilling Info.: Method: Air Hammer (0–25.8 m); Casing: 50mm PVC Calss 12 Casing; Water: WL at 9.39m on DEC 96

Depth (m)	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Comments/Construction
0 – 2.5	Fil	FILL, compacted cobbles of dolerite and tuff.	Protective steel casing; Top of PVC casing 0.30m AGL; Cement surface seal
2.5 – 25.8	Shl	SHALE, moderately weathered, grey/blue, soft, friable.	high dusting; high penetration rate
			50mm PVC casing threaded Class 12
			reduction in dusting
~12		weathered zone 12–12.5m	Backfill
~13–15		brown colouration, returns to the slightly harder material, siliceous content in the shale.	high penetration rate
~15		soft SHALE.	Bentonite
~18			becoming moist at 18m
~20			Gravel pack
~21		SHALE, dark red/brown.	
~23			Factory slotted casing.
25.8		End of bore hole at 25.8m.	hole making small volumes of water during development



Produced By: MC
Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB4.LOG:mc

Borehole/Monitoring Bore ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB5**

Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100321/0002
PROJECT:	Hydrogeological Assesment	DATE COMMENCED:	4 DEC 96
LOCATION:	Woodlawn Mines	DATE COMPLETED:	4 DEC 96
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	BRC

Drill Model: **NA** | Hole Angle: **Vert** deg. | Bore Size: **129 mm** | RL: **2833.98 TOC**

Drilling Fluid: **NA** | Orientation: **NA** deg. | Co-ords: E **9443.70** | N **8025.20**

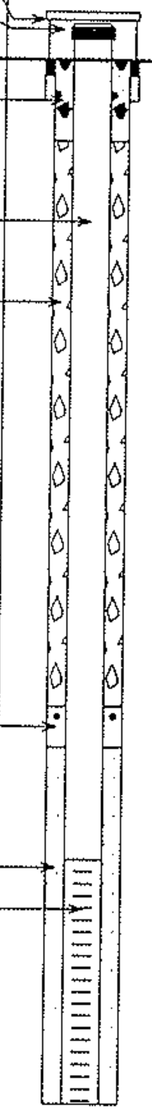
Drilling Info.: Method: Air Hammer; Casing: 50mm PVC Casing Class 12 Casing; Water: WL at 1.92m on DEC 96

Depth (m)	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Consistency / Rel. Density
0	Tuf	Top Soil, dark brown, silty soil, organic.	H
		TUFF, highly weathered siliceous rock, very lght brown to white, with light, tan/brown clay, low to moderate plasticity, moderately soft.	
5		TUFF, fractured, siliceous, minor feldspar, dirty white colour, very hard.	
10		weathered zone at 10-10.75m	
15		Pinkish/brown weathered Tuff.	
20		weathered zone 20-20.2m	
25.8		End of bore hole at 25.8m.	

Comments/Construction

- Protective steel casing
- Top of PVC casing 0.38m AGL
- Cement surface seal
- 50mm PVC casing threaded Class 12
- Backfill
- Bentonite
- Gravel pack
- Factory slotted casing.
- at 23m suddenly makes water (at 1.5L/sec).

Well Diagram



Produced By: MJC
Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB5.LOG:mjc

Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB6**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100321/0002**
PROJECT:	**Hydrogeological Assesment**	DATE COMMENCED:	**5 DEC 96**
LOCATION:	**Woodlawn Mines**	DATE COMPLETED:	**5 DEC 96**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**BRC**

Drill Model:	**NA**	Hole Angle:	**Vert**	deg.	Bore Size:	**129 mm**	RL: **2796.205**
Drilling Fluid:	**NA**	Orientation:	**NA**	deg.	Co-ords: E	**9224.90**	N **9181.90**

Drilling Info.					Material Properties					Field Records/Construction Information				
Method	Casing	Ins. resistance/ Penetration rate/air	Water	Depth (m)	Graphic Log	Classification	Material Description type, plasticity/particle size, colour, secondary/minor components	Moisture Condition	Consistency Rel. Density	Scale	Sampling	Testing	PID (ppm)	Comments/Construction / Well Diagram
Air Hammer	50mm PVC Class 12 Casing		WL at 11.38m on	0		Fill	FILL, dolerite/shale.							Protective steel casing Top of PVC casing 0.36m AGL
				5		Shl	SHALE, highly weathered, brown, with minor clay.		H					Cement surface seal 50mm PVC casing threaded Class 12 high dusting high penetration rate
				10		CH	CLAY, high plasticity, red/brown.							Backfill
						Shl	SHALE, moderately weathered, white/grey, shale/siltstone.		M					Bentonite Gravel pack starts to make water at 17m
				15										
				20		Shl	SHALE, blue/grey, shale/slate, harder band, well laminated/cleavage.		H					Factory slotted casing.
				25			End of bore hole at 25.8m.							
				30										
				35										

Produced By: MJC
Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB6.LOG:mjc

Borehole/Monitoring Bore ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB7**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100321/0002**
PROJECT:	**Hydrogeological Assesment**	DATE COMMENCED:	**2 DEC 96**
LOCATION:	**Woodlawn Mines**	DATE COMPLETED:	**2 DEC 96**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**BRC**

Drill Model: **NA** Hole Angle: **Vert** deg. Bore Size: **129 mm** RL: **2789.07 TOC**

Drilling Fluid: **NA** Orientation: **NA** deg. Co-ords: E **8532.40** N **9283.10**

Drilling Info.: Method: Air Hammer; Casing: 50mm PVC Casing; Water: WL at 1.35m on DEC 96

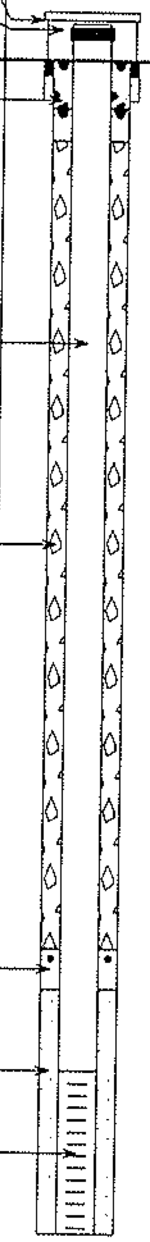
Depth (m)	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Consistency/Rel. Density
0–1.6	CH	CLAY, Silty, moderate to high plasticity, yellow/brown.	
1.6–25	Shl	SHALE, moderately soft, foliated, brown/grey, high dusting.	S
		SHALE, dark brown/grey, well laminated.	
25–29	Tuf	TUFF, Silicious, course grained, white with minor green speckles, distinct cleavage. drill breaks, fractures.	H
29		End of bore hole at 29m.	

Field Records/Construction Information

Comments/Construction

- Protective steel casing
- Top of PVC casing 0.27m AGL
- Cement surface seal
- 50mm PVC casing threaded Class 12
- Backfill
- Bentonite
- Gravel pack
- Factory slotted casing.

Well Diagram



Produced By: MJC

Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB3.LOG:mjc

Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB9**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100321/0002**
PROJECT:	**Hydrogeological Assesment (Farm Bore)**	DATE COMMENCED:	**7 DEC 96**
LOCATION:	**Woodlawn Mines**	DATE COMPLETED:	**7 DEC 96**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**Driller**

Drill Model:	**NA**	Hole Angle:	**Vert**	deg.	Bore Size:	**128 mm**	RL: **2825.570 TOC**
Drilling Fluid:	**NA**	Orientation:	**NA**	deg.	Co-ords: E	**9577.6**	N **11210.9**

Drilling Info.					Material Properties					Field Records/Construction Information				
Method	Casing	Dig resistance / Penetration / Material	Water	Depth (m)	Graphic Log	Classification	Material Description type, plasticity/particle size, colour, secondary/minor components	Moisture Condition	Consistency Rel. Density	Scale	Sampling	Testing PID (ppm)	Comments/Construction	Well Diagram
Air Hammer	125mm PVC Class 9 Casing		WL at 25.73m on DEC 96	0 5 10 15 20 25 30 35 40 45 50		CH	CLAY, medium plasticity, orange/brown.						Top of PVC casing 0.35m AGL Cement surface seal 125mm PVC stormwater pipe Backfill Bentonite Gravel pack making water approx. 450gph Screen, hand cut vertical slots.	
						Shl	SILTSTONE							
						Shl	SHALE, fresh, laminated.							
							End of bore hole at 42m.							

Produced By: MJC
Checked By: BRC

Document No: S:/A31/00321/0002/LOGS/MB9.LOG.mjc

Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB10**

Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100321/0008
PROJECT:	WOODLAWN MINES ED1 ASS	DATE COMMENCED:	11 DEC 96
LOCATION:	ED1	DATE COMPLETED:	11 DEC 96
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	SAB

Drill Model:	NA	Hole Angle:	Vert deg.	Bore Size:	125 mm
Drilling Fluid:	NA	Orientation:	NA deg.	Co-ords: E	9200.9

RL: 2783.80 TOC
N 10163.90

Drilling Info.					Material Properties						Field Records/Construction Information				
Method	Casing	Dynamic Cone Penetration (no. of blows)	Water	Depth (m)	Graphic Log	Classification	Material Description: type, plasticity/particle size, colour, secondary/minor components	Moisture Condition	Consistency Rel. Density	Scale	Sampling	Testing PID (ppm)	Comments/Construction	Well Diagram
Mud Rotary	50mm PVC Casing		WL at 0.3m on 11 DEC 96	0		CH	CLAY, brown and light brown mottled, soft to firm, some very fine sand, minor gravel.	M	M				Protective steel casing Top of PVC casing 1.70m AGL	
						GC	CLAY, dark grey, firm to stiff, minor gravel.	W	W				Cement grout to surface. Wet returns. Caving at change of rod from 2.0 to 6.5m.	
				5		SC	GRAVEL (clayey), light grey, coarse, sub-angular, minor fine gravel.	M/W					Making bore water at 2.0m.	
							SAND, yellow fine, sub-rounded, some soft clay (almost clayeye sand in sections), minor gravel.							
				10			GRAVEL, with a higher clay content than above.							
						GW	Hard silicious band; light green, subangular cuttings.						Bentonite.	
				15			GRAVEL, rounded to sub-angular, well sorted.						Gravel pack Bore making abundant water in gravels. Water flowing surface at at completion of drilling.	
				20			DOLERITE, grey, moderately weathered.						Screen.	
							End of bore at 20.8 m.						Note:SWL 0.30m below top of casing, Dec 1996.	
				25										
				30										
				35										

Produced By: MJC
Checked By: BRC

Document No: S:/A31/0032I/0008/LOGS/MB10.LOG:mj

Borehole/Monitoring Bore ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB11**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100631/0002**
PROJECT:	**WOODLAWN MINES ED2 ASS**	DATE COMMENCED:	**19 JUNE 97**
LOCATION:	**WEST SIDE OF ED2**	DATE COMPLETED:	**19 JUNE 97**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**SB**

Drill Model: **NA**	Hole Angle: **Vert** deg.	Bore Size: **150 mm**	RL: **2778.44 GL**
Drilling Fluid: **NA**	Orientation: **NA** deg.	Co-ords: E **7930.3**	N **10126.5**

Drilling Info. — Method: Air Blade; Casing: 50mm PVC Casing; Penetration (no resistance / refusal); Water: WL at 0.26m on 11 AUGUST 97

Depth (m)	Graphic Log / Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density
0–1.2	CL	CLAY, dark brown becoming light brown and blue-grey, dry then moist.	D/M	
1.2–3.2	Dol	DOLERITE, brown and light grey brown, moderately to highly weathered, damp to moist.	M	
3.2–5.3		SHALE, yellow brown, highly to extremely weathered, soft, moist.	M	S
5.3		End of Borehole at 5.3m.		

Field Records/Construction Information (Scale, Sampling, Testing, PID (ppm), Comments/Construction, Well Diagram)

Comments/Construction: Refusal at 5.3m.

Produced By: FB
Checked By: BRC

Document No: S:/A31/00631/0002/LOGS/MB11.LOG:sgl

Borehole/Monitoring Bore ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB12**

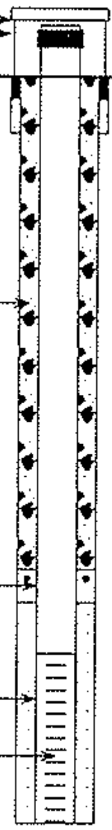
Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100631/0002
PROJECT:	WOODLAWN MINES ED2 ASS	DATE COMMENCED:	19 JUNE 97
LOCATION:	WEST SIDE OF ED2	DATE COMPLETED:	19 JUNE 97
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	SB

Drill Model: **NA** | Hole Angle: **Vert** deg. | Bore Size: **125 mm** | RL: **2778.52 GL**

Drilling Fluid: **NA** | Orientation: **NA** deg. | Co-ords: E **7930.3** | N **10129.3**

Method	Casing	Penetration	Water	Depth (m)	Graphic Log	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density	Comments/Construction
Air Blade	50mm PVC Casing		WL at 0.63m on 11 AUGUST 97	0		Dol	Dolerite floater.			Protective steel casing; Top of PVC casing 2780.0m AGL
				0–13.2			DOLERITE/SHALE/ACID VOLCANIC, grey brown then brown, highly weathered, some clay, damp. Becoming fresher with depth, although still abundant thin moderately to highly weathered, brown, softer layers present.	M		Hammer Bit; Cement grout to surface. Moist at 8.3m. Bentonite. Making water at 10.1m. Gravel pack. Screen.
				13.2			End of Borehole at 13.2m.			



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Checked By: BRC

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Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB13**

Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100631/0002
PROJECT:	WOODLAWN MINES ED2 ASS	DATE COMMENCED:	19 JUNE 97
LOCATION:	MINE BOUNDARY WEST OF ED2	DATE COMPLETED:	19 JUNE 97
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	SB

Drill Model: **NA** Hole Angle: **Vert** deg. Bore Size: **150 mm** RL: **2748.15 GL**

Drilling Fluid: **NA** Orientation: **NA** deg. Co-ords: E **7004.7** N **10089.9**

Drilling Info. | Material Properties | Field Records/Construction Information

Depth (m)	Graphic Log	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density
0		SM	Silty SAND, grey/brown, fine, clayey, dry.	D	
1		CL	CLAY, yellow/brown and brown mottled, with minor gravel, dry.	D	
2		CL	Sandy CLAY, becoming yellow brown and sandy at 1.8m; some green/grey lenses, very fine grained, moist to damp.	M	
3		Dol	VOLCANIC, light brown, fine grained, highly to extremely weathered, quartz and yellow feldspar present, foliated.	D	S
9			DOLERITE, dark brown and olive brown then dark blue grey, slightly to moderately wet.	M/W	
13			End of Borehole at 13.2m.		

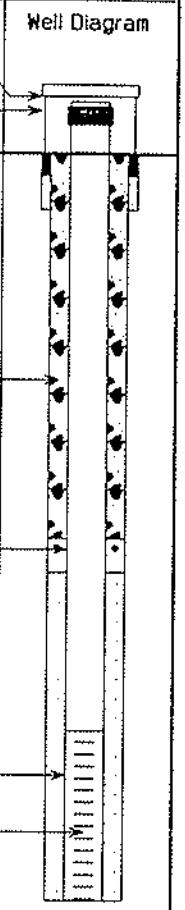
Method: Air Blade

Casing: 50mm PVC Casing

Water: WL at 2.25m on 11 AUGUST 97

Scale | Sampling | Testing PID (ppm)

Comments/Construction | Well Diagram



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Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB14**

Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100631/0002
PROJECT:	WOODLAWN MINES ED2 ASS	DATE COMMENCED:	19 JUNE 97
LOCATION:	NORTH SIDE OF ED2	DATE COMPLETED:	19 JUNE 97
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	SB

Drill Model:	NA	Hole Angle:	Vert	deg.	Bore Size:	150 mm	RL: 2791.81 GL
Drilling Fluid:	NA	Orientation:	NA	deg.	Co-ords: E	8273.8	N 10251.6

Drilling Info. | Material Properties | Field Records/Construction Information

Method	Casing	Rig Resistance/ Penetration	Water	Depth (m)	Graphic Log	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density	Scale	Sampling	Testing	PID (ppm)	Comments/Construction	Well Diagram
Air Blade	50mm PVC Casing		WL at 6.0m on 11 AUGUST 97	1		CL	CLAY, light brown and brown mottled, stiff, dry.	D	St					Protective steel casing; Top of PVC casing 2792.4m AGL	
				2		Dol	DOLERITE, green/grey, hard, fine grained, dry.	D	H						
				3			Becoming slightly to moderately weathered, softer and olive brown at 3.4m.							Cement grout to surface.	
				4											
				5			Becoming harder and fresher at 5.3m.								
				6										Bentonite.	
				7										Gravel pack	
				8			Fracture at 8.1m.								
				9				W							
				10											
				11			Increase in quartz and felspar content at 11.2m.							Screen.	
				12											
				13			End of Borehole at 12.5m.								
				14											
				15											
				16											
				17											
				18											
				19											
				20											
				21											
				22											
				23											
				24											
				25											

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Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB15**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100631/0002**
PROJECT:	**WOODLAWN MINES ED2 ASS**	DATE COMMENCED:	**20 JUNE 97**
LOCATION:	**SOUTH WEST CORNER OF WRD**	DATE COMPLETED:	**20 JUNE 97**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**SB**

Drill Model:	**NA**	Hole Angle:	**Vert**	deg.	Bore Size:	**150 mm**	RL: **2781.81 GL**
Drilling Fluid:	**NA**	Orientation:	**NA**	deg.	Co-ords: E	**8482.7**	N **8438.1**

Drilling Info.					Material Properties					Field Records/Construction Information				
Method	Casing	Dyn resistance/ Penetration (blows/m)	Water	Depth (m)	Graphic Log	Classification	Material Description type, plasticity/particle size, colour, secondary/minor components	Moisture Condition	Consistency Rel. Density	Scale	Sampling Testing PID (ppm)	Comments/Construction	Well Diagram
Air Blaide	50mm PVC Casing		WL at 0m on 11 AUGUST 97	1–25	FILL		FILL, reworked surface, material and waste sock, yellow-brown.	D	H			Protective steel casing Top of PVC Casing 2764.9m AGL Cement grout to surface. Bentonite. Gravel pack. Screen. Backfill.	
							RHYOLITE/VOLCANIC, blue grey, hard, some quartzose sections and veinung, some brown-grey slightly to moderately weathered sections, foliated in some sections, very fine grained, dry.						
							Browner at 2.8m.						
							Hard grey at 4.2m.						
							Slightly softer at 6.4 to 6.5m.						
							Slightly softer at 9.3 to 9.8m.						
							End of Borehole at 23.7m.						

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Document No: S:/A31/00631/0002/LOGS/MB15.LOG:sg

Borehole/Monitoring Bore ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB16**

Sheet: 1 of 1

CLIENT:	**DENEHURST LIMITED**	JOB NUMBER:	**A3100631/0002**
PROJECT:	**WOODLAWN MINES ED2 ASS**	DATE COMMENCED:	**23 JUNE 97**
LOCATION:	**WEST SIDE OF WRD**	DATE COMPLETED:	**23 JUNE 97**
DRILL CONTRACTOR:	**SLADE DRILLING**	LOGGED BY:	**SB**

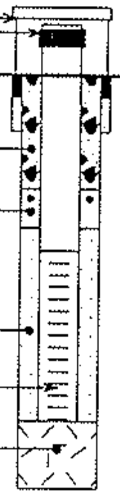
Drill Model: **NA** | Hole Angle: **Vert** deg. | Bore Size: **150 mm** | RL: **2791.81 GL**

Drilling Fluid: **NA** | Orientation: **NA** deg. | Co-ords: E **8535.6** | N **8560.4**

Method	Casing	Penetration (No resistance)	Water	Depth (m)	Graphic Log	Classification	Material Description (type, plasticity/particle size, colour, secondary/minor components)	Moisture Condition	Consistency Rel. Density
Air Blaide	50mm PVC Casing		WL at 2.85m on 11 AUGUST 97	0–0.9		FILL	FILL, waste rock, dump material.		
				0.9–4.0		GC	CLAYEY GRAVEL/GRAVELLY CLAY, light brown, fine to coarse, subrounded to subangular, feldspar and quartz, dry (extremely weathered bedrock). Becoming browner at 2.4m.	D; M/W	
				4.0–7.3			RHYOLITE, fine to medium grained, quartzose and feldspar, slightly to moderately weathered in sections, feldspar are light orange and yellow, hard.		H
				7.3			End of Borehole at 7.3m.		

Field Records/Construction Information: Scale | Sampling | Testing | PID (ppm) | Comments/Construction | Well Diagram

Comments/Construction:



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Borehole/Monitoring Bore
ENVIRONMENTAL FIELD LOG

Woodward-Clyde

Borehole No: **MB17**

Sheet: 1 of 1

CLIENT:	DENEHURST LIMITED	JOB NUMBER:	A3100631/0002
PROJECT:	WOODLAWN MINES ED2 ASS	DATE COMMENCED:	23 JUNE 97
LOCATION:	WEST SIE OF WRD	DATE COMPLETED:	23 JUNE 97
DRILL CONTRACTOR:	SLADE DRILLING	LOGGED BY:	SB

Drill Model: **NA** Hole Angle: **Vert** deg. Bore Size: **150 mm** RL: **2781.81 GL**

Drilling Fluid: **NA** Orientation: **NA** deg. Co-ords: E **8520.1** N **8511.2**

Drilling Info.					Material Properties						Field Records/Construction Information					
Method	Casing	Dynamic Cone Penetration (blows/100mm)	Water	Depth (m)	Graphic Log	Classification	Material Description: type, plasticity/particle size, colour, secondary/minor components	Moisture Condition	Consistency Rel. Density		Scale	Sampling	Testing	PID (ppm)	Comments/Construction	Well Diagram
Air Blaide	50mm PVC Casing		WL at 4.0m on 11 AUGUST 97	1		FILL	FILL, waste rock material.								Protective steel casing	
				2		CH	Sandy CLAY, dark brown then orange brown, stiff, high plasticity, fine sand, minor gravel, damp to moist.	M	St						Top of PVC Casing 2771.1m AGL	
				3			VOLCANICS, blue grey, fine grained, foliated, brown, weathered in upper section then harder and fresher, quartzose and feldspatine, subangular to subrounded, dry.	D	H							
				4			Slightly softer at 3.7m, shale appearance.									
				5			Green-grey at 4.1m.								Cement grout to surface.	
				6			TUFF, light brown, softer, abundant subrounded to subangular quartz (4mm), dry.	D	H							
				7			Harder at 7.5m and light brown-grey.	D	H							
				8			VOLCANICS, green-grey (as for previous), hard.								Bentonite.	
				9			Becoming dark blue-grey at 10.3m.									
				10												
				11												
				12											Gravel pack.	
				13											Screen.	
				14												
				15			End of Borehole at 15.4m.									
				16												
				17												
				18												
				19												
				20												
				21												
				22												
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				24												
				25												

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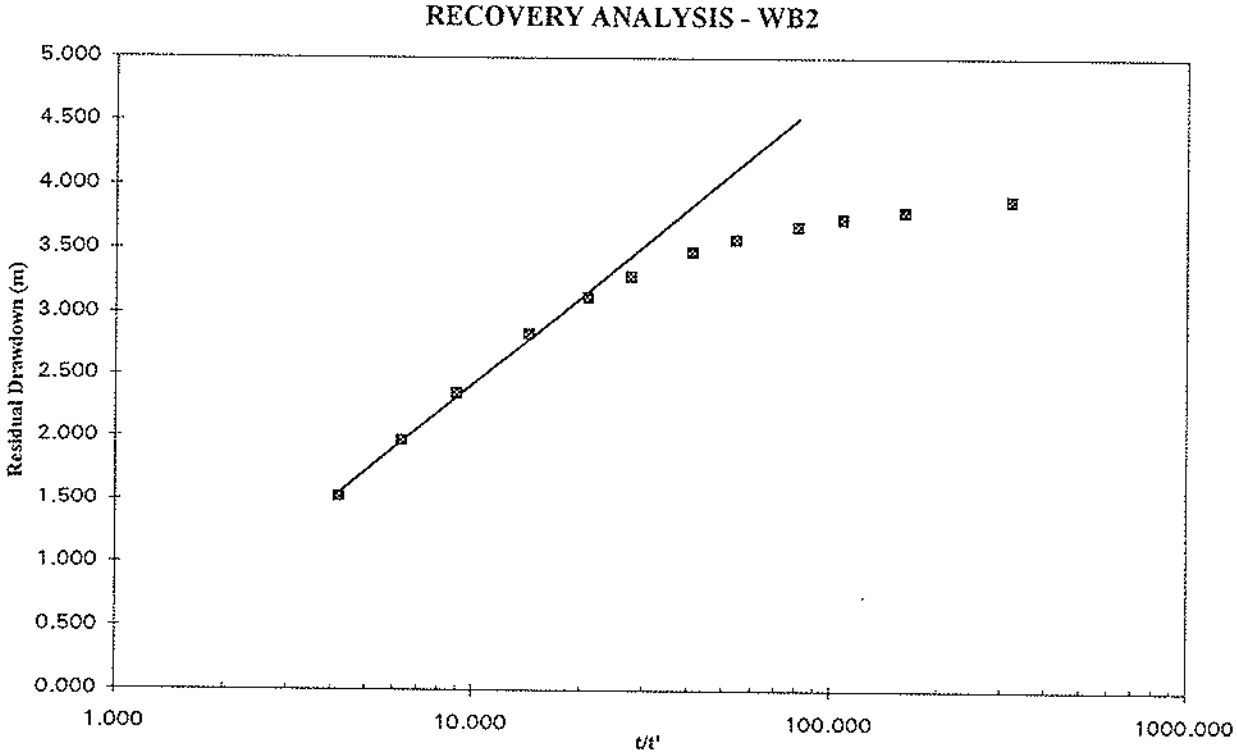
Checked By: BRC

Document No: S:/A3I/00631/0002/LOGS/MBI7.LOG:sg

Appendix G
Aquifer Tests

Test Date	31-Jul-96
Pumping Duration	80.00
Standing Water Level	19.170
Pumping Started	11.00
Volume Removed (L)	589
Discharge Rate (m3/d)	10.61

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
80.25	0.25	321.000	23.050	3.880
80.50	0.50	161.000	22.960	3.790
80.75	0.75	107.667	22.905	3.735
81.00	1.00	81.000	22.850	3.680
81.50	1.50	54.333	22.745	3.575
82.00	2.00	41.000	22.650	3.480
83.00	3.00	27.667	22.460	3.290
84.00	4.00	21.000	22.290	3.120
86.00	6.00	14.333	22.000	2.830
90.00	10.00	9.000	21.525	2.355
95.00	15.0	6.333	21.140	1.970
105.00	25.0	4.200	20.695	1.525



Transmissivity (m2/d)	0.84	^S	2.31
		Y Intercept	0.12
		r	1.00

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLANW MINES

Recovery Data Analysis

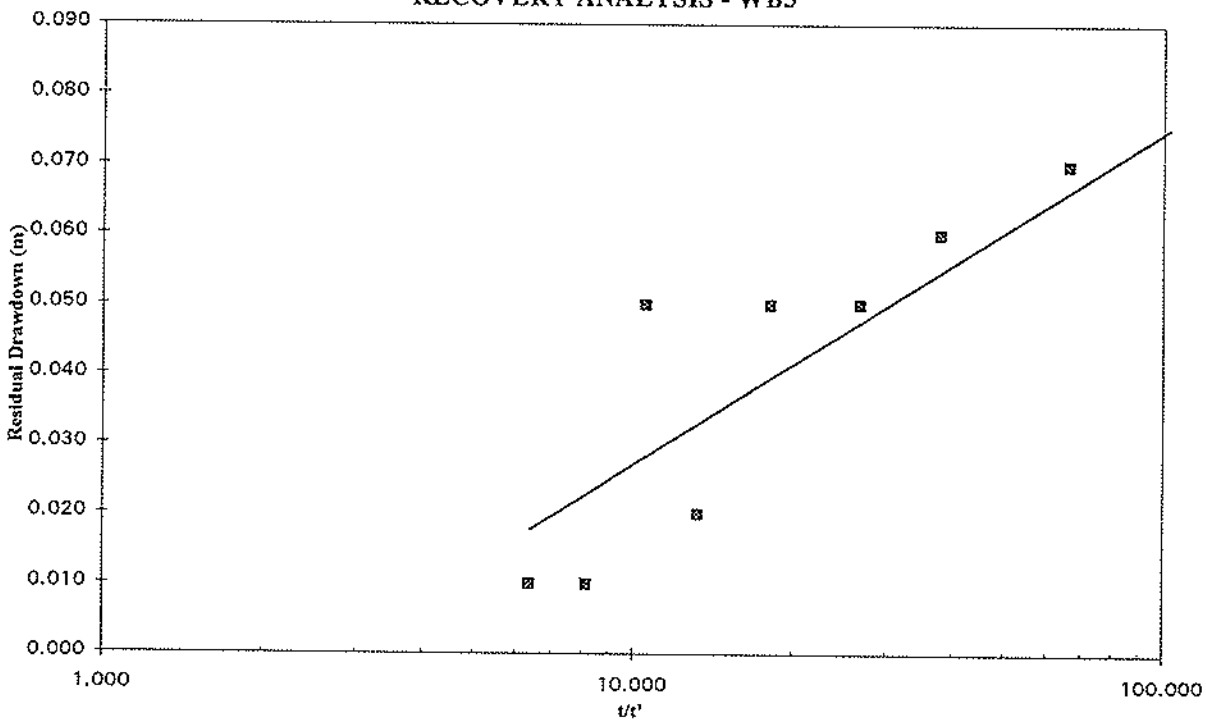
Bore : WB2

Project:	Drawing:	
A3100321	2	

Test Date	31-Jul-96
Pumping Duration	43.00
Standing Water Level	4.100
Pumping Started	9:15
Volume Removed (L)	581
Discharge Rate (m3/d)	19.44

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
43.33	0.33	130.129	4.170	0.070
43.66	0.66	66.152	4.170	0.070
44.17	1.17	37.878	4.160	0.060
44.67	1.67	26.801	4.150	0.050
45.50	2.50	18.200	4.150	0.050
46.50	3.50	13.286	4.120	0.020
47.50	4.50	10.556	4.150	0.050
49.00	6.00	8.167	4.110	0.010
51.00	8.00	6.375	4.110	0.010

RECOVERY ANALYSIS - WB3



Transmissivity (m2/d)	74.46	^S	0.05
		Y Intercept	-0.02
		r	0.75

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

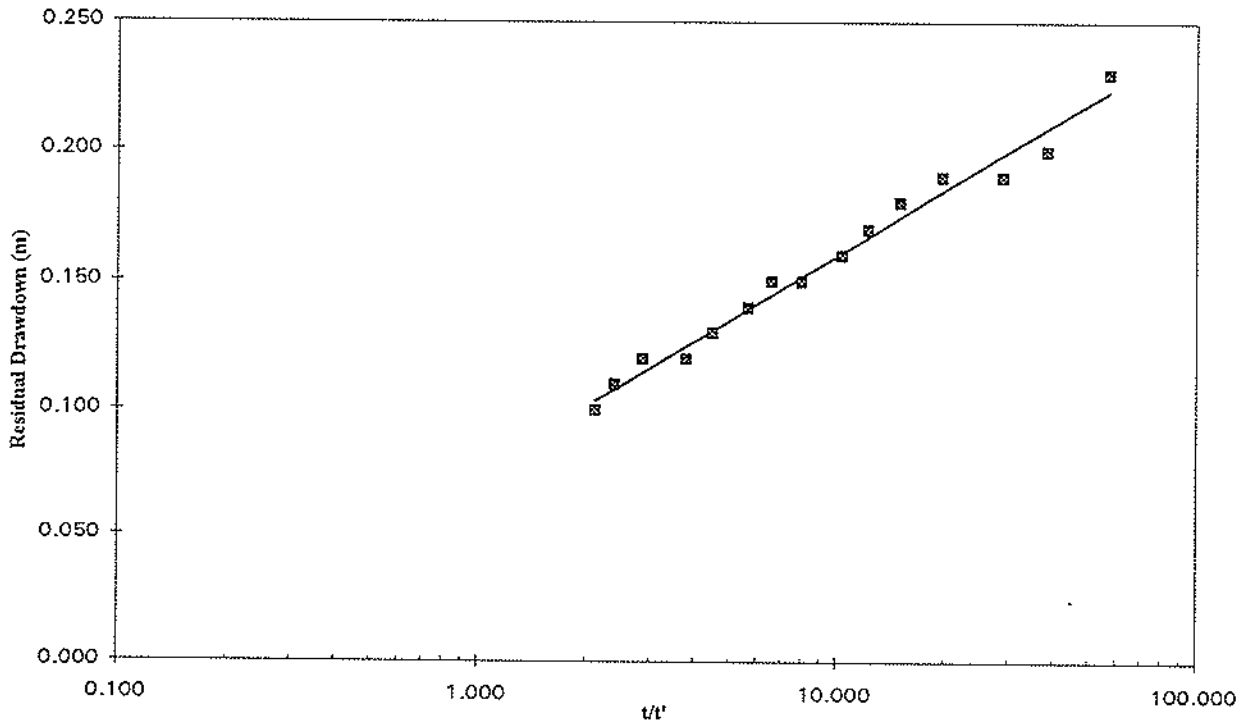
Bore : WB3

Project:	Drawing:
A3100321	3

Test Date	12-Feb-97
Pumping Duration	28.00
Standing Water Level	0.390
Pumping Started	1:12
Volume Removed (L)	375
Discharge Rate (m3/d)	19.29

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
28.50	0.50	57.000	0.620	0.230
28.75	0.75	38.333	0.590	0.200
29.00	1.00	29.000	0.580	0.190
29.50	1.50	19.667	0.580	0.190
30.00	2.00	15.000	0.570	0.180
30.50	2.50	12.200	0.560	0.170
31.00	3.00	10.333	0.550	0.160
32.00	4.00	8.000	0.540	0.150
33.00	5.00	6.600	0.540	0.150
34.00	6.00	5.667	0.530	0.140
36.00	8.00	4.500	0.520	0.130
38.00	10.00	3.800	0.510	0.120
43.00	15.00	2.867	0.510	0.120
48.00	20.00	2.400	0.500	0.110
53.00	25.00	2.120	0.490	0.100
58.00	30.00	1.933	0.490	0.100
63.00	35.00	1.800	0.480	0.090
68.00	40.00	1.700	0.480	0.090
73.00	45.00	1.622	0.475	0.085
78.00	50.00	1.560	0.470	0.080
88.00	60.00	1.467	0.460	0.070

RECOVERY ANALYSIS - MB3



Transmissivity (m2/d)	42.19	^S	0.08
		Y Intercept	0.08
		r	0.97

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLANW MINES

Recovery Data Analysis

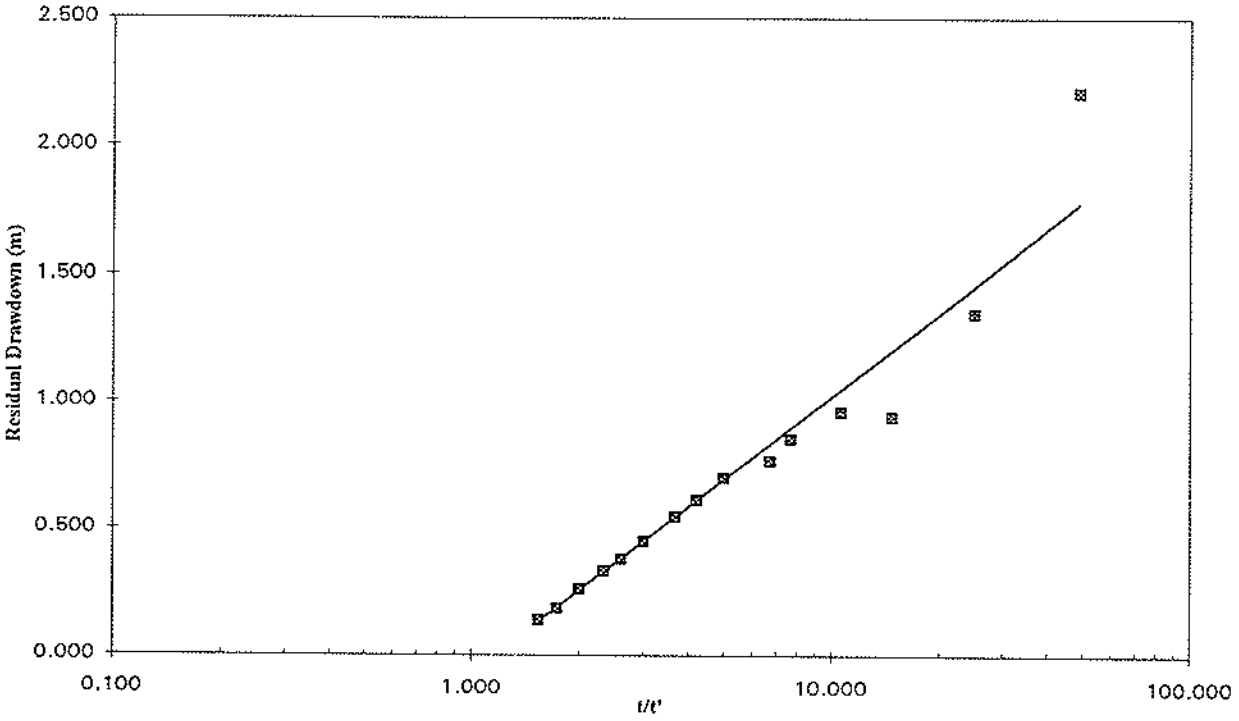
Bore : MB3

Project:	Drawing:	
A3100321	2	

Test Date	12-Feb-97
Pumping Duration	8.00
Standing Water Level	9.730
Pumping Started	9:16
Volume Removed (L)	77
Discharge Rate (m3/d)	13.86

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
8.17	0.17	48.904	11.940	2.210
8.33	0.33	25.024	11.080	1.350
8.58	0.58	14.714	10.670	0.940
8.83	0.83	10.600	10.690	0.960
9.20	1.20	7.667	10.580	0.850
9.40	1.40	6.714	10.495	0.765
10.00	2.00	5.000	10.430	0.700
10.50	2.50	4.200	10.340	0.610
11.00	3.00	3.667	10.275	0.545
12.00	4.00	3.000	10.180	0.450
13.00	5.00	2.600	10.110	0.380
14.00	6.00	2.333	10.060	0.330
16.00	8.00	2.000	9.990	0.260
19.00	11.00	1.727	9.915	0.185
23.00	15.00	1.533	9.870	0.140

RECOVERY ANALYSIS - MB4



Transmissivity (m2/d)	2.32	^S	1.09
		Y Intercept	-0.07
		r	1.00

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLANW MINES

Recovery Data Analysis

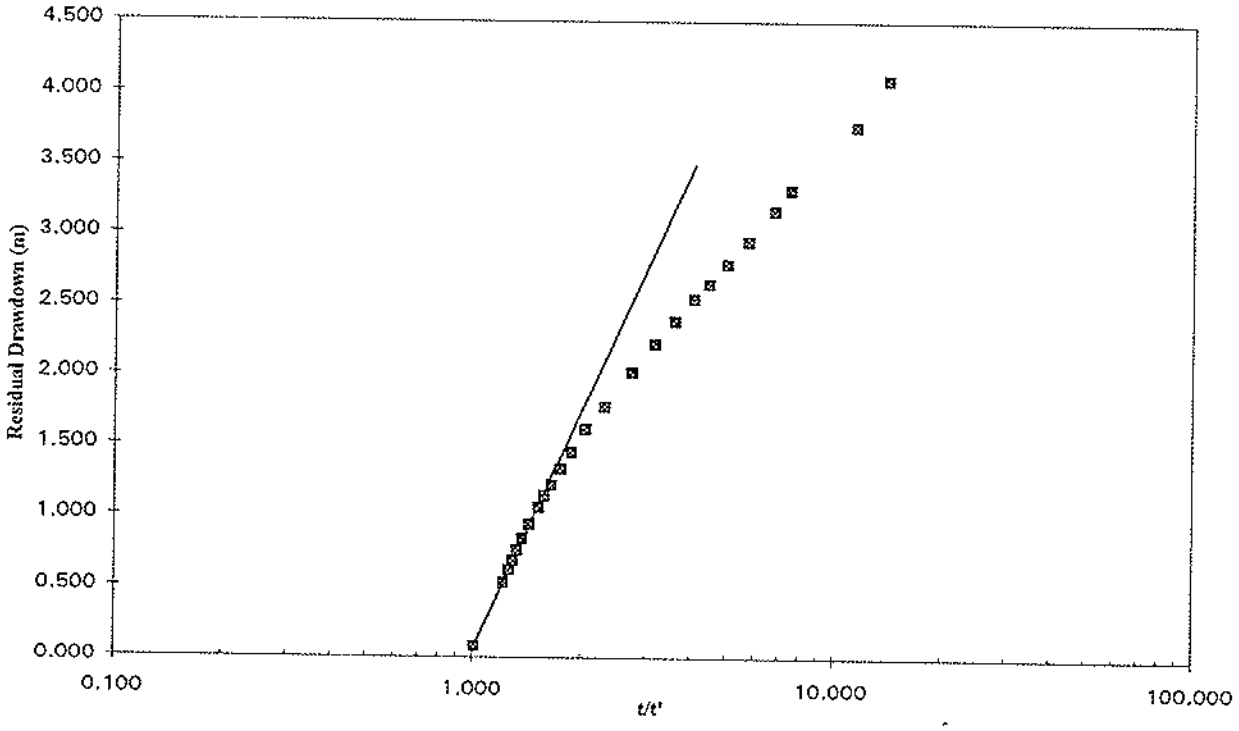
Bore : MB4

Project:	Drawing:	
A3100321	2	

Test Date	18-Feb-97
Pumping Duration	26.00
Standing Water Level	2.350
Pumping Started	15:50
Volume Removed (L)	327
Discharge Rate (m3/d)	18.11

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
28.00	2.00	14.000	6.447	4.097
28.50	2.50	11.400	6.116	3.766
29.00	3.00	9.667	#N/A	#N/A
30.00	4.00	7.500	5.670	3.320
30.50	4.50	6.778	5.520	3.170
31.50	5.50	5.727	5.300	2.950
32.50	6.50	5.000	5.140	2.790
33.50	7.50	4.467	5.000	2.650
34.50	8.50	4.059	4.890	2.540
36.00	10.00	3.600	4.730	2.380
38.00	12.00	3.167	4.570	2.220
41.00	15.00	2.733	4.370	2.020
46.00	20.00	2.300	4.120	1.770
51.00	25.00	2.040	3.960	1.610
56.00	30.00	1.867	3.800	1.450
61.00	35.00	1.743	3.680	1.330
66.00	40.00	1.650	3.570	1.220
71.00	45.00	1.578	3.490	1.140
76.00	50.00	1.520	3.410	1.060
86.00	60.00	1.433	3.290	0.940
96.00	70.00	1.371	3.190	0.840
106.00	80.00	1.325	3.110	0.760
116.00	90.00	1.289	3.040	0.690
126.00	100.00	1.260	2.970	0.620
146.00	120.00	1.217	2.880	0.530
1835.00	1809.00	1.014	2.430	0.080

RECOVERY ANALYSIS - MB5



Transmissivity (m2/d) 0.59

S 5.66

Y Intercept 0.05

r 1.00

Date	Rev	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLANW MINES

Recovery Data Analysis

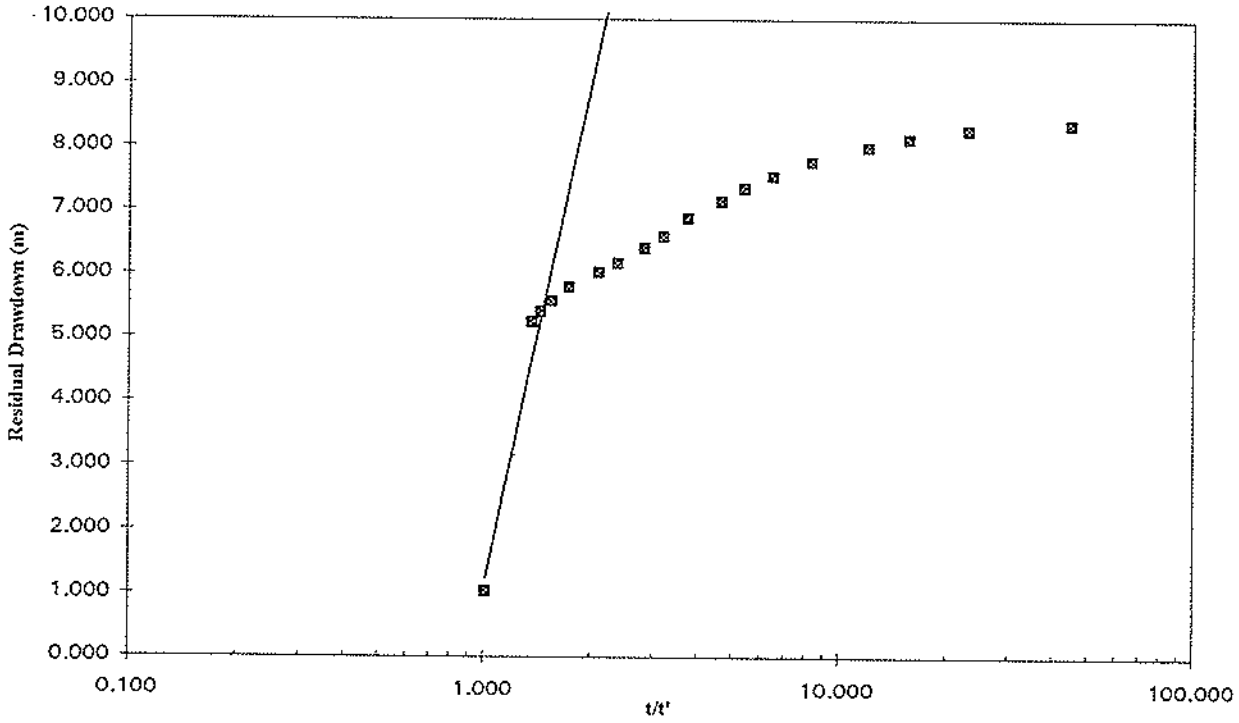
Bore : MB5

Project:	Drawing:	
A3100321	2	

Test Date	13-Feb-97
Pumping Duration	11.00
Standing Water Level	10.825
Pumping Started	17:55
Volume Removed (L)	125
Discharge Rate (m3/d)	16.36

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
11.25	0.25	45.000	19.190	8.365
11.50	0.50	23.000	19.100	8.275
11.75	0.75	15.667	18.955	8.130
12.00	1.00	12.000	18.830	8.005
12.50	1.50	8.333	18.590	7.765
13.00	2.00	6.500	18.360	7.535
13.50	2.50	5.400	18.170	7.345
14.00	3.00	4.667	17.970	7.145
15.00	4.00	3.750	17.700	6.875
16.00	5.00	3.200	17.415	6.590
17.00	6.00	2.833	17.230	6.405
19.00	8.00	2.375	17.000	6.175
21.00	10.00	2.100	16.860	6.035
26.00	15.00	1.733	16.620	5.795
31.00	20.00	1.550	16.405	5.580
36.00	25.00	1.440	16.225	5.400
41.00	30.00	1.367	16.070	5.245
851.00	840.00	1.013	11.870	1.045

RECOVERY ANALYSIS - MB6



Transmissivity (m2/d)	0.11	^S	26.33
		Y Intercept	1.09
		r	0.95

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLANW MINES

Recovery Data Analysis

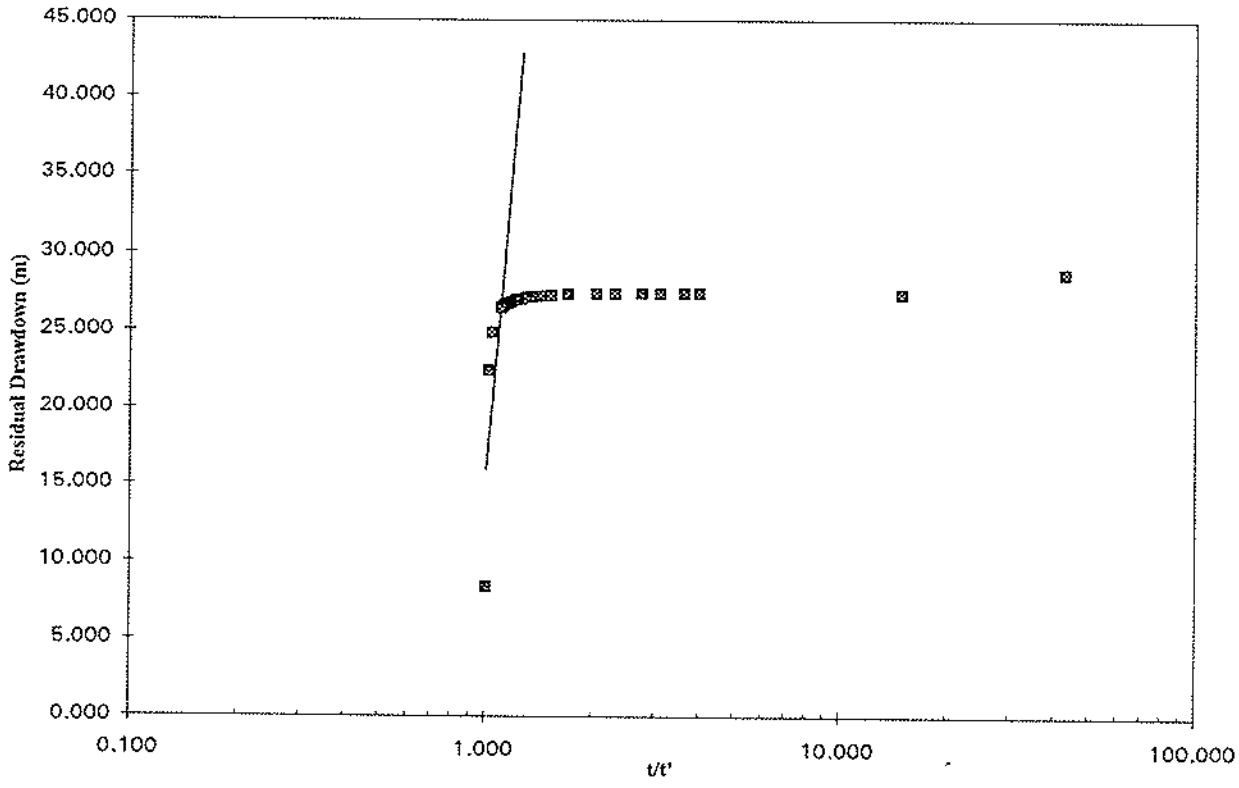
Bore : MB6

Project:	Drawing:	
A3100321	2	

Test Date	18-Feb-97
Pumping Duration	10.50
Standing Water Level	2.135
Pumping Started	9:55
Volume Removed (L)	85
Discharge Rate (m3/d)	11.66

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
10.75	0.25	43.000	30.850	28.715
11.25	0.75	15.000	29.530	27.395
14.00	3.50	4.000	29.570	27.435
14.50	4.00	3.625	29.570	27.435
15.50	5.00	3.100	29.560	27.425
16.50	6.00	2.750	29.550	27.415
18.50	8.00	2.313	29.530	27.395
20.50	10.00	2.050	29.510	27.375
25.50	15.00	1.700	29.460	27.325
30.50	20.00	1.525	29.405	27.270
35.50	25.00	1.420	29.355	27.220
40.50	30.00	1.350	29.305	27.170
45.50	35.00	1.300	29.250	27.115
50.50	40.00	1.263	29.200	27.065
55.50	45.00	1.233	29.160	27.025
60.50	50.00	1.210	29.120	26.985
70.50	60.00	1.175	28.995	26.860
80.50	70.00	1.150	28.890	26.755
90.50	80.00	1.131	28.790	26.655
100.50	90.00	1.117	28.700	26.565
110.50	100.00	1.105	28.58	26.445
270.50	260.00	1.040	27.02	24.880
515.50	505.00	1.021	24.56	22.425
1460.50	1450.00	1.007	10.50	8.365

RECOVERY ANALYSIS - MB6



Transmissivity (m2/d) 0.01

^S 274.15

Y Intercept 15.13

r 0.53

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLANW MINES

Recovery Data Analysis

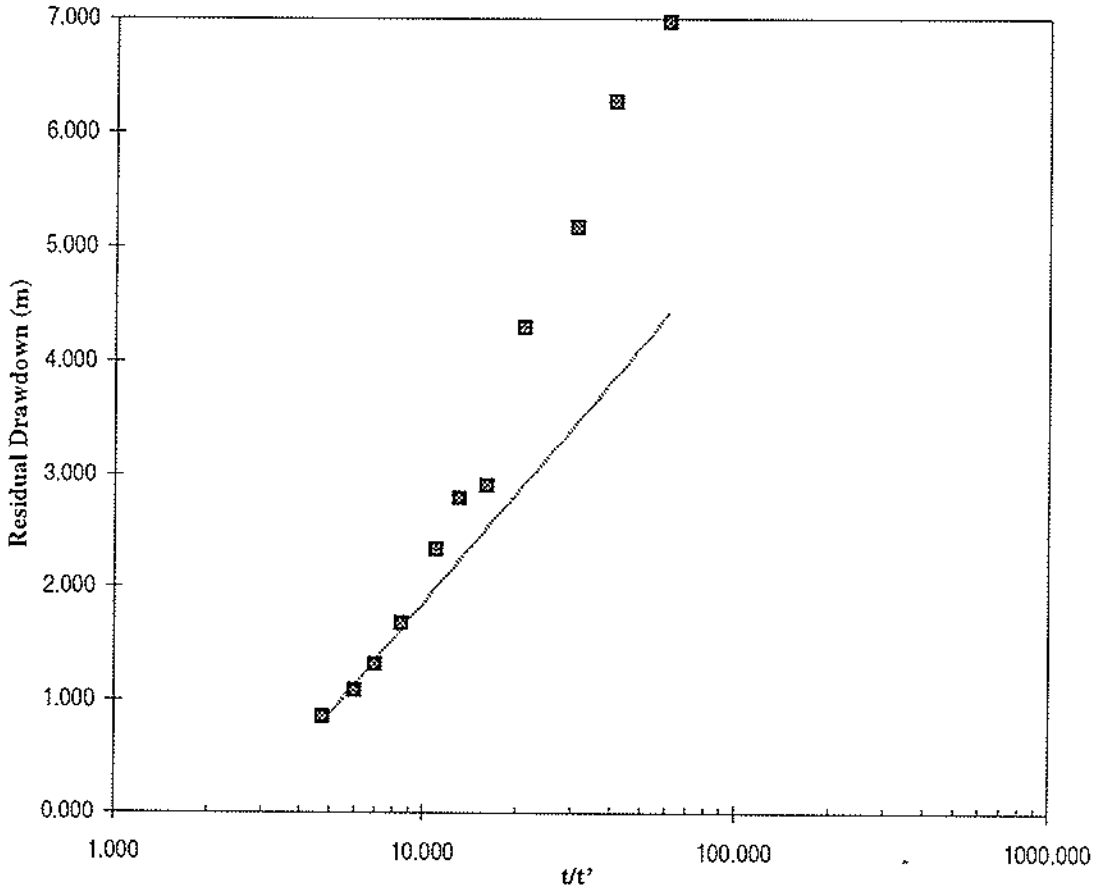
Bore : MB7

Project:	Drawing:	
A3100321	2	

Test Date	13-Feb-97
Pumping Duration	30.00
Standing Water Level	4.300
Pumping Started	17:00
Volume Removed (L)	336
Discharge Rate (m3/d)	16.13

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
30.50	0.50	61.000	11.270	6.970
30.75	0.75	41.000	10.570	6.270
31.00	1.00	31.000	9.470	5.170
31.50	1.50	21.000	8.600	4.300
32.00	2.00	16.000	7.200	2.900
32.50	2.50	13.000	7.090	2.790
33.00	3.00	11.000	6.630	2.330
34.00	4.00	8.500	5.975	1.675
35.00	5.00	7.000	5.610	1.310
36.00	6.00	6.000	5.385	1.085
38.00	8.00	4.750	5.147	0.847

RECOVERY ANALYSIS - MB8



Transmissivity (m2/d) 0.91 ^S 3.26

Y Intercept -1.40

r 0.98

Date	Revision	Description	Drawn:	Checked:
17/12/1996	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

Bore : MB8

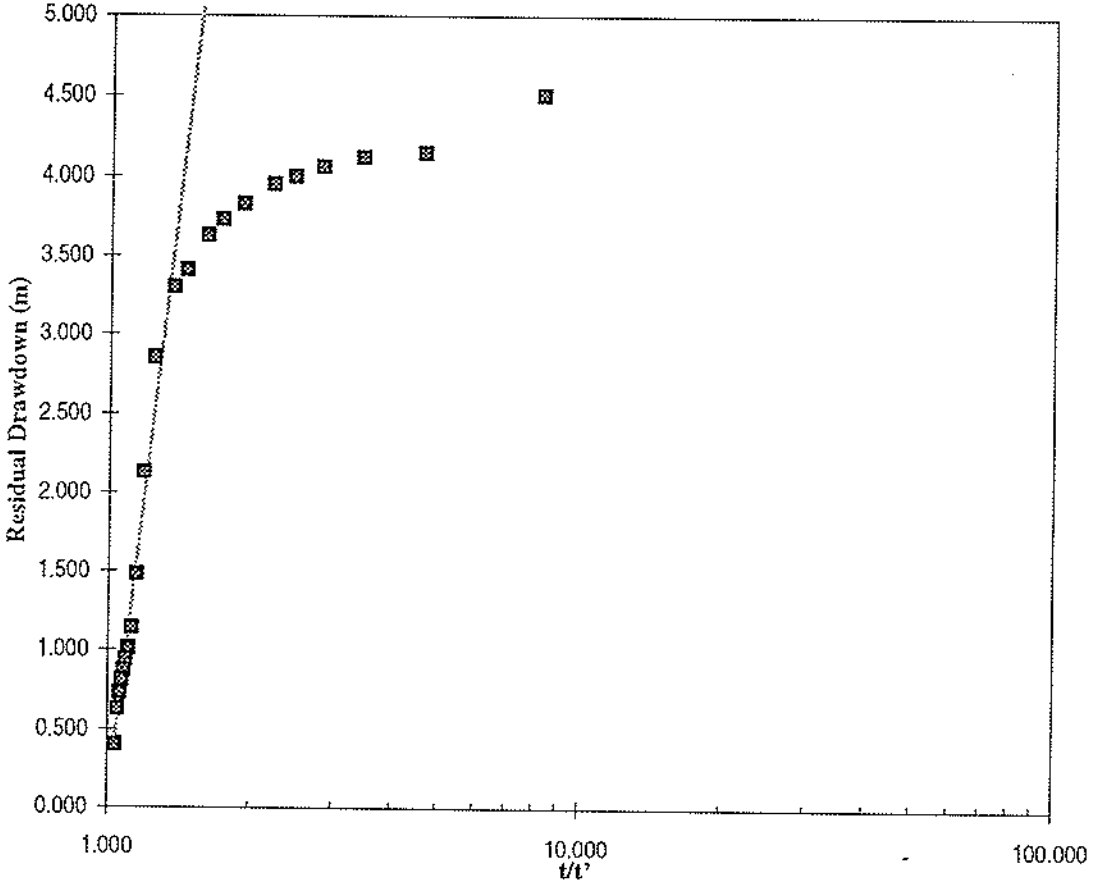
Project: A3100321

Drawing:

Test Date	30-Jul-97
Pumping Duration	3.66
Standing Water Level	0.250
Pumping Started	12:50
Volume Removed (L)	38
Discharge Rate (m3/d)	14.95

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
4.16	0.50	8.320	4.760	4.510
4.66	1.00	4.660	4.400	4.150
5.16	1.50	3.440	4.370	4.120
5.66	2.00	2.830	4.310	4.060
6.16	2.50	2.464	4.250	4.000
6.66	3.00	2.220	4.200	3.950
7.66	4.00	1.915	4.080	3.830
8.66	5.00	1.732	3.980	3.730
9.66	6.00	1.610	3.880	3.630
11.66	8.00	1.458	3.660	3.410
13.66	10.00	1.366	3.550	3.300
18.66	15.00	1.244	3.100	2.850
23.66	20.00	1.183	2.380	2.130
28.66	25.00	1.146	1.730	1.480
33.66	30.00	1.122	1.390	1.140
38.66	35.00	1.105	1.260	1.010
43.66	40.00	1.092	1.190	0.940
48.66	45.00	1.081	1.120	0.870
54.66	51.00	1.072	1.060	0.810
63.66	60.00	1.061	0.980	0.730
73.66	70.00	1.052	0.880	0.630
98.66	95.00	1.039	0.650	0.400

RECOVERY ANALYSIS - MB11



Transmissivity (m2/d) 0.10 ^S 26.39

Y Intercept 0.01

r 0.95

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

Bore : MB11

Project: A3100321

Drawing:

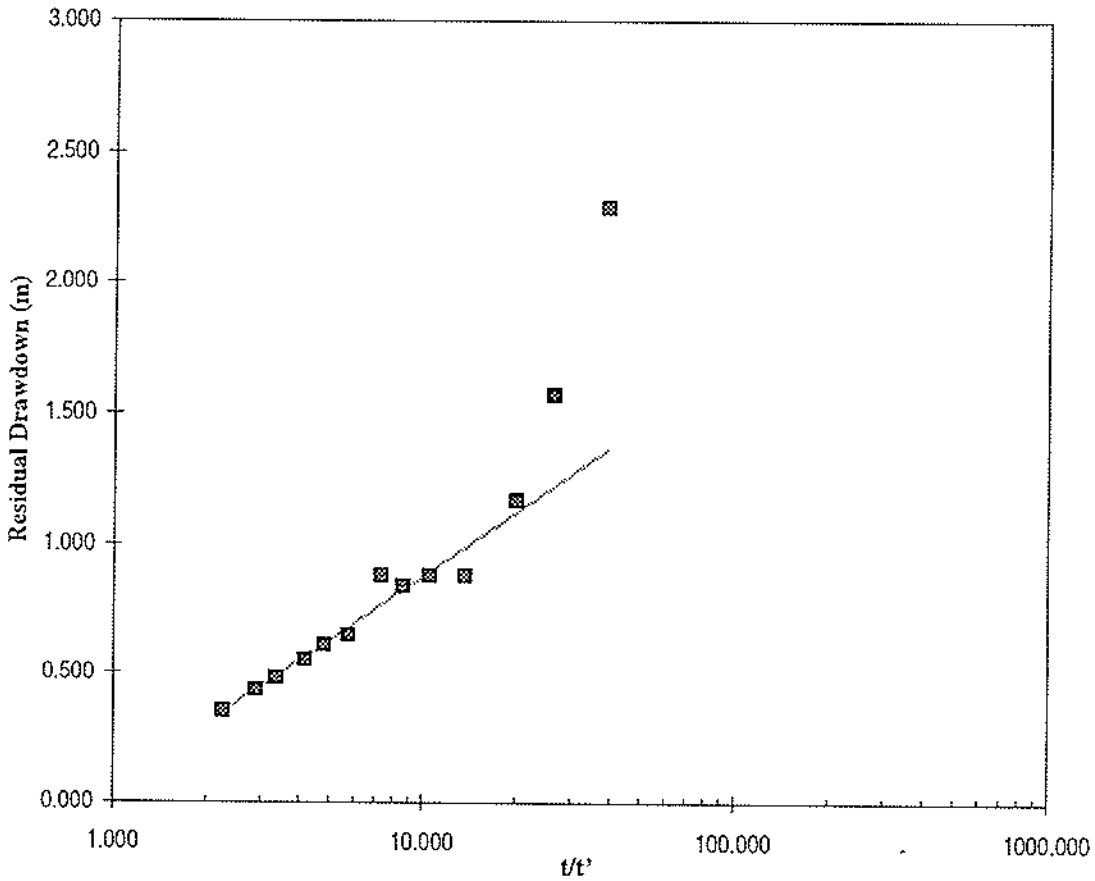
Test Date	30-Jul-97
Pumping Duration	19.00
Standing Water Level	0.100
Pumping Started	17:15
Volume Removed (L)	229
Discharge Rate (m3/d)	25.00

unknown

assumed similar to MB13

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
19.50	0.50	39.000	2.390	2.290
19.75	0.75	26.333	1.670	1.570
20.00	1.00	20.000	1.270	1.170
20.50	1.50	13.667	0.980	0.880
21.00	2.00	10.500	0.980	0.880
21.50	2.50	8.600	0.940	0.840
22.00	3.00	7.333	0.980	0.880
23.00	4.00	5.750	0.750	0.650
24.00	5.00	4.800	0.710	0.610
25.00	6.00	4.167	0.650	0.550
27.00	8.00	3.375	0.580	0.480
29.00	10.00	2.900	0.530	0.430
34.00	15.00	2.267	0.450	0.350

RECOVERY ANALYSIS - MB12



Transmissivity (m2/d) 5.56

^S 0.82

Y Intercept 0.05

r 0.95

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

Bore : MB12

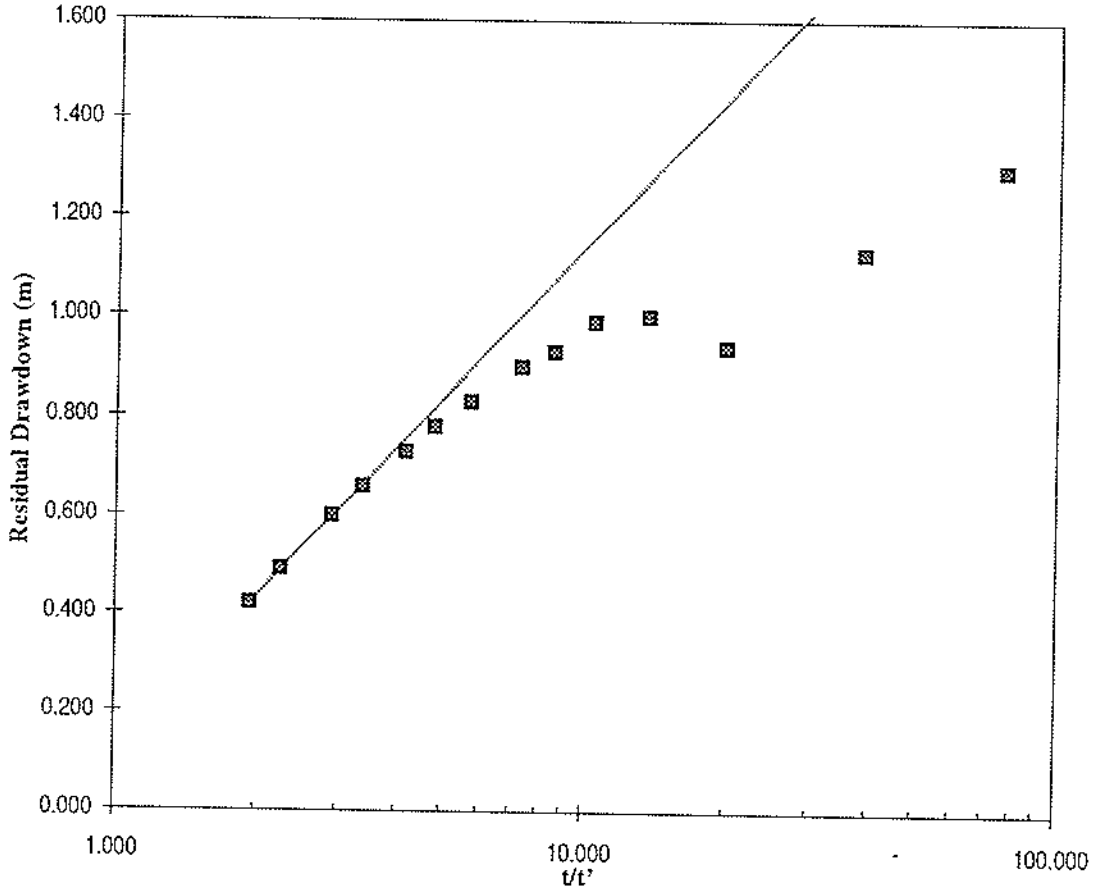
Project: A3100321

Drawing:

Test Date	30-Jul-97
Pumping Duration	19.00
Standing Water Level	2.300
Pumping Started	11:00
Volume Removed (L)	330
Discharge Rate (m3/d)	25.01

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
19.25	0.25	77.000	3.600	1.300
19.50	0.50	39.000	3.430	1.130
20.00	1.00	20.000	3.240	0.940
20.50	1.50	13.667	3.300	1.000
21.00	2.00	10.500	3.290	0.990
21.50	2.50	8.600	3.230	0.930
22.00	3.00	7.333	3.200	0.900
23.00	4.00	5.750	3.130	0.830
24.00	5.00	4.800	3.080	0.780
25.00	6.00	4.167	3.030	0.730
27.00	8.00	3.375	2.960	0.660
29.00	10.00	2.900	2.900	0.600
34.00	15.00	2.267	2.790	0.490
39.00	20.00	1.950	2.720	0.420

RECOVERY ANALYSIS - MB13



Transmissivity (m2/d) 4.53

^S 1.01

Y Intercept 0.13

r 1.00

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

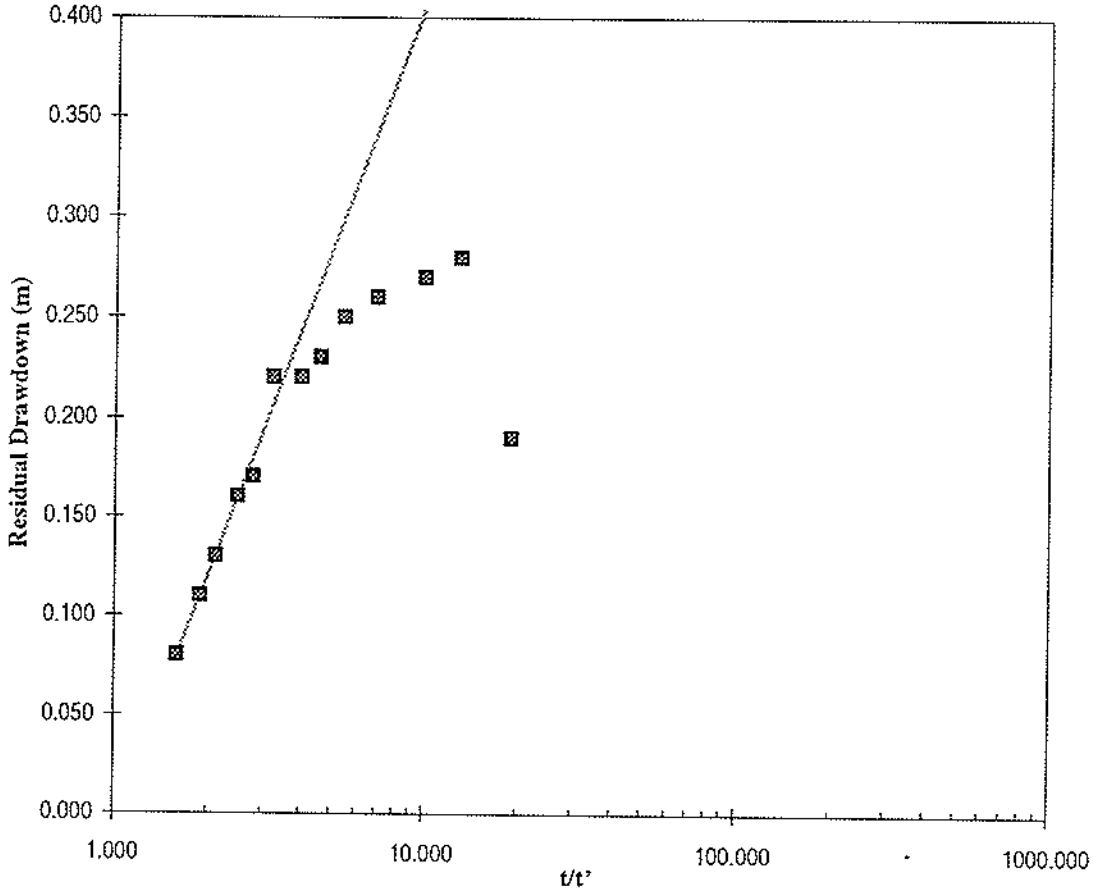
Bore : MB13

Project:	Drawing:	
A3100321		

Test Date	30-Jul-97
Pumping Duration	9.00
Standing Water Level	6.030
Pumping Started	16:25
Volume Removed (L)	121
Discharge Rate (m3/d)	19.36

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
9.50	0.50	19.000	6.220	0.190
9.75	0.75	13.000	6.310	0.280
10.00	1.00	10.000	6.300	0.270
10.50	1.50	7.000	6.290	0.260
11.00	2.00	5.500	6.280	0.250
11.50	2.50	4.600	6.260	0.230
12.00	3.00	4.000	6.250	0.220
13.00	4.00	3.250	6.250	0.220
14.00	5.00	2.800	6.200	0.170
15.00	6.00	2.500	6.190	0.160
17.00	8.00	2.125	6.160	0.130
19.00	10.00	1.900	6.140	0.110
24.00	15.00	1.600	6.110	0.080

RECOVERY ANALYSIS - MB14



Transmissivity (m2/d) 8.59

^S 0.41

Y Intercept 0.00

r 1.00

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

Bore : MB14

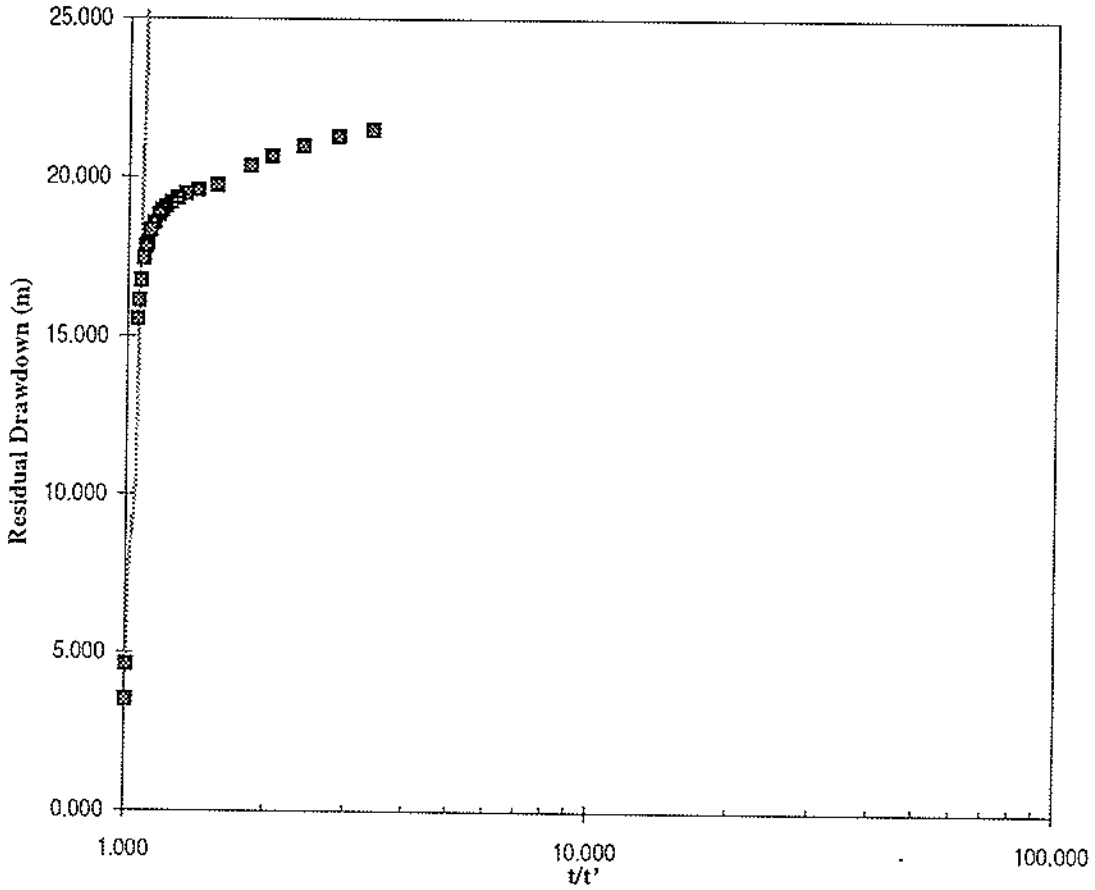
Project: A3100321

Drawing:

Test Date	31-Jul-97
Pumping Duration	8.33
Standing Water Level	0.000
Pumping Started	15:07
Volume Removed (L)	96
Discharge Rate (m3/d)	16.60

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
11.83	3.50	3.380	21.500	21.500
12.83	4.50	2.851	21.290	21.290
14.33	6.00	2.388	20.990	20.990
16.33	8.00	2.041	20.650	20.650
18.33	10.00	1.833	20.360	20.360
23.33	15.00	1.555	19.740	19.740
28.33	20.00	1.417	19.600	19.600
33.33	25.00	1.333	19.470	19.470
38.33	30.00	1.278	19.340	19.340
43.33	35.00	1.238	19.200	19.200
48.33	40.00	1.208	19.070	19.070
53.33	45.00	1.185	18.940	18.940
58.33	50.00	1.167	18.810	18.810
68.33	60.00	1.139	18.550	18.550
78.33	70.00	1.119	18.310	18.310
88.33	80.00	1.104	17.920	17.920
98.33	90.00	1.093	17.800	17.800
108.33	100.00	1.083	17.450	17.450
128.33	120.00	1.069	16.740	16.740
148.33	140.00	1.060	16.120	16.120
168.33	160.00	1.052	15.520	15.520
978.66	970.33	1.009	4.600	4.600
1293.66	1285.33	1.006	3.500	3.500

RECOVERY ANALYSIS - MB15



Transmissivity (m2/d)	0.01	^S	470.56
		Y Intercept	-15.90
		r	0.80

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

Bore : MB15

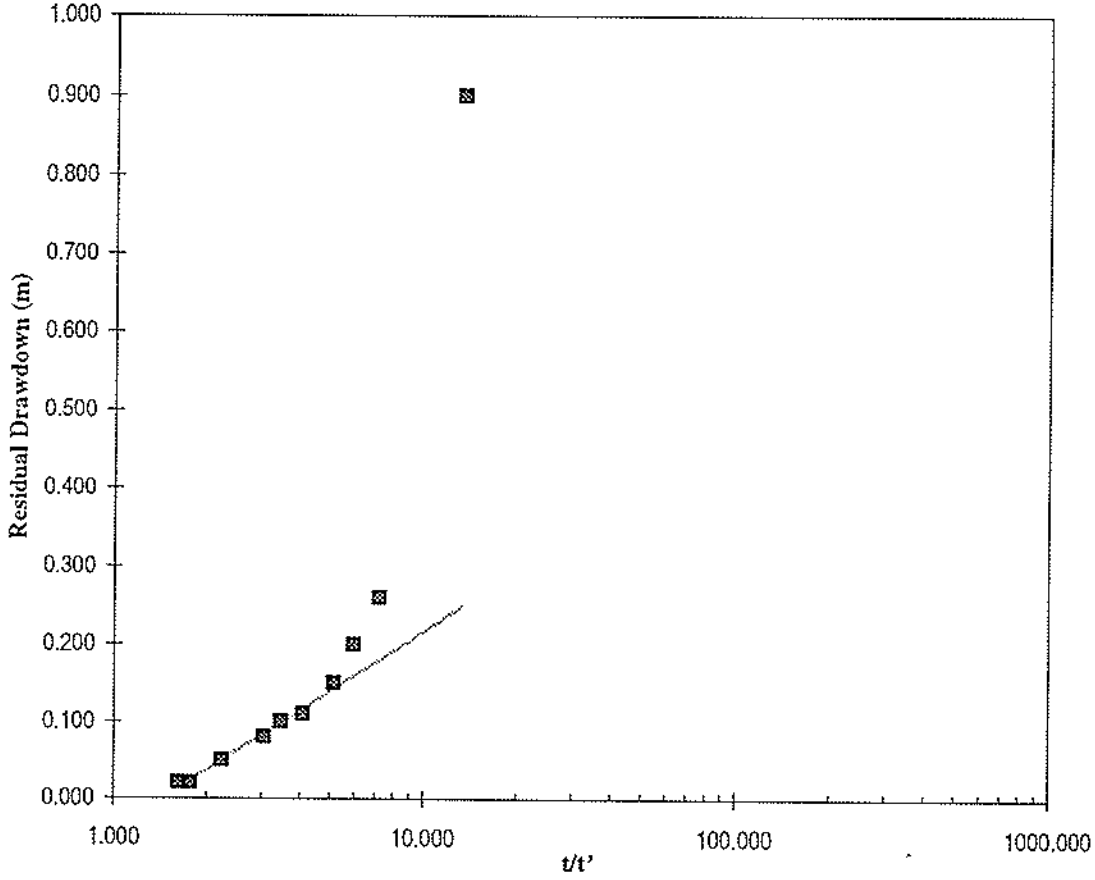
Project:	Drawing:	
A3100321	2	

A3100146/0003/recovery.xls

Test Date	31-Jul-97
Pumping Duration	12.40
Standing Water Level	2.850
Pumping Started	8:28
Volume Removed (L)	117
Discharge Rate (m3/d)	13.59

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
13.40	1.00	13.400	3.750	0.900
14.40	2.00	7.200	3.110	0.260
14.90	2.50	5.960	3.050	0.200
15.40	3.00	5.133	3.000	0.150
16.40	4.00	4.100	2.960	0.110
17.40	5.00	3.480	2.950	0.100
18.40	6.00	3.067	2.930	0.080
22.40	10.00	2.240	2.900	0.050
28.40	16.00	1.775	2.870	0.020
32.40	20.00	1.620	2.870	0.020

RECOVERY ANALYSIS - MB16



Transmissivity (m2/d)	9.69	^S	0.26
		Y Intercept	-0.04
		r	0.99

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

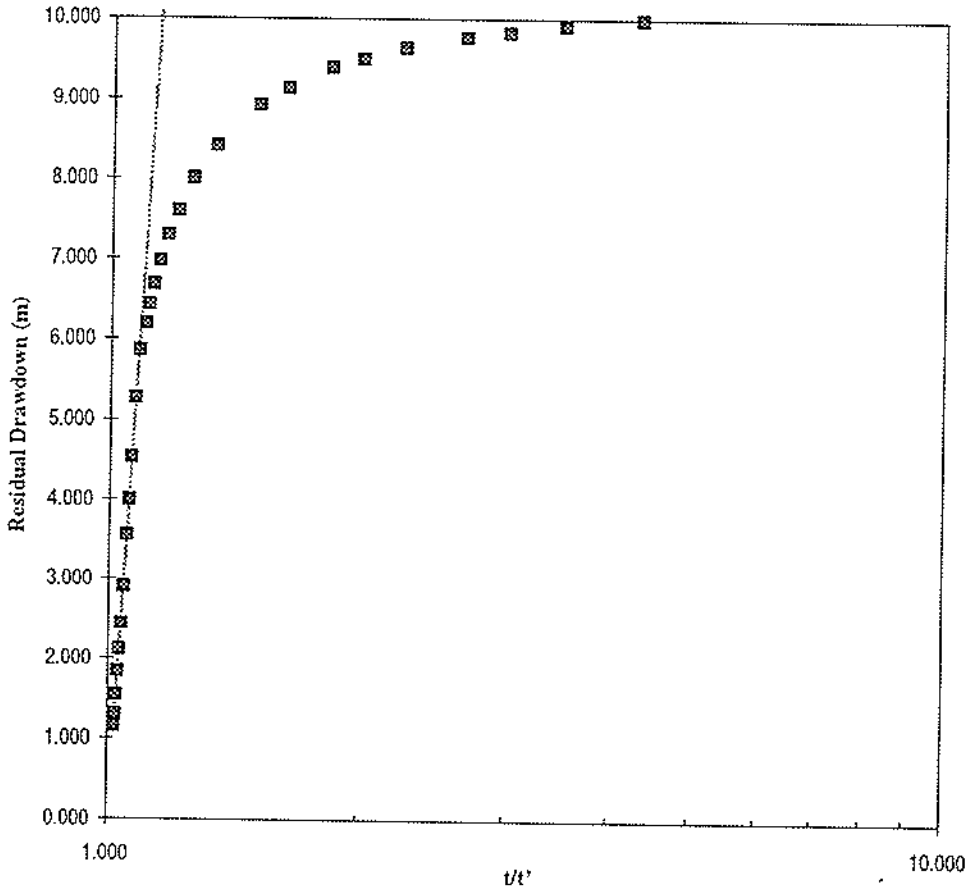
Bore : MB16

Project:	Drawing:	
A3100321		

Test Date	31-Jul-97
Pumping Duration	5.00
Standing Water Level	3.970
Pumping Started	10:13
Volume Removed (L)	56
Discharge Rate (m3/d)	16.13

Time since Pumping Started (min)	Time Since Pumping Stopped (min)	t/t'	Water Level (m)	Residual Drawdown s' (m)
5.00	0.00	#DIV/0!	15.120	11.150
6.50	1.50	4.333	13.960	9.990
7.00	2.00	3.500	13.880	9.910
7.50	2.50	3.000	13.800	9.830
8.00	3.00	2.667	13.740	9.770
9.00	4.00	2.250	13.610	9.640
10.00	5.00	2.000	13.470	9.500
11.00	6.00	1.833	13.360	9.390
13.00	8.00	1.625	13.110	9.140
15.00	10.00	1.500	12.900	8.930
20.00	15.00	1.333	12.390	8.420
25.00	20.00	1.250	11.980	8.010
30.00	25.00	1.200	11.580	7.610
35.00	30.00	1.167	11.270	7.300
40.00	35.00	1.143	10.940	6.970
45.00	40.00	1.125	10.650	6.680
50.00	45.00	1.111	10.390	6.420
55.00	50.00	1.100	10.160	6.190
65.00	60.00	1.083	9.830	5.860
75.00	70.00	1.071	9.240	5.270
85.00	80.00	1.063	8.510	4.540
95.00	90.00	1.056	7.970	4.000
105.00	100.00	1.050	7.530	3.560
125.00	120.00	1.042	6.880	2.910
145.00	140.00	1.036	6.410	2.440
165.00	160.00	1.031	6.080	2.110
185.00	180.00	1.028	5.810	1.840
215.00	210.00	1.024	5.510	1.540
245.00	240.00	1.021	5.270	1.300
275.00	270.00	1.019	5.120	1.150

RECOVERY ANALYSIS - MB17



Transmissivity (m2/d)	0.02	^S	182.82
		Y Intercept	-0.33
		r	1.00

Date	Revision	Description	Drawn:	Checked:
8/12/97	A	Recovery Analysis	BRC	

Woodward-Clyde

A.C.N. 000 691 690

WOODLAWN MINES

Recovery Data Analysis

Bore : MB17

Project:	Drawing:	
A3100321		

Appendix H
QA\QC Laboratory Analysis

Appendix C: ED-1 Clay Permeability Testing

Sydney Laboratory
57 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1600037
Issue No: 1
This report replaces all previous issues of report no 'SYD1600037'.

Client:
Earth 2 Water Pty Ltd
Material Evaluation
Gerringong NSW 2534

Project: 2124279

Accredited for compliance with ISO / IEC 17025

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 22/01/2016

Sample Details

GHD Sample No	SYD16-0012-05
Date Sampled	12/01/2016
Sampled By	Sampled By Client
Location	Woodlawn
BH / TP No.	ED1 CLAY
Soil Description	CLAY: brown with gravel & sand

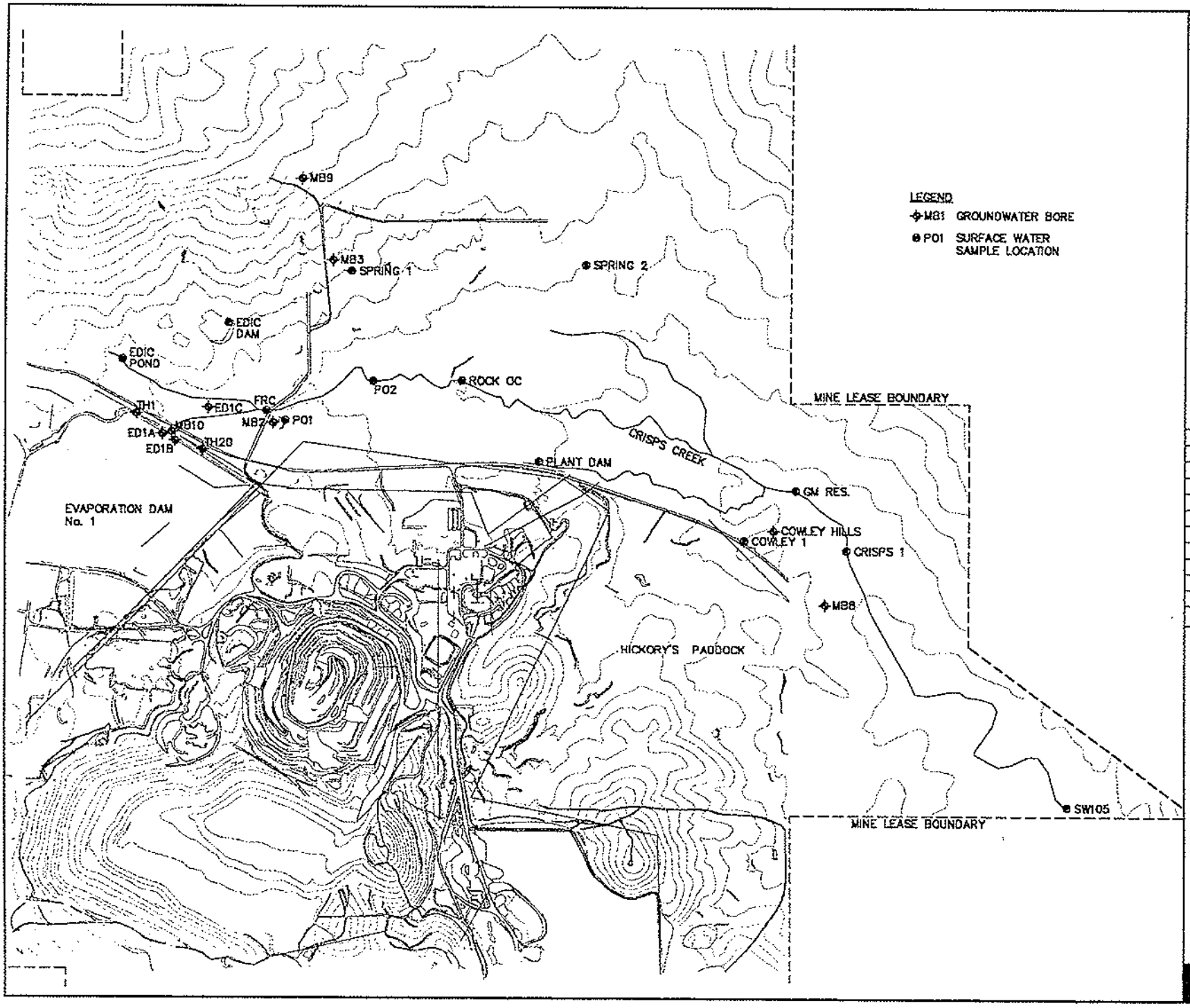
Test Results

Description	Method	Result	Limits
Coef of Permeability (m/sec)	AS 1289.6.7.3	4 E -09	
Mean Stress Level (kPa)		30	
Permeant Used		Tap Water	
Length (mm)		85.1	
Diameter (mm)		73.1	
Length/Diameter Ratio		1.20	
Laboratory Moisture Ratio (%)		0.0	
Laboratory Density Ratio (%)		0.0	
CompactiveEffort		Approx 100% standard	
Method of Compaction		Tamped	
Surcharge Applied (Kg)		0.0	
Pressure Applied (Kpa)		10	
Oversize Sieve (mm)		9.5	
Percentage Oversize (%)		1.0	
Moisture Content (%)		32.3	
Date Tested		14/01/2016	

Comments

At clients request specimen remoulded to approximately 100% standard compactive & approximately OMC. Moisture and Density Ratio's not applicable.
Remoulded moisture content = 21.7% , Remoulded dry density = 1.574 t/m³

Appendix D: ED-1 Leakage Study Figures (URS, 1997)



REVISION:	DESIGNED: B.R.C.
SCALE: AS SHOWN	DRAWN: S.J.L.
DRAWING No: A31/00321	CHECKED:
CAD FILE NO: 0321M006	APPROVED:
DATE: 16/2/97	STATUS:

REV	REV DESCRIPTION	REV	DATE

0 100 200 400 600 800
SCALE IN METRES

CLIENT
DENEHURST LIMITED

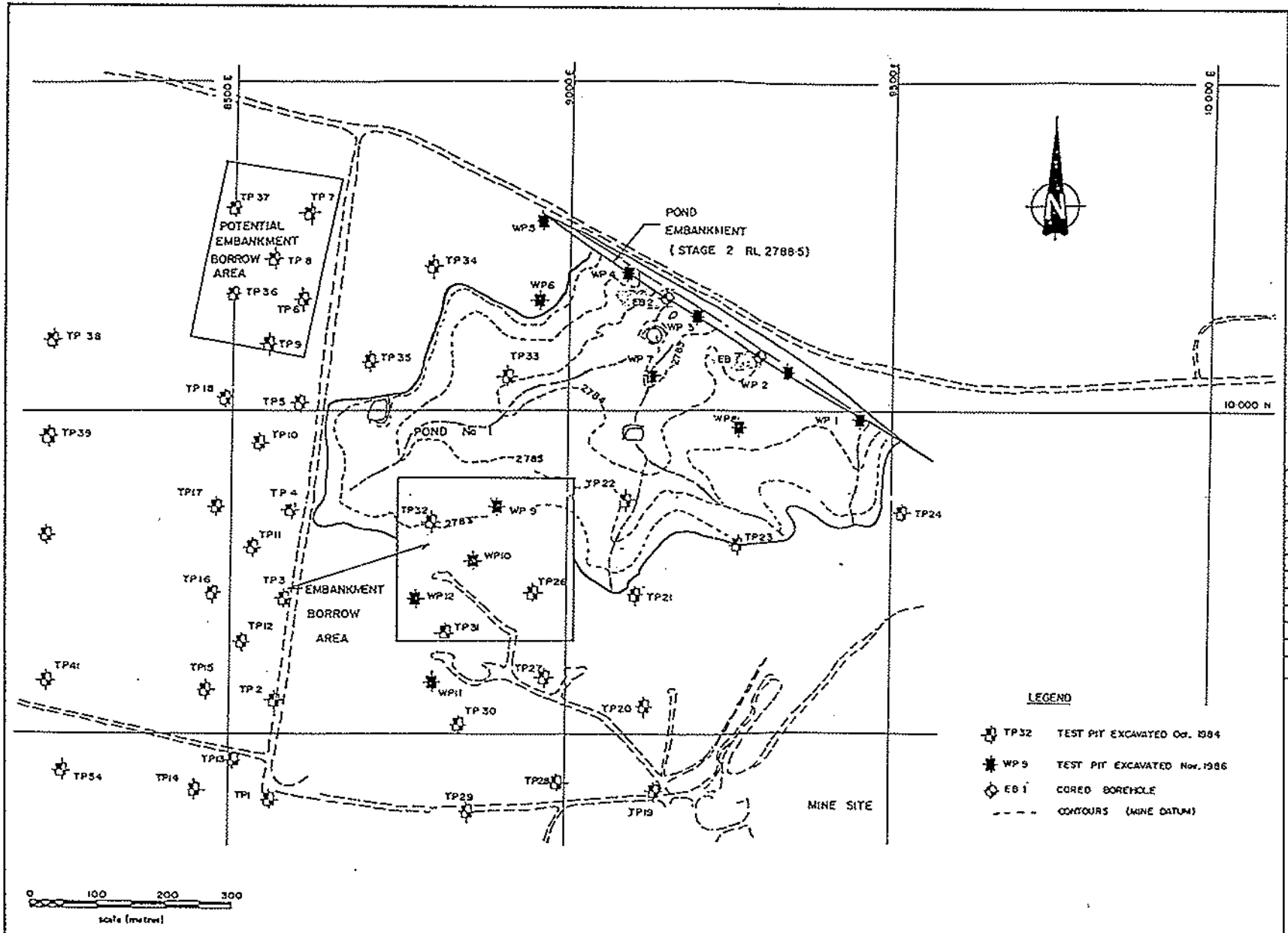
PROJECT
ED1 LEAKAGE ASSESSMENT

TITLE
SITE PLAN

FIGURE
1

A3

Woodward Clyde



AFTER COFFEY & PARTNERS PTY. LTD.
DRAWING No.C3857/1-1

REVISION:
SCALE: AS SHOWN
DRAWING No: A31/00321
CAD FILE NO: 0329A008
DATE: 18/2/87

DESIGNED: S.R.G.
DRAWN: S.J.L.
CHECKED:
APPROVED:
STATUS:

REV	REV DESCRIPTION	REV	DATE

CLIENT
DENEHURST LIMITED

PROJECT
ED1 LEAKAGE ASSESSMENT

TITLE
COFFEY & PARTNERS SITE PLAN (APRIL 1986)

FIGURE
2

A3

Woodward Clyde

Appendix E: Historical Aerial Photographs


Roll
844
0437
WOODLAWN MINE
FRAME
0437
H=17000ftASL
17-11-84
BHP
Engineering


Roll
1034
2325
WOODLAWN MINE
FRAME
2325
H:17000ftASL
9 – 6 – 87
BHP
Engineering

WOODLAWN MINES

FRAME
4697

H:20000ftASL
11 - 9 - 94

BHP
Engineering

Appendix F: Limitations

Earth2Water Pty Ltd has prepared this report for the use of Veolia in accordance with the standard terms and conditions of the consulting profession. This report is prepared with regard to Veolia brief and agreed scope of work. The methodology adopted and sources of information used by E2W are outlined in this report.

E2W has made no independent verification of the monitoring or technical information provided by the client. E2W assumes no responsibility for any inaccuracies or omissions in the data.

This report was prepared by E2W from June to July 2016 and is based on the information reviewed at the time of preparation. This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

The precision with which site conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of surface water and groundwater and some aspects of the contaminants in the environment are complex. Our professional interpretation and conclusions of the data and technical information are based upon our education, experience and review of available consultant reports from the site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, E2W should be notified of any such findings and be provided with an opportunity to review the facts, content and recommendations included herein.

LAST PAGE OF REPORT

Thank you for the opportunity to work with Veolia.

Feedback is Welcomed at Earth2Water (dino@earth2water.com.au)

earth2water Pty Ltd
Environmental & Groundwater Consulting