ERIAS Group

Hayes Creek Project groundwater investigation completion report

24 January 2018

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January 24, 2018
Project Number: AWS170073.01

Mr. David Browne
Principal

ERIAS Group
22B Beulah Road
Norwood SA 5067

Dear David,

RE: Hayes Creek Project groundwater investigations completion report

Please find attached our report that details the results and analysis for the recently completed groundwater investigation programs at the Mt Bonnie and Iron Blow deposits. In total, 11 monitoring bores and two test bores were completed at the Mt Bonnie deposit, and seven holes (five installed as monitoring bores) were completed at the Iron Blow deposit.

We trust the report meets your expectations. Please do not hesitate to contact Michael Short or Kate Holder if you require further information regarding the information presented in this report.

Sincerely,

Dr. Michael Short
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cc: Andy Bennett

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Section 1 Introduction

1.1 Background

CDM Smith Australia Pty Ltd (CDM Smith) has been engaged by PNX Metals Limited (PNX), through ERIAS Group (ERIAS), to undertake hydrogeological field investigations for the Hayes Creek Project (the Project; Figure 1). The field investigations have been undertaken in support of the Definitive Feasibility Study (DFS) for the Project and the environmental approvals process following the completion of a Scoping Study in March 2016 (PNX, 2016) and a Pre-Feasibility Study (PFS) in June 2017 (PNX, 2017).

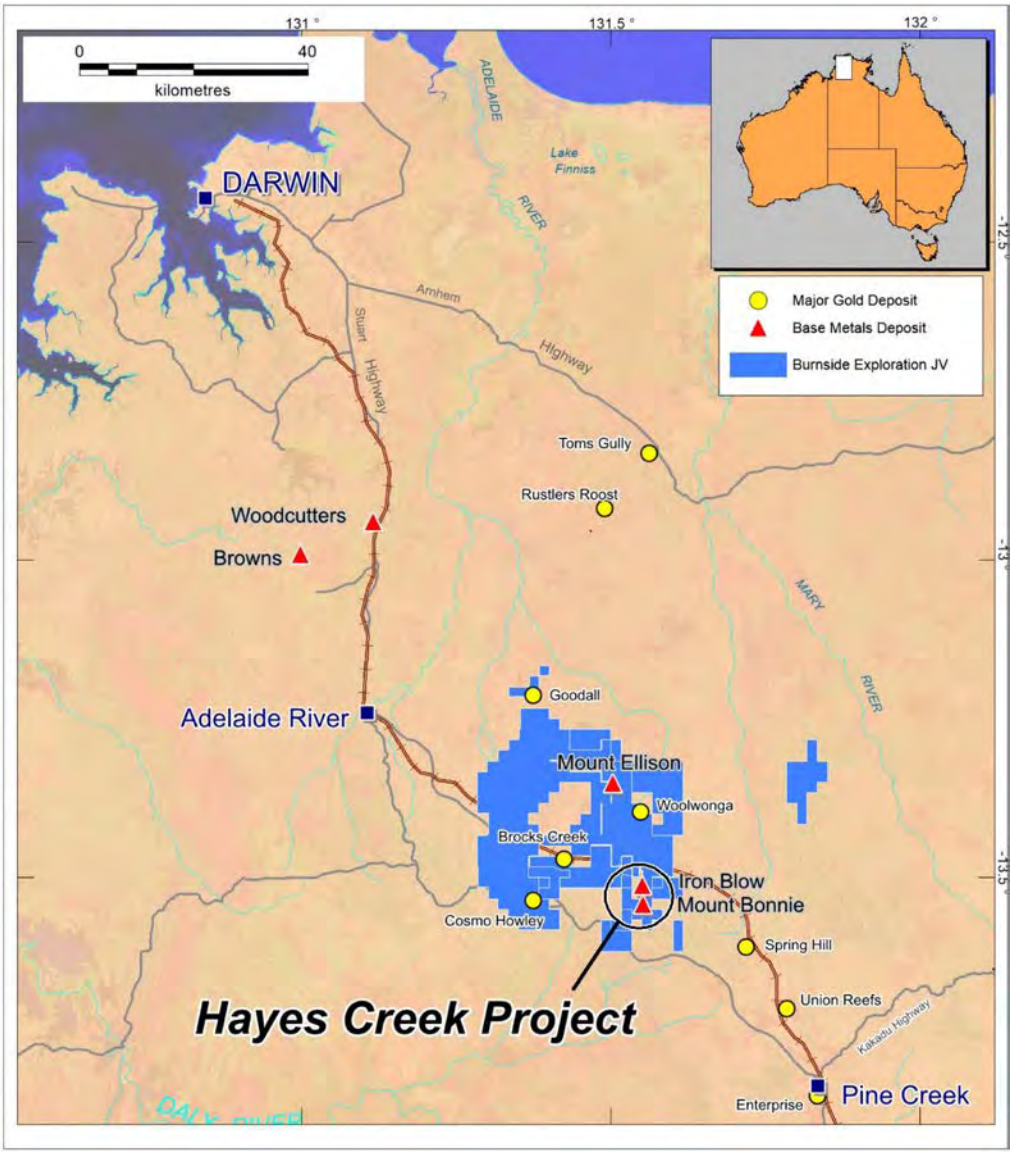


Figure 1 **Hayes Creek Project location plan** (source: PNX, 2017)

The Project is located approximately 170 km south of Darwin (Figure 1) within the Pine Creek region of the Northern Territory, and consists of the Mt Bonnie and Iron Blow zinc-gold-silver deposits. PNX proposes to use open pit mining methods at the Mt Bonnie deposit, which will be followed by underground mining methods at the Iron Blow deposit. The combined planned life-of-mine (LOM) is 6.5 years, commencing in 2019.

The Mt Bonnie and Iron Blow deposits were originally discovered in the late-1800s, at which point limited open pit and underground mining activities occurred. In the 1980s, gold and silver oxide and supergene ore was mined from small open pits at Mt Bonnie and Iron Blow.

The mineral resources for the Project is contained within largely sulfide ore bodies hosted within the Mt Bonnie Formation and South Alligator Group (PNX, 2017). Acid generation from tails and waste rock is likely to present water management issues for the Project, as there is evidence from earlier mining activity that this has been the case. Disposal of tailings and potentially acid generating (PAG) waste rock into decommissioned mine pits to mitigate the impact of possible acidic metalliferous drainage (AMD) leachate on local and regional water resources may be an important consideration for PNX during feasibility studies (CDM Smith, 2017a).

The Project will require a water supply for both construction and LOM operations, including ore processing, camp water supply and dust suppression. The water demand, which is still being assessed by PNX, has the potential to be partially supplied by water inflow to, and stored in, existing pits but this need to be supplemented by other water sources.

Detailed descriptions of the existing environment and hydrogeological setting are presented in CDM Smith (2017a).

1.2 Objectives

The objectives of this study were to:

- Design and supervise the installation of groundwater bores to be utilised in the future for water level monitoring, water quality sampling and aquifer testing.
- Collect observations on lithology and hydrogeology during drilling activities to provide a better understanding of the physical and hydraulic properties of the hydrostratigraphic units (HSUs) present in the vicinity of the Project.
- Conduct hydraulic tests on completed bores at Mt Bonnie and Iron Blow to estimate the hydraulic properties of the HSUs present in the vicinity of the Project.
- Collect water samples from surface water and groundwater sites for chemical analysis to assess the baseline water quality of the HSUs and surface water features (existing dams and pit lakes) in the vicinity of the Mt Bonnie and Iron Blow deposits.
- Document a detailed summary of the field program outcomes, including compilation and analysis of the data collected.

Section 2 Drilling and bore installation

2.1 Overview

Hydrogeological field investigations were undertaken during two phases, commencing on 11 October 2017 and completed on 10 December 2017. Drilling activities were undertaken by Geo Drilling Pty Ltd using the reverse circulation downhole hammer drilling method. The first phase was undertaken at the Mt Bonnie deposit and the second at the Iron Blow deposit (see Figure 2).

The field investigations consisted of drilling and bore construction, hydraulic testing, water level measurements and collection of samples for field and laboratory water quality analysis. Drilling locations were constrained to the Exploration Leases (ELs) and chosen to provide preliminary hydrogeological information for the lease areas that will be available for use in subsequent studies associated with Project approvals.

Composite bore logs for the Mt Bonnie and Iron Blow groundwater bores are presented in Appendix A and drilling observation depth profiles (penetration rate, water EC, airlift yield and water temperature) are presented in Appendix B.

2.2 Mt Bonnie

A total of 16 groundwater bores have been drilled in the vicinity of the Mt Bonnie deposit (Figure 3). Drilling commenced on 12 October 2017 and was completed on 31 October 2017. Eleven of the Mt Bonnie bores were completed as monitoring bores with DN 50 mm Class 18 PVC casing (bores HCM-5 to HCM-16), two drillholes were constructed as test bores with DN 150 mm Class 9 PVC casing (HCT-1 and HCT-2), and one drillhole was abandoned ('HCT-2 (lost)') due to the driller attempting to install PVC casing with an outside diameter that was too large for the drillhole, which resulted in the casing getting lodged (and unable to be retrieved) at a shallow depth.

Observations during drilling suggest that groundwater in the Mt Bonnie area is typically hosted within fracture zones or areas of increased quartz/sulfide veining within the Mt Bonnie Formation. Maximum yields recorded during drilling range from 0.1 L/s at HCM-5 up to 13 L/s at HCM-10. These types of bore yields are typical of the aquifers hosted in the Mt Bonnie Formation (DLPE, 1994).

Distinct variations in groundwater quality (e.g. pH and electrical conductivity (EC)) and yield were observed with depth at two bores (e.g. HCM-14 and HCM-15; see Appendix B), suggesting that groundwater within fractures at different depths may be somewhat disconnected, or connected to the Mt Bonnie pit or other surface water features.

Summary details for the Mt Bonnie bores are presented in Table 1, and construction details of completed bores are presented in Table 2.

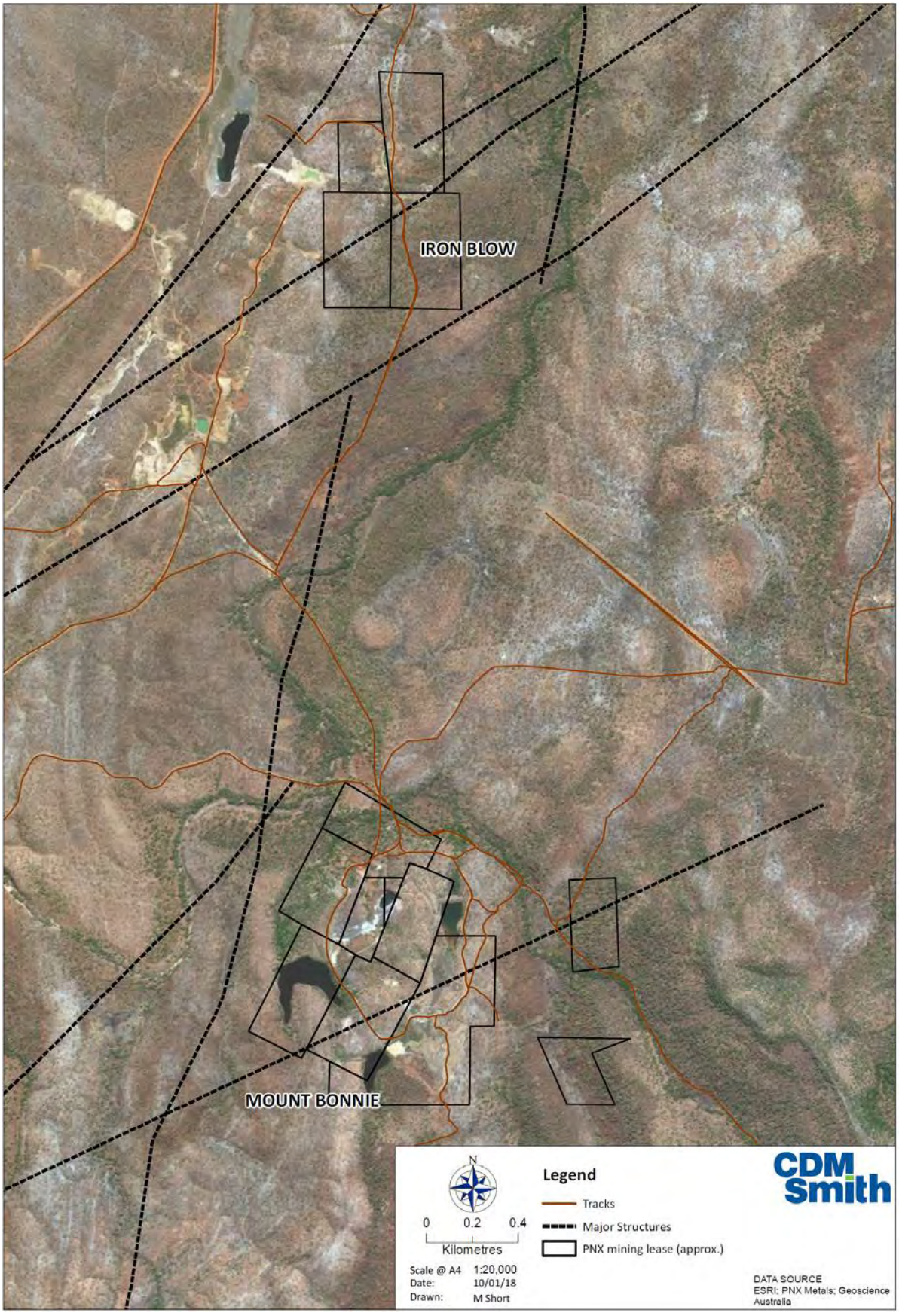


Figure 2 **Mt Bonnie and Iron Blow deposit locality plan**

Legend

- Abandoned bore
- Monitoring bore
- Surface water sample
- Test bore
- Legacy mine features
- PNX Mineral Lease (approx.)

Proposed features

- ROM
- PAF stockpile
- NAF stockpile
- Pit outline

N

0 100 200

Metres

Scale @ A4 1:8,000
Date: 24/01/18
Drawn: M Short

DATA SOURCE
ESRI
PNX Metals

Figure 3

Mt Bonnie drilling and water quality sampling site location plan

CDM Smith

Table 1 Summary details of bores drilled at Mt Bonnie

Bore ID	Purpose	Easting[1]	Northing[1]	Date of SWL	SWL[2]	Drilled depth (m bgl)	Depth of first water strike (m bgl)	Max. airlift yield[3] (L/s)	Field EC (µS/cm)	Field pH	Notes
HCT-1	Test bore	776 006	8 501 784	1-Nov-17	4.26	25	14	1.2	440	7.85	North of the Mt Bonnie mine within close proximity to the Margaret River.
HCT-2		776 052	8 501 221	30-Oct-17	17.72	79	28	0.6	541	7.10	Located southwest of the Oxide Pit and adjacent to the disused waste rock dump.
HCT-2 (lost)	Abandoned	776 034	8 501 209	28-Oct-17	18.52	55	39	5.6	258	6.79	
HCM-5	Monitoring	775 854	8 501 538	25-Oct-17	2.26	18	12	0.1 [4]	318	7.56	Located northwest of the mine, north of the proposed potential acid forming (PAF) material stockpile, and adjacent to a tributary of Margaret River.
HCM-6		776 382	8 501 395	25-Oct-17	9.77	36	16	10.2	292	7.24	Located north of Dam 4, which is a disused tailings storage pond.
HCM-7		776 175	8 501 255	25-Oct-17	40.23	58	55	1.0	411	8.02	Located south of the Oxide Pit, within the footprint of the proposed Project's Mt Bonnie Pit.
HCM-8		776 351	8 501 118	25-Oct-17	11.17	30	18	3.4	2,180	7.64	Located south of Dam 4, north of the disused tailings storage facility (TSF) 1 and north of the proposed non-acid forming (NAF) material stockpile.
HCM-9		776 166	8 500 940	25-Oct-17	20.97	49	41	0.5	2,142	7.43	Located in the central area of Mt Bonnie EL, between Dam 3 and Dam 4 and within the footprint of the proposed NAF material stockpile.
HCM-10		775 890	8 500 631	25-Oct-17	9.83	42	17	13.0	427	7.57	Located west of Dam 2, in the south area of Mt Bonnie EL.
HCM-11		776 365	8 500 485	25-Oct-17	18.13	42	22	7.0	796	7.49	Located southeast of the Mt Bonnie EL, on the southern boundary of the lease.

Table 1 Summary details of bores drilled at Mt Bonnie (cont.)

Bore ID	Purpose	Easting[1]	Northing[1]	Date of SWL	SWL[2]	Drilled depth (m bgl)	Depth of first water strike (m bgl)	Max. airlift yield[3] (L/s)	Field EC (µS/cm)	Field pH	Notes
HCM-12	Monitoring	776 010	8 501 795	25-Oct-17	3.55	25	7	2.0	431	7.28	Monitoring bore located adjacent to HCT-1 on the north boundary of EL within close proximity to the Margaret River.
HCM-13		776 040	8 501 215	27-Oct-17	18.60	67	21.5	0.6	279	7.57	Monitoring bore located adjacent to HCT-2, southwest of the Oxide Pit and adjacent to the disused waste rock dump.
HCM-14		776 152	8 501 452	26-Oct-17	18.76	72	50	4.0	504	6.15	Located north of the Oxide Pit and within the footprint of the proposed Mt Bonnie pit.
HCM-15		775 936	8 501 093	25-Oct-17	7.47	55	16	6.0	631	7.46	Located on the northern boundary of Dam 1, southwest of the disused waste rock dump.

Notes:
1. GDA 94 Zone 52
2. Standing water level (metres below top of casing)
3. As recorded during drilling
4. Observations during development and slug testing suggest introduction of air during RC drilling may be 'holding back' water during drilling.

Table 2 Drilling and construction details of bores drilled at Mt Bonnie

Bore ID	Drilled depth (m bgl)	Drilled diameter (mm)	Casing type	Casing DN (mm)	Cased depth (m bgl)	Casing stick-up (m agl)	Slotted interval (m bgl)
HCT-1	25	254	Class 9 PVC	150	25.0	1.17	13.0 - 25.0
HCT-2	79	254	Class 9 PVC	150	55.0	0.95	37.0 - 55.0
HCT-2 (lost)	55	200	-	-	-	0.05	-
HCM-5	18	133	Class 18 PVC	50	18.0	0.98	12.0 - 18.0
HCM-6	36	133	Class 18 PVC	50	36.0	0.84	18.0 - 36.0
HCM-7	58	133	Class 18 PVC	50	58.0	0.93	52.0 - 58.0
HCM-8	30	133	Class 18 PVC	50	30.0	0.91	18.0 - 30.0
HCM-9	49	133	Class 18 PVC	50	49.0	0.87	43.0 - 49.0
HCM-10	42	133	Class 18 PVC	50	42.0	0.96	18.0 - 39.0
HCM-11	42	133	Class 18 PVC	50	42.0	0.86	36.0 - 42.0
HCM-12	25	133	Class 18 PVC	50	24.3	0.80	6.3 - 24.3
HCM-13	67	133	Class 18 PVC	50	55.0	0.96	43.0 - 55.0
HCM-14	72	133	Class 18 PVC	50	60.5	0.76	39.5 - 60.5
HCM-15	55	133	Class 18 PVC	50	46.0	0.93	19.0 - 46.0

Notes: m bgl – metres below ground level
m agl – metres above ground level
DN – nominal diameter, varies according to class of casing

2.3 Iron Blow

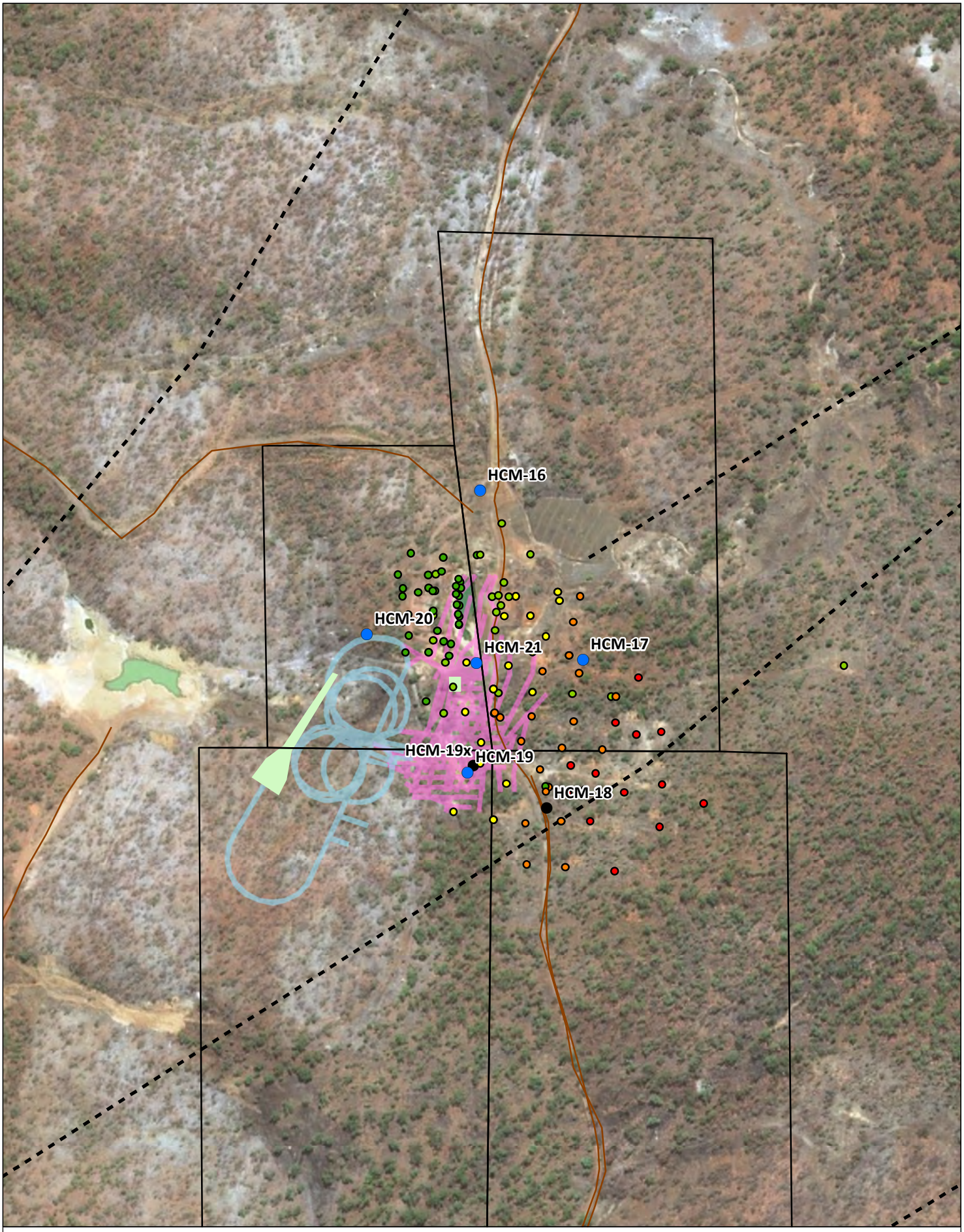
Six groundwater drilling sites were planned at Iron Blow. However due to difficult drilling conditions that resulted in two abandoned holes, a total of seven bores were drilled but only five completed as monitoring bores (HCM-16 to HCM-21) (Figure 4).

Observations during drilling suggest the weathering profile generally extends 30 to 40 m bgl, and groundwater is hosted by/in the upper weathered and fractured zone of the Mt Bonnie Formation. Unstable ground conditions were experienced in the weathering profile at most drillholes and casing installation at all but one of the sites (HCM-21) was unable to reach total depth due to collapsing ground. The first attempt at HCM-19 (designated as 'HCM-19x') was abandoned due to clastic material collapsing on the hammer and insufficient means to divert discharge water at the surface. Drilling at HCM-18 was abandoned due a large amount of clastic materials collapsing on the hammer.

First water strikes were encountered in the upper 25 m, within the weathered zone, and the main water inflows were observed in fractured intervals, typically around 50 to 60 m bgl. Drilling penetration rates and airlift yields generally declined with increasing depth into fresh bedrock.

Salinity (measured as EC during drilling) was observed to steadily increase with increasing depth at HCM-17 (fresh to fresh/brackish with increasing depth), HCM-19 (although water quality remained fresh), and HCM-20 (although water quality remained fresh).

Summary details for the Iron Blow bores are presented in Table 3, and construction details of completed bores are presented in Table 4.



N

0 75 150

Metres

Scale @ A4 1:5,000
Date: 24/01/18
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Legend

PNX drill holes depth (m)
- 1.0 - 58.0
- 58.0 - 126.0
- 126.0 - 210.2
- 210.2 - 329.8
- 329.8 - 501.2

- Abandoned bore
- Monitoring bore
- Major structure
- Tracks
- Vent/portal
- Decline
- Level development
- PNX Mineral Lease (approx.)

Figure 4
Iron Blow drilling location plan

DATA SOURCE
ESRI
PNX Metals

CDM Smith

SHORTMA B:\AWS170073_HayesCk\GIS\DATA\MXD\TEMP\Figure4 IronBlow_20180118.mxd 24/01/2018

Table 3 Summary details of bores drilled at Iron Blow

Bore ID	Purpose	Easting[1]	Northing[1]	Date of SWL	SWL[2]	Drilled depth (m bgl)	Depth of first water strike (m bgl)	Max. airlift yield[3] (L/s)	Field EC (µS/cm)	Field pH	Notes
HCM-16	Investigation / monitoring	776145	8504691	10-Dec-17	8.25	100.0	15	3.6	155	6.39	Located north of the proposed mine development. Only 16 m of slotted casing was installed due to the hole collapsing from 100 m bgl to 16 m bgl. HCM-16 may still be used for water table level monitoring in the future.
HCM-17		776249	8504519	7-Dec-17	4.48	120.0	24	8.0	1,519	7.77	Located east of the proposed mine development. Only 36 m of slotted and blank casing was installed due to the hole collapsing back to 36 m bgl. HCM-17 may still be used for water table level monitoring in the future.
HCM-18	n/a (abandoned)	776212	8504369	-	-	24.0	18	1.3	199	6.96	Drilling targeted the mapped southwest-northeast oriented major structure, to assess if there is enhanced fracturing in this area. Due to unstable drilling conditions, the decision was made to abandon drilling at this location at a depth of 24 m bgl.
HCM-19x		776138	8504412	-	-	30.0	18	2.5	248	7.82	Located to the south of the proposed mine development. The first attempt at drilling was abandoned due to unstable drilling conditions. Only 9.5 m of slotted casing was installed due to the hole collapsing back to 9.5 m bgl from 100 m bgl. HCM-19 may still be used for water table level monitoring in the future.
HCM-19	Investigation / monitoring	776132	8504405	8-Dec-17	5.40	100.0	15	4.1	633	7.56	
HCM-20		776030	8504545	4-Dec-17	7.36	114.0	18	3.5	210	7.65	Located west of the proposed mine development, at the edge of the proposed decline. Only 10 m of slotted casing was installed due to the hole collapsing back to 10 m bgl from 114 m bgl. HCM-20 may still be used for water table level monitoring in the future.
HCM-21		776141	8504516	1-Dec-17	4.22	100.0	20	6.7	215	6.46	Located in the centre of the proposed mine development area.

Notes: 1. GDA 94 Zone 52
2. Standing water level (metres below reference point)
3. As recorded during drilling

Table 4 Drilling and construction details of bores drilled at Iron Blow

Bore ID	Drilled depth (m bgl)	Drilled diameter (mm)	Casing type	Casing DN (mm)	Casing depth (m bgl)	Casing stick-up (m agl)	Slotted interval (m bgl)	Open hole interval (m bgl)	Comment
HCM-16	100.0	133	Class 18 PVC	50	16.0	0.96	0-16	-	Collapsed from 16 to 100 m bgl
HCM-17	120.0	133	Class 18 PVC	50	36.0	0.92	23-36	-	Collapsed back to 36 m bgl
HCM-18	24.0	133	-	-	-	-	-	-	Hole abandoned
HCM-19x	30.0	133	-	-	-	-	-	-	Hole abandoned
HCM-19	100.0	133	Class 18 PVC	50	9.5	1.06	0-9.5	-	Collapsed back to 9.5 m bgl
HCM-20	114.0	133	Class 18 PVC	50	10.0	0.98	0-10	-	Collapsed back to 10 m bgl
HCM-21	100.0	133	Class 18 PVC	50	36.0	1.03	24-36	36-100	

Notes: m bgl – metres below ground level
m agl – metres above ground level
DN – nominal diameter, varies according to class of casing

Section 3 Hydraulic testing

3.1 Overview

Hydraulic tests (slug tests and airlift recovery tests) were conducted at selected groundwater bore locations on the Mt Bonnie and Iron Blow ELs. The purpose of the hydraulic testing is to obtain head response data for estimating the hydraulic properties of the screened lithology (described in this section). These estimates can later inform studies undertaken to assess potential mine water inflows during mining at Iron Blow, area of drawdown influence from pumping / mine dewatering, mine water supply potential, and potential effects of mine-water affecting activities on sensitive receptors (e.g. Margaret River aquatic ecosystems).

Slug tests consisted of rapidly lowering ('slug in') or raising ('slug out') a 'slug' (36 mm diameter x 2 m inert plastic cylinder) below/above the standing water level and recording the water level response using a submerged pressure transducer. Analysis of the test results provides an estimate of the hydraulic conductivity (K) of the strata directly adjacent to the bore.

Airlift recovery tests consisted of airlifting the bores / drillholes whilst recording the airlift pumping rates and then recording water level recovery using a pressure transducer. Analysis of the test data provides estimates of the transmissivity (T) of the pumped lithology. Pressure transducers were also installed within adjacent monitoring bores at Mt Bonnie during the airlifting to monitor water level response during the airlift 'pumping' and recovery stages of the tests, which allows estimates of aquifer storativity to be derived. Airlift recovery tests at Mt Bonnie were undertaken on cased bores, whereas test at Iron Blow were undertaken on open holes before bore completion.

All analyses of hydraulic test data have been undertaken using the industry standard aquifer test analysis software, AQTESOLV (Duffield, 2007).

3.2 Mt Bonnie

3.2.1 Slug tests

Slug testing was conducted at all 11 monitoring bores completed at Mt Bonnie.

All but one of the Mt Bonnie monitoring bores (HCM-9) produced water level responses typical of high-K aquifers (i.e. 'underdamped' or oscillating water levels). An example of the high-K response is shown in Figure 5, which presents the normalised head change (relative to the initial standing water level) measured during the falling head test (i.e. after the slug was submerged below the water level).

An example of the low-K water level response (i.e. 'overdamped') recorded at HCM-9 is presented in Figure 6, which presents the normalised head change (relative to the initial standing water level) measured in HCM-9 after the slug was raised from below the water level.

Summary details of the slug test analyses of Mt Bonnie monitoring bores are presented in Table 5 and graphical outputs are presented in Appendix C.

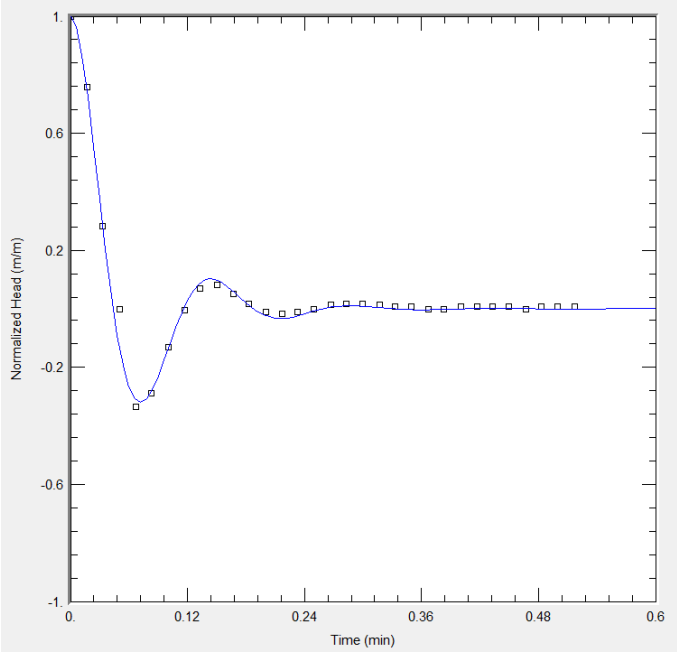

Figure 5 **Normalised head response to slug submersion recorded at HCM-5**

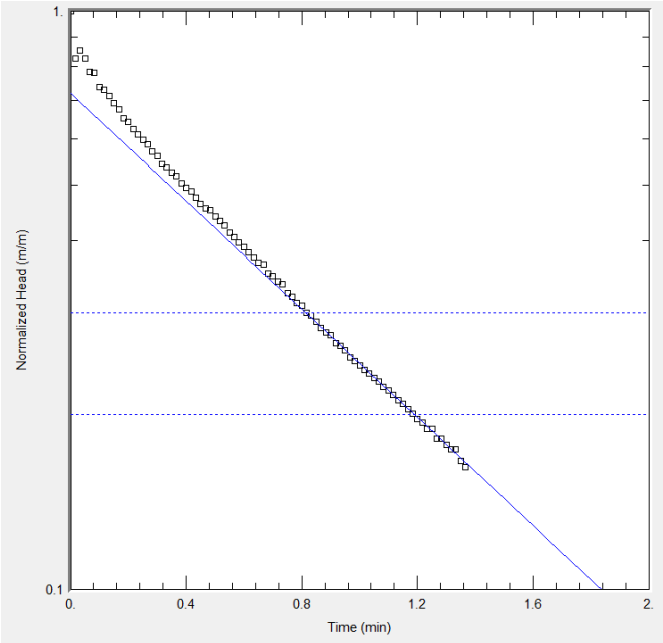

Figure 6 **Normalised head response to slug removal recorded at HCM-9**

Table 5 Summary details of slug test analyses completed for the Mt Bonnie monitoring bores

Bore ID	Lithology / aquifer	Aquifer interval (b)		Airlift yield (L/s)	Water level response type	Analysis method	Test phase	Estimated K (m/day)	Adopted K[2] (m/day)
		(m)	Explanation						
HCM-5	Mt Bonnie Formation (siltstone)	6.0	First water strike (12 m bgl) to end of hole (18 m bgl)	0.1 [1]	High-K (oscillatory)	Butler et al (2003)	Slug in 1	13.2	13.1
							Slug in 2	12.3	
							Slug out 1	12.6	
							Slug out 2	14.6	
HCM-6	Mt Bonnie Formation (graphitic shale)	20.0	First water strike (16 m bgl) to end of hole (36 m bgl)	10.2	High-K (oscillatory)	Butler et al (2003)	Slug in 1	20.9	22.3
							Slug out 1	19.2	
							Slug out 2	27.5	
HCM-7	Gerowie Tuff	3.0	First water strike (55 m bgl) to end of hole (58 m bgl)	1.0	High-K (oscillatory)	Butler et al (2003)	Slug in 1	39.0	40.0
							Slug in 2	41.1	
HCM-8	Mt Bonnie Formation (mudstone)	12.0	First water strike (18 m bgl) to end of hole (30 m bgl)	3.4	High-K (oscillatory)	Butler et al (2003)	Slug in 1	13.5	12.2
							Slug in 2	15.4	
							Slug out 1	9.7	
							Slug out 2	11.0	
HCM-9	Mt Bonnie Formation (mudstone)	8.0	First water strike (41 m bgl) to end of hole (49 m bgl)	0.5	Low-K	Bouwer and Rice (1976)	Slug in 1	0.18	0.20
							Slug out 1	0.23	
HCM-10	Mt Bonnie Formation (mudstone and sandstone)	25.0	First water strike (17 m bgl) to end of hole (42 m bgl)	12.5	High-K (oscillatory)	Butler et al (2003)	Slug in 1	7.6	8.7
							Slug in 2	8.4	
							Slug out 1	9.4	
							Slug out 2	9.5	

Table 5 **Summary details of slug test analyses completed for the Mt Bonnie monitoring bores** (cont.)

Bore ID	Lithology / aquifer	Aquifer thickness		Airlift yield (L/s)	Water level response type	Analysis method	Test phase	Estimated K (m/day)	Adopted K[2] (m/day)
		(m)	Explanation						
HCM-11	Mt Bonnie Formation (sandstone)	20.0	First water strike (22 m bgl) to end of hole (42 m bgl)	7.0	High-K (oscillatory)	Butler et al (2003)	Slug in 1	44.3	33.5
							Slug in 2	50.8	
							Slug out 1	22.7	
							Slug out 2	24.6	
HCM-12	Alluvium	17.3	First water strike (7 m bgl) to end of hole (24.3 m bgl)	2.0	High-K (oscillatory)	Butler et al (2003)	Slug in 1	5.9	6.3
							Slug in 2	6.6	
HCM-13	Mt Bonnie Formation (siltstone)	33.5	First water strike (21.5 m bgl) to bottom of slotted casing (55 m bgl)	0.6	High-K (oscillatory)	Butler et al (2003)	Slug in 1	6.5	6.0
							Slug in 2	5.6	
HCM-14	Mt Bonnie Formation (mudstone)	25.5	First water strike (35 m bgl) to bottom of slotted casing (60.5 m bgl)	>4	High-K (oscillatory)	Butler et al (2003)	Slug in 1	4.3	5.8
							Slug in 2	5.6	
							Slug out 1	6.7	
							Slug out 2	7.0	
HCM-15	Mt Bonnie Formation (mudstone)	30.0	First water strike (16 m bgl) to bottom of slotted casing (46 m bgl)	>6	High-K (oscillatory)	Butler et al (2003)	Slug in 1	8.8	7.3
							Slug in 2	10.0	
							Slug out 2	4.4	

Notes: 1. Airlift yield measured during drilling. Observations during bore development and slug testing suggest that the airlift yield is actually > 0.1 L/s.

2. Geometric mean of estimated K

3.2.2 Airlift recovery tests

Airlift recovery tests were completed at the two Mt Bonnie test bores (HCT-1 and HCT-2). Summary details of the Mt Bonnie airlift recovery test analyses are presented in Table 6 and graphical outputs are presented in Appendix C.

3.2.3 Summary

Estimates of hydraulic properties derived from hydraulic testing, and drilling observations at the Mt Bonnie bore sites indicate:

- Mt Bonnie Formation
  - The estimated K of moderately to highly fractured rock ranges from around 2 to 33 m/day.
  - The estimated K of less fractured rock / matrix is K around 0.2 m/day.
  - The estimated storativity is 7×10^{-5}.
- Gerowie Tuff
  - The estimated K of the fractured tuff is around 40 m/day.
- Alluvial sediments
  - The estimated K of alluvial materials on the Margaret River floodplain ranges from 2 to 6 m/day.
  - The estimated storativity is 2×10^{-5}.
- There is no clear spatial trend in K across the EL.
- General
  - Approximate elevations (surface elevations were recorded by a Garmin handheld GPS unit) of first water strikes within the Mt Bonnie Formation ranged between 112 and 142 m AHD.
  - Approximate elevations of the main inflow zones (as observed by airlift yield during drilling) within the Mt Bonnie Formation ranged between 95 and 130 m AHD.
  - Approximate elevations of first water strikes within the alluvial sediments ranged between 112 and 142 m AHD. No distinct peak in inflow was observed at bore drilled in the alluvial sediments.

Table 6 Summary details of Mt Bonnie airlift recovery test analyses

Test bore ID	Monitored bores	Lithology / aquifer	Aquifer thickness (m)	Average airlift rate (L/s)	Test duration (minutes)	Analysis method	Estimated T [1] (m^2/day)	Estimated K (m/day)	Adopted K (m/day)	S [2]
HCT-1	HCT-1	Alluvium (transported Mt Bonnie Formation)	11.0	1.7	171 (airlifting) 1,220 (recovery)	Theis (1935)	25 (recovery)	2.3 (recovery)	3	-
	HCM-12						53 (airlifting) 28 (recovery)	4.8 (airlifting) 2.5 (recovery)		2×10^{-5}
HCT-2	HCT-2	Mt Bonnie Formation (siltstone)	18.0	1.2	200 (airlifting) 1,040 (recovery)	Theis (1935)	33 (recovery)	1.8 (recovery)	2	-
	HCM-13						43 (airlifting) 37 (recovery)	2.4 (airlifting) 2.1 (recovery)		7×10^{-5}

Notes: 1. T = transmissivity
2. S = storativity (dimensionless)

3.3 Iron Blow

3.3.1 Airlift recovery tests

Airlift recovery tests were completed at five of the Iron Blow bores, prior to construction. Recording of water level recovery using a pressure transducer could not commence until the drill rods could be safely disconnected at the rig table and the transducer lowered into the water column. This generally occurred around 5 minutes after airlifting ceased, with the exception HCM-16 where monitoring commenced 10 minutes after airlifting ceased. This limited the amount of data available for analysis as water levels at most sites had recovered to less than 1 m from static water level by the time the transducer was lowered to depth (i.e. significant recovery had occurred prior to setting of the transducer), with the exception of HCM-20 where water levels had recovered to around 5 m.

Summary details of the Iron Blow hydraulic tests are presented in Table 7 and graphical outputs from the completed analyses are presented in Appendix C.

Table 7 Summary details of Iron Blow airlift recovery test analyses

Bore ID	Lithology / aquifer	Aquifer interval (b)		Average airlift pumping rate (L/s)	Test duration (minutes)	Estimated T (m^2/day)	Estimated K (m/day) [1]
		(m)	Explanation				
HCM-16	Mt Bonnie Formation (mudstone)	33	First water strike (15 m bgl) to depth of peak yield (48 m bgl)	3.5	56.3 (airlifting) 82.3 (recovery)	50	1.5
HCM-17	Mt Bonnie Formation (siltstone and sandstone)	56	First water strike (24 m bgl) to depth of last significant water cut (80 m bgl)	10.0	55.0 (airlifting) 52.0 (recovery)	168	3.0
HCM-19	Mt Bonnie Formation (siltstone)	42	First water strike (15 m bgl) to depth of peak yield (57 m bgl)	3.4	40.5 (airlifting) 60.8 (recovery)	43	1.0
HCM-20	Mt Bonnie Formation (siltstone)	52	First water strike (18 m bgl) to depth of last significant water cut (70 m bgl)	2.2	42.5 (airlifting) 19.4 (recovery)	11	0.2
HCM-21	Mt Bonnie Formation (mudstone)	34	First water strike (20 m bgl) to depth of peak yield (54 m bgl)	6.5	60 (airlifting) 60 (recovery)	N/A – data logger files were corrupted	

Notes: T = transmissivity
1. Calculated by dividing T by b (observed aquifer interval)

3.3.2 Summary

Estimates of hydraulic properties derived from hydraulic testing and drilling observations at the Iron Blow bore sites indicate:

- The highest estimated transmissivity (at HCM-17) is around 170 m^2/day.
- Estimates of K for the fractured Mt Bonnie Formation range between 0.2 and 3 m/day.
- General
  - Approximate elevations of first water strikes within the fractured Mt Bonnie Formation ranged between 94 and 112 m AHD.
  - Approximate elevations of the main inflows within the fractured Mt Bonnie Formation ranged between 79 and 100 m AHD.

Section 4 Water quality

4.1 Overview

Water quality samples were collected from all airlifted bores at Mt Bonnie and Iron Blow, and a selection of surface water features from the Mt Bonnie deposit (e.g. existing dams and pit lake). At each sampling site, the following measurements and samples were collected:

- Field parameters (e.g. temperature, EC, pH, dissolved oxygen and redox potential)
- Laboratory analytes
  - Major dissolved constituents (e.g. total dissolved solids, alkalinity, major ions, silicon, etc.)
  - Dissolved (i.e. filtered) metals (a suite of 23 metals)

Chemical analyses on all water samples were undertaken at a NATA accredited laboratory for the analyses required (ALS Environmental, Sydney). Laboratory reports are presented in Appendix D.

4.2 Mt Bonnie

The locations of the surface water monitoring sites are listed in Table 8. Locations for all sampling points (surface water and groundwater) are presented on Figure 3. Table 9 and 10 present the water quality results for surface water and groundwater samples collected in the Mt Bonnie EL area.

The salinity of groundwater sampled from Mt Bonnie EL bores area ranges from fresh (159 mg/L total dissolved solids (TDS)) to brackish (1,990 mg/L TDS), and pH ranges from slightly acidic (6.22) to slightly alkaline (8.29). The salinity of groundwater at HCM-8 and HCM-9 is approximately three to ten times the salinity of groundwater at other bore sites. These results may indicate seepage and evapoconcentration from a previous TSF (TSF 1) located in close proximity to these bores.

The salinity of surface water sampled in the Mt Bonnie area is fresh (104 to 222 mg/L TDS), and pH ranges from acidic (3.59 at Dam 4) to neutral (7.26 at the Margaret River site).

A Piper Diagram is presented in Figure 7, which shows the major ion water types of samples collected in the Mt Bonnie EL area, as well as Darwin rainwater. The Piper Diagram shows that most surface water and groundwater in the Mt Bonnie area report magnesium as their dominant cation, and either sulfate or carbonate species as their dominant anion. Of interest on the Piper Diagram, are the two clusters of samples with similar water types. The cluster identified by the red circle in Figure 7 includes the surface water of the dams and the eastern monitoring bores (i.e. HCM-6, 8, 9, 11 and 14). The cluster identified by the purple circle in Figure 7 includes Darwin rainwater, Margaret River, a small tributary and the remaining Mt Bonnie bores (predominantly located on the western side of the deposit). However, Darwin rainwater has a dramatically different magnesium and sulfate compositions to all of the Mt Bonnie water samples.

Dissolved metals have been compared to the 95% species protection guideline for fresh water quality (ANZECC, 2000). Exceedances of the guideline values are identified as grey cells in Table 10. Of note are exceedances in groundwater samples for arsenic, cadmium, copper, manganese, nickel and zinc. Additionally, there are a number of exceedances for aluminium, mercury and lead in some of the dam samples.

A duplicate sample was collected at HCT-1 for quality assurance purposes. The only analytes that show significant differences are minor metals (e.g. cobalt, molybdenum, strontium) or redox sensitive metals (e.g. arsenic, manganese), which may have been impacted by the sampling method (i.e. airlifting with drill rods). Airlifting, where used, is likely to cause oxygenation of the water samples and may also introduce minor metal contamination.

Table 8 Mt Bonnie surface water sampling locations

Sample ID	Type	Date	Easting[1]	Northing[1]	Notes
Dam 1	Surface water	11-Oct-17	775711	8500826	Low turbidity
Dam 3		11-Oct-17	776160	8500672	
Dam 4		11-Oct-17	776373	8501258	
HCM-5 area		11-Oct-17	775849	8501543	Stagnant, black water with organic odour
Margaret River		11-Oct-17	775840	8501818	Pool of water with mosquito larvae

Notes: 1. GDA 94 Zone 52

Table 9 Mt Bonnie field water quality parameters

Sample ID	Temperature (°C)	pH	Electrical conductivity (µS/cm)	Dissolved oxygen		Redox potential (mV)
				(mg/L)	(% saturation)	
HCM-5	30.5	7.56	318	Not measured. Parameters relating to oxygen (dissolved oxygen and redox potential) are not representative of *in situ* groundwater because samples were collected at the end of airlift development.		
HCM-6	30.0	7.24	292			
HCM-7	32.5	8.02	411			
HCM-8	33.0	7.64	2,180			
HCM-9	31.5	7.43	2,142			
HCM-10	32.5	7.57	427			
HCM-11	32.0	7.49	796			
HCM-12	29.5	7.28	431			
HCM-13	32.5	7.57	279			
HCM-14	31.0	6.15	504			
HCM-15	33.0	7.46	631			
HCT-1	29.0	7.85	440			
HCT-1 (duplicate)	29.0	7.85	440			
HCT-2	31.5	7.10	241			
Dam 1	33.0	6.03	165	4.06	57.0	204
Dam 3	35.0	5.20	242	2.17	31.3	208.5
Dam 4	33.0	3.79	330	3.91	58.1	301.9
HCM-5 area	31.5	6.22	222	0.05	0.7	-13.6
Margaret River	29.9	6.78	219	1.33	17.6	130.4

Table 10 Mt Bonnie laboratory water quality results

Analyte	Units	ANZECC freshwater guideline [1]	HCM-5	HCM-6	HCM-7	HCM-8	HCM-9	HCM-10	HCM-11	HCM-12	HCM-13	HCM-14	HCM-15	HCT-1	HCT-1 (duplicate)	HCT-2	Dam 1	Dam 3	Dam 4	HCM-5 area	Margaret River
pH	-	-	7.82	7.55	8.29	8.11	8.1	8.01	8.02	8.01	7.85	6.22	7.97	8.24	8.23	7.9	7	5.96	3.59	6.82	7.26
TDS [2]	mg/L	-	254	356	245	1,910	1,990	250	569	316	194	372	448	326	324	159	104	222	181	129	127
Ca		-	12	12	6	151	209	22	74	24	9	22	46	23	24	4	4	6	6	5	8
Mg		-	24	19	36	167	174	26	53	33	25	28	44	33	34	23	8	10	12	9	10
Na		-	16	13	26	172	80	31	21	19	8	17	22	18	19	8	10	4	3	2	7
K		-	2	2	2	5	8	2	3	4	2	4	3	3	3	3	2	9	3	13	4
Cl		-	3	1	18	44	50	2	12	4	5	10	10	4	4	5	2	3	<1	3	8
SO_4		-	41	110	13	1,200	1,150	28	258	68	21	231	112	69	69	14	41	91	116	<10	6
F		-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.1	0.2	0.1	0.2
Si		-	21	19.1	16.4	20.2	27.1	19.6	26.8	22.7	15.2	12.4	28.1	24.2	23.5	12.4	4.8	3.3	3	6.2	11.6
CO_3	mg/L as $CaCO_3$	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
HCO_3		-	133	30	196	241	150	212	237	191	125	10	255	182	180	118	18	4	<1	68	86
OH		-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total alkalinity		-	133	30	196	241	150	212	237	191	125	10	255	182	180	118	18	4	<1	68	86
Total hardness		-	129	108	163	1,060	1,240	162	403	196	125	170	296	193	200	105	43	56	64	50	61
Total acidity		-	<1	2	<1	<1	1	<1	<1	<1	2	47	<1	<1	<1	<1	3	8	34	14	6
Silver (Ag)	µg/L	0.05	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Aluminium (Al)		55	<10	<10	20	<10	<10	30	<10	<10	<10	<10	<10	40	40	<10	10	110	2,440	40	30

Analyte	Units	ANZECC freshwater guideline [1]	HCM-5	HCM-6	HCM-7	HCM-8	HCM-9	HCM-10	HCM-11	HCM-12	HCM-13	HCM-14	HCM-15	HCT-1	HCT-1 (duplicate)	HCT-2	Dam 1	Dam 3	Dam 4	HCM-5 area	Margaret River
Antinomy (Sb)		-	<1	<1	2	<1	4	2	1	<1	49	<1	6	<1	<1	32	<1	2	<1	<1	9
Arsenic (As)		13	747	9	4	4	<1	314	69	1,210	2	2	2	8	3	4	30	135	18	6	<50
Boron (B)		370	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	74
Barium (Ba)		-	7	9	20	20	11	17	12	22	18	9	104	20	17	8	11	66	35	62	<1
Beryllium (Be)		-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.1
Cadmium (Cd)		0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	13	<0.1	<0.1	7	<0.1	<0.1	<0.1	<0.1	26	8	<0.1	<1
Chromium (Cr)		1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4
Cobalt (Co)		-	<1	<1	<1	<1	<1	1	4	4	1,030	38	15	10	2	26	1	23	38	3	<1
Copper (Cu)		1.4	<1	<1	<1	<1	<1	<1	<1	4	<1	<1	<1	<1	<1	<1	2	257	254	1	2,170
Iron (Fe)		-	140	60	<50	<50	<50	<50	<50	<50	140	12,400	<50	<50	<50	190	<50	1,360	380	1,510	<0.1
Mercury (Hg)		0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<1
Lead (Pb)		3.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	32	22	<1	2,030
Manganese (Mn)		1,900	267	295	198	206	92	4	604	815	565	79	5,360	1,240	320	140	16	7,400	5,990	1,330	<1
Molybdenum (Mo)		-	<1	2	<1	<1	<1	<1	<1	<1	2	<1	<1	4	1	5	<1	<1	<1	<1	<1
Nickel (Ni)		11	2	<1	<1	<1	<1	<1	1	5	2	<1	14	<1	<1	3	<1	9	45	<1	<1
Selenium (Se)		11	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tin (Sn)		-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Strontium (Sr)		-	12	80	78	76	44	18	89	28	303	30	76	122	67	399	16	28	7	35	38
Thorium (Th)		-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Analyte	Units	ANZECC freshwater guideline [1]	HCM-5	HCM-6	HCM-7	HCM-8	HCM-9	HCM-10	HCM-11	HCM-12	HCM-13	HCM-14	HCM-15	HCT-1	HCT-1 (duplicate)	HCT-2	Dam 1	Dam 3	Dam 4	HCM-5 area	Margaret River
Uranium (U)		-	<1	<1	<1	<1	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc (Zn)		8	<5	<5	19	8	5	<5	12	<5	640	12,800	<5	<5	<5	122	<5	2,360	648	7	<5

Notes: Grey cells indicate an exceedance of the ANZECC guideline concentration for freshwater ecosystems (ANZECC, 2000)

1. 95% species protection trigger for freshwater (ANZECC, 2000)
2. Gravimetrically determine total dissolved solids (TDS)

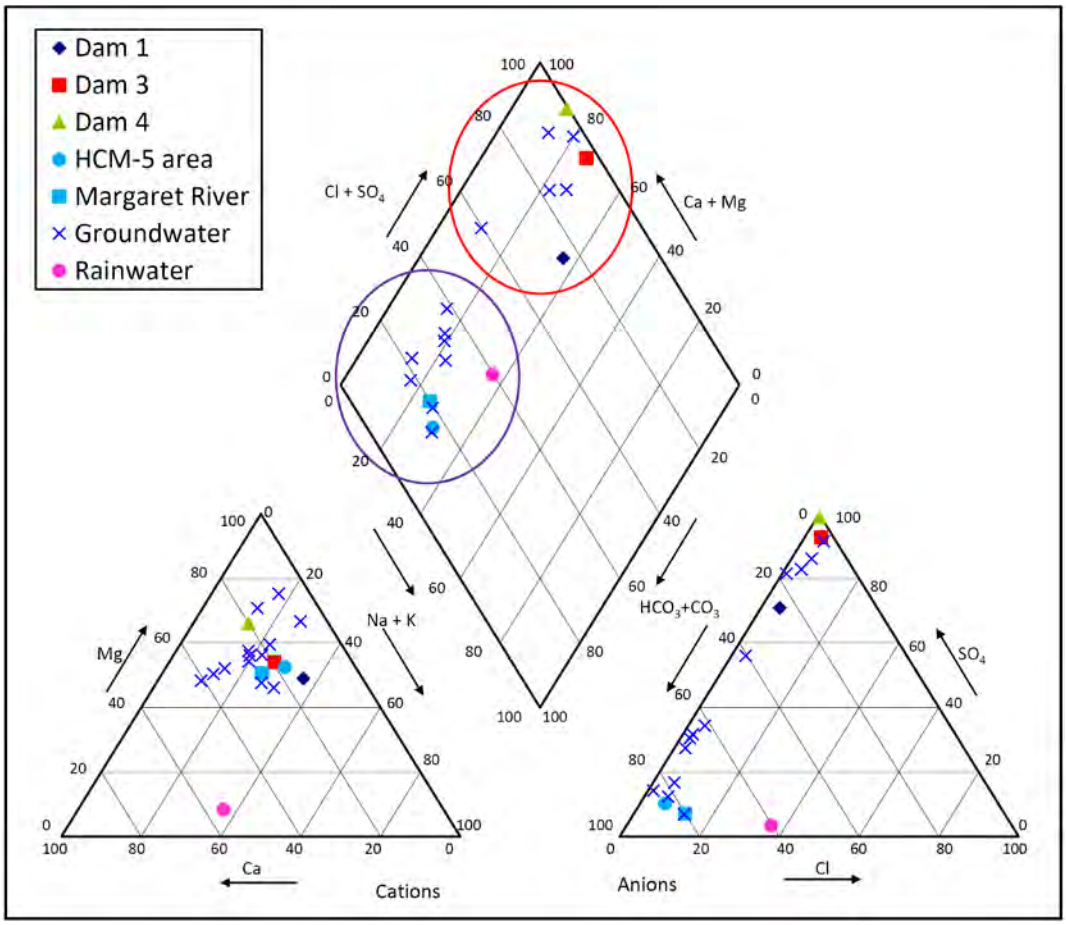

Figure 7 **Piper diagram of Mt Bonnie groundwater and surface water samples**

4.3 Iron Blow

Tables 11 and 12 present the water quality results for groundwater samples collected in the Iron Blow area. The salinity of groundwater sampled from bores on the Iron Blow EL ranges from fresh (165 mg/L TDS) to brackish (1,310 mg/L TDS), and pH ranges from neutral (7.02) to slightly alkaline (7.91). The salinity of groundwater at HCM-17 is approximately three to eight times the salinity of groundwater at other bore sites.

A Piper Diagram is presented in Figure 8, which shows the major ion water types of samples collected in the Iron Blow area, as well as the Margaret River sample and Darwin rainwater for reference. The Piper Diagram shows that groundwater from beneath the Iron Blow EL has a consistent water type, with magnesium and sulfate as their dominant ions. The Iron Blow groundwater quality data also appears to be distinct from Margaret River surface water and rainwater.

Dissolved metals have been compared to the 95% species protection guideline for freshwater water quality (ANZECC, 2000). Exceedances of the guideline values are identified as grey cells in Table 12. Of note are exceedances in groundwater samples for aluminium, arsenic, cadmium, copper, and zinc.

A blank sample (i.e. de-ionised water) designated 'rinsate blank' was collected during the Iron Blow program for the purposes of quality assurance to assess the potential for metal contamination during sampling (i.e. sampling technique and cleanliness/sealing of the filtering apparatus). All metal concentrations of the blank sample returned results below the laboratory level of reporting (LOR; see Appendix D) indicating no measurable metal contamination was likely to be introduced by the sampling technique.

Table 11 Iron Blow field water quality parameters

Sample ID	Temperature (°C)	pH	Electrical conductivity (µS/cm)	Dissolved oxygen		Redox potential (mV)
				(mg/L)	(% saturation)	
HCM-16	31.4	6.39	155	Not measured. Parameters relating to oxygen (dissolved oxygen and redox potential) are not representative of *in situ* groundwater because samples were collected at the end of airlift development.		
HCM-17	31.3	7.77	1,519			
HCM-19	30.4	7.56	633			
HCM-20	30.7	7.65	210			
HCM-21	30.1	6.46	215			

Table 12 Iron Blow laboratory water quality results

Analyte	Units	ANZECC freshwater guideline [1]	HCM-16	HCM-17	HCM-19	HCM-20	HCM-21
pH	-	-	7.02	7.91	7.86	7.6	7.11
TDS[2]	mg/L	-	269	1,310	466	186 [3]	165
Ca		-	3	134	36	4	10
Mg		-	9	118	44	17	10
Na		-	6	48	16	18	4
K		-	3	5	3	2	2
Cl		-	<1	3	2	1	<1
SO_4		-	37	748	217	86	65
F		-	0.6	0.5	0.8	1.2	0.7
Si		-	<1	<1	<1	<1	<1
CO_3	mg/L as $CaCO_3$	-	12	141	101	37	28
HCO_3		-	<1	<1	<1	<1	<1
OH^-		-	12	141	101	37	28
Total alkalinity		-	44	730	271	46	66
Total hardness		-	5	6	4	2	10
Total acidity		-	13.4	16.4	15.4	5.24	13.6
Silver (Ag)	µg/L	0.05	<1	<1	<1	<1	<1
Aluminium (Al)		55	20	<10	70	90	<10
Antinomy (Sb)		-	4	18	22	7	73
Arsenic (As)		13	222	96	913	5	1,680
Boron (B)		370	<50	<50	<50	<50	<50
Barium (Ba)		-	<1	<1	<1	<1	<1
Beryllium (Be)		-	1	26	16	8	27
Cadmium (Cd)		0.2	18	<0.1	4	<0.1	5
Chromium (Cr)		1	<1	<1	<1	<1	<1
Cobalt (Co)		-	3	4	4	<1	5
Copper (Cu)		1.4	4	<1	<1	<1	<1
Iron (Fe)		-	<50	1,380	660	<50	2,160
Mercury (Hg)		0.6	<0.1	<0.1	<0.1	<0.1	<0.1
Lead (Pb)		3.4	<1	1	<1	<1	3
Manganese (Mn)		1,900	383	1,580	562	69	792
Molybdenum (Mo)		-	3	35	19	29	4
Nickel (Ni)		11	3	4	6	3	7
Selenium (Se)		11	<10	<10	<10	<10	<10

Analyte	Units	ANZECC freshwater guideline [1]	HCM-16	HCM-17	HCM-19	HCM-20	HCM-21
Tin (Sn)		-	9	351	55	8	10
Strontium (Sr)		-	<1	<1	<1	<1	<1
Thorium (Th)		-	<1	<1	<1	<1	<1
Uranium (U)		-	<1	2	<1	<1	<1
Zinc (Zn)		8	1,910	34	109	10	3,360

Notes: Grey cells indicate an exceedance of the ANZECC guideline concentration for freshwater ecosystems (ANZECC, 2000)

1. 95% species protection trigger for freshwater (ANZECC, 2000)
2. Gravimetrically determine total dissolved solids (TDS)
3. TDS unable to be determined gravimetrically due to sample turbidity. Value represents the sum of all dissolved analytes.

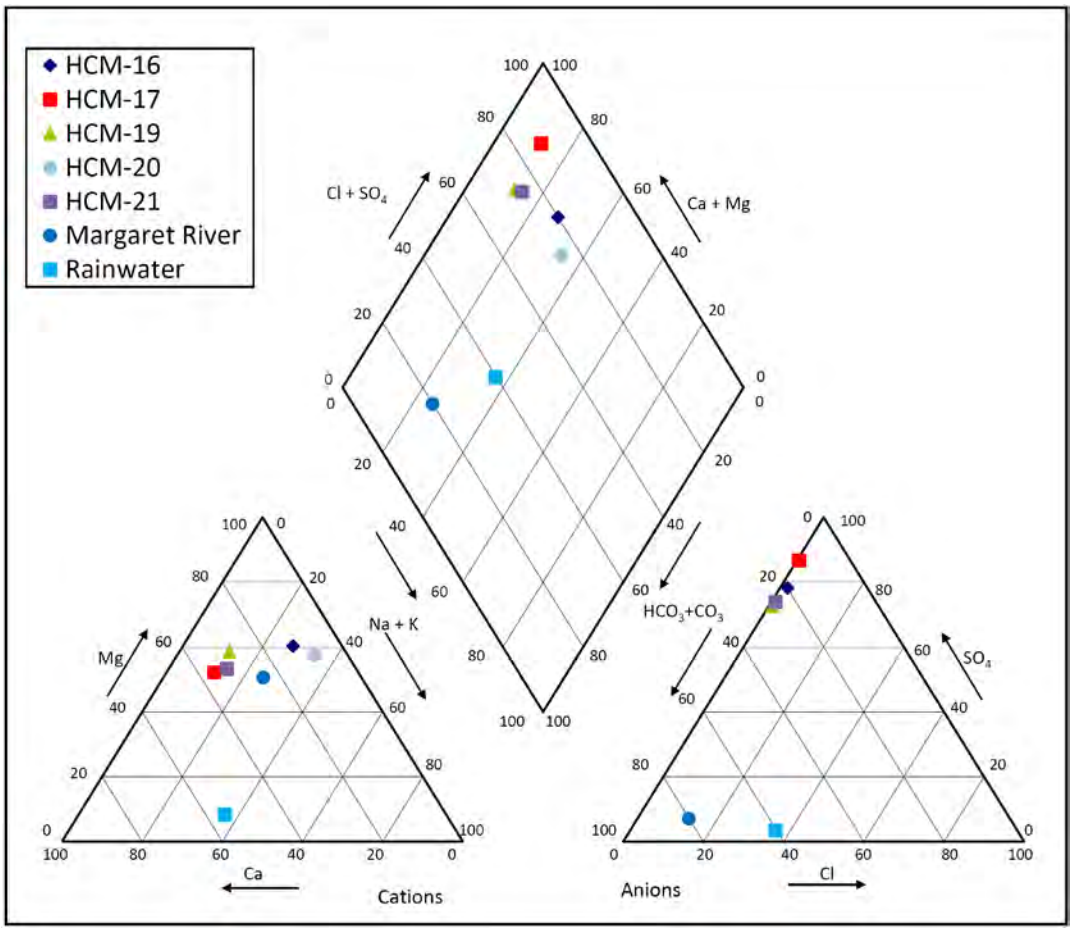

Figure 8 **Piper diagram of Iron Blow groundwater samples**

Section 5 Conclusions and recommendations

5.1 Conclusions

The following points summarise the key drilling observations and estimated hydraulic properties for the two deposits:

- Mt Bonnie
  - The estimated K of moderately to highly fractured rock ranges from around 2 to 33 m/day; the estimated K of less fractured rock / matrix is K around 0.2 m/day; and the estimated K of the fractured tuff is around 40 m/day.
  - Approximate elevations for the main inflow zones (as observed by airlift yield during drilling) within the fractured Mt Bonnie Formation ranged between 95 and 130 m AHD.
- Iron Blow
  - Estimates of K for the fractured Mt Bonnie Formation range between 0.2 and 3 m/day.
  - Approximate elevations for the main inflow zones within the fractured Mt Bonnie Formation ranged between 79 and 100 m AHD.

The following points summarise the key water quality results at each of the deposits:

- Mt Bonnie
  - The salinity of groundwater at HCM-8 and HCM-9 is approximately three to ten times the salinity of groundwater at other bore sites. These results may indicate seepage and evapoconcentration from a previous TSF (TSF 1; Figure 3) located in close proximity to these bores.
  - Exceedances of ANZECC (2000) metal concentration guidelines for freshwater were observed for groundwater sampled from HCM-5, 7, 8, 10, 11, 12, 13, 14, 15, and HCT-2.
  - Exceedances of ANZECC (2000) metal concentration guidelines for freshwater were observed for surface water sampled from Dam 1, 3, 4, and Margaret River.
- Iron Blow
  - The salinity of groundwater at HCM-17 is approximately three to eight times the salinity of groundwater at other bore sites.
  - Exceedances of ANZECC (2000) metal concentration guidelines for freshwater were observed for groundwater sampled from HCM-16, 17, 19, 20 and 21.

5.2 Recommendations

CDM Smith's original proposal for addressing water management aspects of the Project to support environmental approvals for the Hayes Creek Project (CDM Smith, 2017b) recommended two main sub-tasks for groundwater related studies (i.e. 'Task 4'):

(i) Mine dewatering / depressurisation assessment

(ii) Pit lake recovery modelling

These tasks are required to ensure that management of water and PAF material during mining activities and mine closure does not pose unacceptable risks to the environment and sensitive water receptors. They will also help to inform the additional water management studies relating to surface water (baseline assessment and flood study), pit lake water quality (solute balance and geochemical modelling), and water treatment options recommended in the original proposal.

This report presents results and analysis of preliminary work that will be used to develop the conceptual hydrogeological models for Mt Bonnie and Iron Blow ELs, and more broadly, as well as baseline water quality. The development of conceptual hydrogeological models for each deposit is important for understanding and describing the essential elements of the groundwater systems (e.g. recharge and discharge mechanisms, interactions between HSUs and between groundwater and surface water), and in later developing numerical or analytical models to assess the interactions between mine-water affecting activities and the groundwater, and surface water, systems.

In line with the scope of work outlined in the proposal (CDM Smith, 2017b), and on the basis of the findings of the work program described in this report, the following tasks are recommended to support environmental approvals for the Hayes Creek Project:

- Record accurate, surveyed ground and measurement-point (i.e. top of casing) elevations for all bores to better correlate groundwater inflow depths to proposed pit and mine geometries, and to develop groundwater head contours.
- Investigate the source of high salinity concentrations reported for HCM-8, HCM-9 and HCM-17 groundwaters.
- Collect additional groundwater samples using clean, low flow sampling pumps to better determine the baseline concentrations of redox sensitive elements and trace metals, especially at sites that recorded metal concentrations that exceed ANZECC freshwater guidelines.
- Drill and complete deep monitoring bores at Iron Blow using an appropriate drilling / bore completion method, using an appropriately qualified and licensed driller.
- Further investigate potential structural controls (e.g. close proximity of mapped faults) on aquifer properties and groundwater flow at Iron Blow.
- Development of conceptual hydrogeological models for Mt Bonnie and Iron Blow.
- Assess dewatering / depressurisation requirements to re-commence mining at the Mt Bonnie and Iron Blow deposits using analytical or numerical modelling. This is an important step required to inform modelling of pit lake water levels and water quality response to mine-water affecting activities.
- Undertake mine water and solute balance modelling to assist in addressing and communicating any future mine water management needs, such as pit backfilling with PAF materials, emergency storage requirements.
- Where possible, conduct quarterly monitoring of groundwater levels and field water quality at completed monitoring bores.

Section 6 References

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Appendix A Composite bore logs

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCT-1

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Advance Casing & Air Hammer
Bore Diameter: 10"
Date Started: 30/10/2017

Total Depth (m bgl): 25
Well Permit Number: n/a
Surface Elevation (m AHD): 130
Static Water Level
Date: 1/11/2017 **Depth (mbRP):** 4.26
Projection: GDA94 Z52
Easting: 776006 **Northing:** 8501784
Date Completed: 31/10/2017

DRILLING INFO.				GEOLOGICAL DESCRIPTION			FIELD RECORDS / CONSTRUCTION INFO.							
METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	12"		0		**Topsoil** Red/brown silt and clay with minor quartz sand and gravel						Stick up 1.17m		0-8m cement seal
					Alluvial sediments Leached, light grey mudstone gravel (angular to sub-rounded) with red/brown silt and clay.								0-10m 10" PVC pre-collar
		0.47			**Alluvial sediments** Highly-weathered, large (5-30mm), angular to sub-rounded grey mudstone gravel and cobbles with tan silt and clay. Poorly-sorted, medium silicate sand occurs throughout.								8-9m bentonite seal
			10		**Alluvial sediments** Moderately-weathered grey mudstone gravel with iron-stained surfaces - transported fragments of basement (Mount Bonnie Formation). Poorly-sorted, medium silicate sand occurs throughout.								0-13m 150mm Cl.9 PVC blank casing
		0.38				14		<0.1			First water strike @ 14m		9-25m gravel pack (3-6mm)
Air Hammer	10"												
		0.60	20				28.8	1.2	379	7.35			13-25m 150mm Cl.9 PVC hand slotted casing (1.5mm aperture)
		0.38			**Alluvial sediments** Grey mudstone gravel, cobbles and boulder fragments with pyrite veining - transported fragments of basement. Polished and rounded surfaces evident - likely to be fragments of larger pebbles, cobbles or boulders. Very large cuttings (2-6cm). Poorly-sorted, medium silicate sand occurs throughout.		29.3	1.2	403	7.26			EOH @ 25m

LOGGED BY: MS **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCT-2

CDM Smith

CDM Smith Australia Pty Ltd

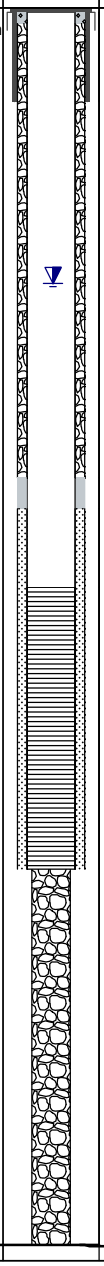
Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 10"
Date Started: 28/10/2017

Total Depth (m bgl): 79
Well Permit Number: n/a
Surface Elevation (m AHD): 148
Static Water Level
Date: 30/10/2017 **Depth (mbRP):** 17.72
Projection: GDA94 Z52
Easting: 776052 **Northing:** 8501221
Date Completed: 29/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS
Air Hammer	12"	0.5	0	**Waste rock** No sample						Stick up 0.95m
				Waste rock Red/brown silt with angular fragments of weathered grey mudstone fragments (waste rock).						
		0.3	10	**Mount Bonnie Formation** Weathered grey mudstone with iron-stained fracture surfaces						
		0.4	20							
Air Hammer	10"	0.4		**Mount Bonnie Formation** Fresh dark grey mudstone with pyrite on fracture surfaces. Pyrite dominant @ 45-47m	28	33.6	<0.1	197	6.98	First water strike @ 28m
		0.5	30							
		0.5				33.2	0.1	216	6.31	
		0.5	40			31.5	0.3	243	6.26	
		1.0	50	**Mount Bonnie Formation** Transition to Gerowie Tuff. Soft green/grey talc with some quartz and hard sections		32.5	0.6	242	6.76	
		0.9				32.7	0.6	236	7.00	
Air Hammer	5.25"	0.9	60	**Gerowie Tuff** Soft waxy green/grey talc. Very soft drilling. Minor chert bands throughout		33.2	0.6	232	7.00	
		0.7				33.4	0.6	235	7.16	
		1.0	70			33.1	0.6	239	7.24	
		1.2				33.1	0.6	266	7.67	



WELL DESCRIPTION

0-1m cement seal
0-6m 10" steel pre-collar
0-37m 150mm Cl.9 PVC blank casing
1-30m backfill
30-32 bentonite seal
32-55m gravel pack (3-6mm)
37-55m 150mm Cl.9 PVC hand slotted casing (1.5mm aperture)
55-79m backfill
EOH @ 79m

LOGGED BY: MS **DATE:** 30/10/2017
CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCT-2 (lost)

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 7.75"
Date Started: 26/10/2017

Total Depth (m bgl): 55
Well Permit Number: n/a
Surface Elevation (m AHD): 148
Static Water Level
Date: 28/10/2017 **Depth (mbRP):** 18.52
Projection: GDA94 Z52
Easting: 776034 **Northing:** 8501209
Date Completed: 27/10/2017

DRILLING INFO.				GEOLOGICAL DESCRIPTION			FIELD RECORDS / CONSTRUCTION INFO.							
METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	10"	0.5	0		**Waste rock** Red/brown silt with angular fragments of highly-weathered grey mudstone						Hole lost due to stuck casing @ 24m		0-6m 9" PVC pre-collar
		0.5			**Waste rock** White clay with angular fragments of highly-weathered and leached grey mudstone								
		0.5	10		**Mount Bonnie Formation** Leached and weathered khaki/brown mudstone								
		0.2	20		**Mount Bonnie Formation** Weathered grey mudstone with iron-stained fracture surfaces	18		<0.1					12m of fallen 6" PVC left in hole at approximately 12-24m
		0.2			**Mount Bonnie Formation** Fresh grey mudstone with pyrite on fracture surfaces	29.5		<0.5					
Air Hammer	7.75"	0.2	30				35.2	0.45	130	6.67			0-55m backfill
		0.2				39	33.2	0.79	191	6.72			
		0.2	40				32.1	5.64	272	6.78			
		0.2	50		**Gerowie Tuff** Transition to Gerowie Tuff. Soft green/grey talc with some quartz @ 49-51m		32.5	5.64	260	6.78			
		0.3					33.1	5.64	258	6.79			EOH @ 55m

LOGGED BY: MS **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-5

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 12/10/2017

Total Depth (m bgl): 18
Well Permit Number: n/a
Surface Elevation (m AHD): 130
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 2.26
Projection: GDA94 Z52
Easting: 775854 **Northing:** 8501538
Date Completed: 12/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"		0		**Quaternary sediments** Grey brown quartz and siltstone						Stick up 0.98m		0-1m cement seal
					Mount Bonnie Formation Greywacke with fine siltstone inclusions								0-6m 6" PVC pre-collar
					Mount Bonnie Formation Dark grey siltstone with greywacke incusions. Some chert @8-9m								1-7.8m annulus backfill
													0-12m 50mm Cl.18 PVC blank casing
													7.8-9.5m bentonite seal
Air Hammer	5.25"		10		**Mount Bonnie Formation** Dark grey siltstone, greywacke and shale	12	34.6	0.1	469	7.01	First water strike @ 12m		9.5-18m gravel pack (3-6mm)
													12-18m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
							34.2	0.1	193	7.23			EOH @ 18m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-6

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 15/10/2017

Total Depth (m bgl): 36
Well Permit Number: n/a
Surface Elevation (m AHD): 134
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 9.77
Projection: GDA94 Z52
Easting: 776382 **Northing:** 8501395
Date Completed: 16/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"		0		**Quaternary sediments** Cream sandstone. Fine to medium grained						Stick up 0.84m		0-2m cement seal
					Mount Bonnie Formation Grey/brown sandstone and mudstone								0-6m 6" PVC pre-collar
					Mount Bonnie Formation Grey/purple sandstone with iron staining								2-11.9m annulus backfill
					Mount Bonnie Formation Khaki/grey sandstone. Fine grained								0-18m 50mm Cl.18 PVC blank casing
			10										11.9-14m bentonite seal
					Mount Bonnie Formation Grey/pink sandstone with clay and minor quartz	16	24.7	0.5	285	6.67	First water strike @ 16 m		
					Mount Bonnie Formation Khaki/grey sandstone and mudstone. Quartz vein @ 19-20m		33.9	0.5	288	6.77			14-36m gravel pack (3-6mm)
Air Hammer	5.25"	1.10	20			21	31.7	2.9	294	6.85			
							31.6	3.9	294	6.82			
					Mount Bonnie Formation Dark grey, graphitic shale with sandstone	27	30.2	7.0	301	6.89			
							30.7	7.7	302	6.83			
			30				31.1	4.4	301	6.87			18-36m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.63					31.3	4.4	300	6.89			
							30.6	4.4	301	6.89			
		0.71					31.7 31.1	4.4 10.2	299 302	6.87 6.90			EOH @ 36m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-7

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 21/10/2017

Total Depth (m bgl): 58
Well Permit Number: n/a
Surface Elevation (m AHD): 173
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 40.23
Projection: GDA94 Z52
Easting: 776175 **Northing:** 8501255
Date Completed: 21/10/2017

DRILLING INFO.				GEOLOGICAL DESCRIPTION			FIELD RECORDS / CONSTRUCTION INFO.							
METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"		0		**Mount Bonnie Formation** Dark grey siltstone/greywacke with dull red bands occasionally. Some iron-stained fractures.						Stick up 0.93m		0-1m cement seal 0-6m 6" PVC pre-collar
		0.33	10		**Mount Bonnie Formation** As above. More blocky with obvious oxidised and iron-stained fracture surfaces.								
		0.35			**Mount Bonnie Formation** Weathered mineralised zone. Hematitic and goethitic clay and siltstone. Quartz vein at 20-21m.								0-52m 50mm Cl.18 PVC blank casing
		0.86	20		**Mount Bonnie Formation** Soft carbonate alteration with foliation of the above lithology. Some iron staining in fractures.								1-46.5m annulus backfill
		1.00			**Mount Bonnie Formation** Dark grey siltstone/greywacke. Slightly coarser grained than at shallower depths.								
Air Hammer	5.25"	0.75	30		**Mount Bonnie Formation** Grey-green soft siltstone. Quartz vein @ 45-46m. Some minor hard dark grey bands throughout (1-2 m in thickness)								
		0.33	40										46.5-48.9m bentonite seal 48.9-58m gravel pack (3-6mm)
		0.32											
		0.43	50		**Gerowie Tuff** Dark grey, hard, cherty siltstone/talc. Quartz vein @ 56-57m (all quartz in cuttings)								52-58m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.30				55	41.8	0.4	311	6.93	First water strike @ 55m		
		0.38					32.8	1.0	402	7.92			EOH @ 58m

LOGGED BY: MS **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-8

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 17/10/2017

Total Depth (m bgl): 30
Well Permit Number: n/a
Surface Elevation (m AHD): 154
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 11.17
Projection: GDA94 Z52
Easting: 776351 **Northing:** 8501118
Date Completed: 17/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.54	0		**Mount Bonnie Formation** Khaki brown sandstone (fine-grained) with iron stained fractures and minor quartz veins. Transition zone between weathered and fresh rock						Stick up 0.91m		0-1m cement seal 0-6m 6" PVC pre-collar 1-8.5m annulus backfill 8.5-10m bentonite seal 0-18m 50mm Cl.18 PVC blank casing
		0.55	10										
Air Hammer	5.25"	0.46			**Mount Bonnie Formation** Grey and brown sandstone and mudstone. Slightly weathered. Stained fracture surfaces	18					First water strike @ 18m		
			20		**Mount Bonnie Formation** Fresh grey mudstone with iron-stained fractures		31.9	0.5	2533	6.78			10-30m gravel pack (3-6mm)
							33.1	1.2	2573	7.29			
						24	32.2	3.4	2553	7.52			18-30m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.26					32.9	n/a	1651	7.70			
		0.26	30										EOH @ 30m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-9

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 18/10/2017

Total Depth (m bgl): 49
Well Permit Number: n/a
Surface Elevation (m AHD): 164
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 20.97
Projection: GDA94 Z52
Easting: 776166 **Northing:** 8500940
Date Completed: 18/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"		0		**No Sample**						Stick up 0.87m		0-1m cement seal
					Mount Bonnie Formation Grey/brown weathered mudstone with iron stained fractures								0-6m 6" PVC pre-collar
					Mount Bonnie Formation Brown/grey weathered mudstone, iron-rich with stained fracture surfaces								
			10										
					Mount Bonnie Formation Green/grey mudstone (reduced)								1-38m annulus backfill
			20		**Mount Bonnie Formation** Weathered mudstone with pale-tan/brown clay								
Air Hammer	5.25"				**Mount Bonnie Formation** Grey/light-grey mudstone with iron-stained fracture surfaces								0-43m 50mm Cl.18 PVC blank casing
			30										38-39.5m bentonite seal
			40			41	37.5	<0.5	1792	6.70	First water strike @ 41m		39.5-49m gravel pack (3-6mm)
							37.5	<0.5	1791	7.06			43-49m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.50					38.3	0.5	1758	7.30			EOH @ 49m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-10

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 19/10/2017

Total Depth (m bgl): 42
Well Permit Number: n/a
Surface Elevation (m AHD): 152
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 9.83
Projection: GDA94 Z52
Easting: 775890 **Northing:** 8500631
Date Completed: 19/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.35	0		**Mount Bonnie Formation** Khaki and pink sugary sandstone with minor mudstone. Iron-stained fracture surfaces						Stick up 0.96m		0-1m cement seal 0-6m 6" PVC pre-collar 1-11.7m annulus backfill
		0.71	10		**Mount Bonnie Formation** Weathered grey and brown mudstone and sandstone with clay. Iron-stained fracture surfaces.	17					First water strike @ 17m		0-18m 50mm Cl.18 PVC blank casing 11.7-13.5m bentonite seal
Air Hammer	5.25"	0.52	20		**Mount Bonnie Formation** Grey graphitic mudstone with weak lamination and minor sandstone.		37.2 36.6 32.5 32.5 33.3 33.5 33.7 34.4 33.4 33.3 33.4	3.0 4.0 7.6 8.0 8.5 8.7 9.0 8.7 8.0 9.0 10	307 342 347 362 367 374 388 382 380 381 377	6.84 7.50 7.61 7.66 7.78 7.81 7.90 7.91 7.97 8.00 7.84		13.5-42m gravel pack (3-6mm)
		0.39	30			31	33.7 32.2	9.5-11 10-11	382 396	7.86 7.64			18-39m 50mm Cl.18 PVC machine-slotted casing (0.5mm aperture)
		0.35					32.1 32.9	12.5 11	393 402	7.70 7.82			
		0.33			**Mount Bonnie Formation** Blue/grey sugary sandstone, with pyrite veining		33.4 33.0 32.9 33.4	10 13 8 3	397 399 392 397	7.67 7.61 7.37 7.45			39-42m 50mm Cl.18 PVC hand-slotted casing (2mm aperture)
			40		**Mount Bonnie Formation** Grey silicious mudstone		33.5 33.9 33.1	 10	397 397 392	7.47 7.27 7.35			EOH @ 42m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-11

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 17/10/2017

Total Depth (m bgl): 42
Well Permit Number: n/a
Surface Elevation (m AHD): 164
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 18.13
Projection: GDA94 Z52
Easting: 776365 **Northing:** 8500485
Date Completed: 18/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"		0		**Quaternary sediments** Dark tan, fine-grained sandstone						Stick up 0.86m		1m cement seal
					Mount Bonnie Formation Grey/green mudstone with weak sericite alteration. Iron-staining on fracture surfaces								0-6m 6" PVC pre-collar
			10										0-36m 50mm Cl.18 PVC blank casing
													1-29.5m annulus backfill
		0.32	20		**Mount Bonnie Formation** Bedded grey mustone with chert and silicious bands	22	37.3	<0.5	586	7.88	First water strike @ 22m		
Air Hammer	5.25"	0.24					36.5	<0.5	653	7.93			
							32.1	<0.5	611	7.99			
							33.2	1.5	608	8.00			
							32.1	1.0	736	7.98			
			30				33.0	0.8	729	8.06			
		0.39					33.2	0.8	710	8.09			29.5-31.5m bentonite seal
					Mount Bonnie Formation Grey, fine-grained sandstone with minor quartz veining.		32.1	0.6	707	8.00			31.5-42m gravel pack (3-6mm)
							33.8	0.5	714	8.02			
							34.1	0.5	705	8.02			
							32.4	0.5	669	7.74			
		0.86											36-42m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
							31.5	<0.5	717	7.72			
			40			40	32.0	7.0	735	7.68			
							32.2	7.0	684	7.86			
		0.86					31.6	7.0	741	7.85			EOH @ 42m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-12

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 13/10/2017

Total Depth (m bgl): 25
Well Permit Number: n/a
Surface Elevation (m AHD): 130
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 3.55
Projection: GDA94 Z52
Easting: 776010 **Northing:** 8501795
Date Completed: 14/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"		0		**Topsoil** Red/brown silt and clay						Stick up 0.80m		0-2m cement seal 0-6m 6" PVC pre-collar
					Alluvial sediments Orange/brown sandstone and clay with minor quartz								2-4.3m bentonite seal
		0.64			**Alluvial sediments** Transported fragments of grey/brown mudstone and minor sandstone with iron-stained fractures. Weak sericite alteration @ 12m	7					First water strike @ 7m		0-6.3m 50mm Cl.18 PVC blank casing
			10										4.3-24.3m gravel pack (3-6mm)
		0.55			**Alluvial sediments** Transported fragments of shale with minor graphitic alteration. Minor quartz veining								
Air Hammer	5.25"				**Alluvial sediments** Transported fragments of grey mudstone with minor sandstone. Minor pyrite veining								6.3-24.3m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.60	20				32.9	2.0	571	7.04			
							30.7	2.0	611	7.52			
							31.6	2.0	608	6.11			24.3-25m fallback
							31.2	2.0	611	6.16			EOH @ 25m

LOGGED BY: SAO **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-13

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 22/10/2017

Total Depth (m bgl): 67
Well Permit Number: n/a
Surface Elevation (m AHD): 148
Static Water Level
Date: 27/10/2017 **Depth (mbRP):** 18.60
Projection: GDA94 Z52
Easting: 776040 **Northing:** 8501215
Date Completed: 22/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.5	0		**Waste rock** Highly-weathered, leached mudstone/greywacke fragments (waste rock)						Stick up 0.96m		0-1m cement seal 0-6m 6" PVC pre-collar
		0.8	10		**Mount Bonnie Formation** Clayey zone. Mottled with some quartz and weathered mudstone cuttings **Mount Bonnie Formation** Highly-weathered mudstone with minor goethitic clay.								
		0.4	20		**Mount Bonnie Formation** Slightly-weathered mudstone/siltstone. Iron-stained fracture surfaces. **Mount Bonnie Formation** Fresh dark grey siltstone. No iron-stained fractures	21.5	37.1	<0.10	97	6.58	First water strike @ 21.5m		0-43m 50mm Cl.18 PVC blank casing 1-38.5m annulus backfill
		0.2	30				33.1	0.08	148	6.59			
Air Hammer	5.25"	0.2			**Mount Bonnie Formation** As above with minor pyrite on fracture surfaces. Fracture zone/quartz vein @ 47-48m. Pyrite dominant @53-54m, 57-58m.	33	32.2	0.14	171	6.59			38.5-40m bentonite seal
		0.2	40				32.1	0.15	186	6.61			40.5-55.5m gravel pack (3-6mm)
		0.2	50			47	32.7	0.52	276	6.70			43-55m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.5					32.5	0.60	256	6.79			55.5-56m bentonite plug
		0.5	60		**Gerowie Tuff** Soft, light grey-green talc.		33.1	0.64	271	6.67			56-67m backfill
		0.8					32.4	0.60	253	6.82			EOH @ 67m

LOGGED BY: MS **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-14

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 24/10/2017

Total Depth (m bgl): 72
Well Permit Number: n/a
Surface Elevation (m AHD): 147
Static Water Level
Date: 26/10/2017 **Depth (mbRP):** 18.76
Projection: GDA94 Z52
Easting: 776152 **Northing:** 8501452
Date Completed: 25/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.5	0	**Mount Bonnie Formation** Highly-weathered mudstone with mottled clay and silt						Stick up 0.76m		0-1m cement seal
				Mount Bonnie Formation Grey-purple, highly-weathered mudstone								0-6m 6" PVC pre-collar
		0.5	10	**Mount Bonnie Formation** Slightly weathered grey mudstone. Iron-stained fractures throughout. Deep weathering profile								1-33.5m annulus backfill
		0.5										
		0.5	20									0-39.5m 50mm Cl.18 PVC blank casing
		0.5										
		0.7	30	**Mount Bonnie Formation** Khaki clay with leached mudstone. Mostly fine cuttings	35		<0.1			First water strike @ 35m		33.5-35.5m bentonite seal
Air Hammer	5.25"	1.0		**Mount Bonnie Formation** Highly-fractured zone. Grey mudstone with iron-stained fractures.								
			40	**Mount Bonnie Formation** Fresher grey mudstone with no iron-stained fractures		29.3	0.45	121	7.13			
		0.5		**Mount Bonnie Formation** As above but with a greenish serecite alteration. Soft ground.		33.2	0.45	123	6.31			35.5-61m gravel pack (3-6mm)
		0.4	50	**Mount Bonnie Formation** Hard dark grey/black mudstone. Quartz and pyrite vein @ 52-54m.		32.8	2.17	304	5.69			39.5-60.5m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.4										
		0.2	60			30.2	>4	533	5.80			61-61.5m bentonite plug
		0.1				31.3	>4	680	5.79			61.5-72m backfill
		0.1	70	**Gerowie Tuff** Hard, silicified khaki-grey mudstone. Chert in parts.		31.1	>4	653	5.80			EOH @ 72m

LOGGED BY: MS **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-15

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Mount Bonnie
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 5.25"
Date Started: 23/10/2017

Total Depth (m bgl): 55
Well Permit Number: n/a
Surface Elevation (m AHD): 144
Static Water Level
Date: 25/10/2017 **Depth (mbRP):** 7.47
Projection: GDA94 Z52
Easting: 775936 **Northing:** 8501093
Date Completed: 23/10/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.5	0		**Mount Bonnie Formation** Colluvium-top soil. Brittle leached mudstone chips						Stick up 0.93m		1m cement seal
					Mount Bonnie Formation Fractured grey mudstone/greywacke. Iron-staining on fracture surfaces								0-6m 6" PVC pre-collar
		0.6	10										1-13m annulus backfill
		0.9	20										0-19m 50mm Cl.18 PVC blank casing
						16		<0.5			First water strike @ 16m		13-15.7m bentonite seal
		0.7				23	32.9	0.45	478	6.60			
					Mount Bonnie Formation As above but with pyrite on fracture surfaces. No obvious highly-fractured interval.	27	30.2	4.45	535	7.03			15.7-46.5m gravel pack (3-6mm)
Air Hammer	5.25"	0.6	30										19-46m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.4	40				28.9	4.45	551	6.83			
		0.4			**Gerowie Tuff** Grey mudstone/siltstone with soft soapy texture (talc)		30.5	4.45	565	6.93			
		0.5	50				30.4	>6	600	7.53			46.5-47m bentonite plug
													47-55m backfill
		0.2			**Gerowie Tuff** Dark grey/black shaly mudstone		31.5	>6	604	7.54			EOH @ 55m

LOGGED BY: MS **DATE:** 30/10/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-16

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Iron Blow
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 7.75", 5.25"
Date Started: 9/12/2017

Total Depth (m bgl): 100
Well Permit Number: n/a
Surface Elevation (m AHD): 121
Static Water Level
Date: 10/12/2017 **Depth (mbRP):** 8.25
Projection: GDA94 Z52
Easting: 776145 **Northing:** 8504691
Date Completed: 10/12/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.8	0		**Mount Bonnie Formation** Extremely weathered siltstone, red/brown, quartz present						Stick up 0.96m		0-1m Cement seal
		0.9	10		**Mount Bonnie Formation** Very weathered grey/brown/white siltstone, with clay inclusions								0-6m 6" PVC pre-collar
		1.1	20		**Mount Bonnie Formation** Weathered grey/brown/white siltstone, some clay inclusions	15							0-16m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.7			**Mount Bonnie Formation** Weathered brown/cream claystone, very brittle								
		1.1	30		**Mount Bonnie Formation** Fresh, dark grey siltstone, occasional pyrite		30.5	2.7	154	6.06			16-100m fallback
		0.5					30.5	3.0	132	6.28			
		0.5	40				30.0	3.3	125	6.49			
		0.4					29.6	2.9	138	6.56			
Air Hammer	5.25"	0.3	50		**Mount Bonnie Formation** Fresh, very dark grey mudstone, occasional bands of carbonaceous mudstone, pyrite common		30.1	3.6	140	6.48			
		0.3					29.9	3.6	137	6.45			
		0.3	60		**Mount Bonnie Formation** Fresh, very dark grey siltstone, pyrite and quartz abundant		30.3	2.9	143	6.32			
		0.3					31.0	3.4	145	6.22			
		0.3	70				31.6	3.7	146	6.40			
		0.2			**Mount Bonnie Formation** Fresh, very dark grey mudstone, small quartz veins common throughout, pyrite present		31.0	3.3	149	6.35			
		0.2	80		**Mount Bonnie Formation** Fresh, dark grey siltstone, frequent quartz veins, pyrite present.		31.3	3.0	150	6.45			
		0.2					32.1	3.2	189	6.40			
		0.2	90				32.0	2.0	196	6.20			
		0.2	100				31.5	2.8	173	6.40			EOH @ 100m

LOGGED BY: MW **DATE:** 20/12/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-17

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Iron Blow
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 7.75", 5.25"
Date Started: 5/12/2017

Total Depth (m bgl): 120
Well Permit Number: n/a
Surface Elevation (m AHD): 118
Static Water Level
Date: 7/12/2017 **Depth (mbRP):** 4.22
Projection: GDA94 Z52
Easting: 776249 **Northing:** 8504519
Date Completed: 7/12/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.9	0		**Top soil** Red/orange clay/silt with poorly-sorted silica gravel (1-4 mm)						Stick up 0.92m		0-1m Cement seal 0-6m 6" PVC pre-collar 0-24m 50mm Cl.18 PVC blank casing
		0.8	10		**Mount Bonnie Formation** Highly-weathered and leached gravels with red/orange clay/silt								
		1.0	20		**Mount Bonnie Formation** Highly-weathered grey mudstone and siltstone gravel with iron-staining in light grey clay (60-70%)								
		1.2			**Mount Bonnie Formation** Highly-weathered grey mudstone and siltstone with no iron-staining in a very light grey clay (80-90%).	24							24-36m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		1.2	30				32.0	3.5	450	6.30			
		0.4			**Mount Bonnie Formation** Moderately-weathered grey siltstone (grading to sandstone texture) with very minor pyrite on fractures. Carbonaceous (graphite in discharge water) between 33-35m.		29.9	4.0	453	6.45			
		0.4	40				31.3	5.0	457	6.49			
		0.5			**Mount Bonnie Formation** Soft grey, fine-grained sandstone		29.5	5.0	445	6.57			36-120m fallback
		0.5	50		**Mount Bonnie Formation** Dark grey, fine-grained sandstone. Fractured and blocky cuttings. Interbedded with minor dark grey siltstone. Some rare quartz veining		29.8	5.5	454	6.75			
Air Hammer	5.25"	0.4	60		**Mount Bonnie Formation** As above - quartz veining becoming more common		30.4	6.5	575	6.95			
		0.3					30.2	6.5	739	7.30			
		0.3	70				30.5	7.0	1000	7.32			
		0.3			**Mount Bonnie Formation** As above - less siltstone interbedding		30.6	7.5	1109	7.18			
		0.3	80				30.7	7.5	1071	7.15			
		0.2	90		**Mount Bonnie Formation** As above - no visible siltstone (entirely sandstone)		30.9	7.5	1090	7.34			
		0.3					30.8	7.5	1120	7.40			
		0.2	100				31.2	8.0	1239	7.51			
		0.2					31.2	8.0	1301	7.33			
		0.2	110				31.2	8.0	1418	7.48			
		0.2	120				31.1	8.0	1585	7.81			EOH @ 120m

LOGGED BY: MS + MW **DATE:** 20/12/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-19

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Iron Blow
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 7.75", 5.25"
Date Started: 7/12/2017

Total Depth (m bgl): 100
Well Permit Number: n/a
Surface Elevation (m AHD): 122
Static Water Level
Date: 8/12/2017 **Depth (mbRP):** 5.4
Projection: GDA94 Z52
Easting: 776138 **Northing:** 8504412
Date Completed: 8/12/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.86	0		**Top soil** Red/orange silt and clay with poorly-sorted mixed (silica, mudstone) gravel.						Stick up 1.02m		0-1m Cement seal
		0.75	10		**Mount Bonnie Formation** Highly-weathered tan, leached mudstone/siltstone/sandstone with tan clay (60%)	15							0-6m 6" PVC pre-collar
		0.86	20		**Mount Bonnie Formation** Highly-weathered grey siltstone and sandstone in brown clay with iron-stained fracture surfaces		31.7	1.2	193	7.71			0-9.5m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
		0.67					31.4	1.1	238	7.78	First attempt at drilling at HCM-19 was abandoned due to insufficient means of diverting large volumes of discharge water away from the drill rig		9.5-100m fallback
		0.86	30		**Mount Bonnie Formation** As above but no iron-staining and with 60-70% grey clay		30.3	1.5	228	7.82			
		0.67			**Mount Bonnie Formation** Moderately-weathered grey siltstone and sandstone with 40% grey clay.		31.3	2.5	223	7.81			
		0.67	40		**Mount Bonnie Formation** Slightly-weathered dark grey siltstone/sandstone. Occasionally layered with khaki siltstone		30.4	3.2	214	7.81			
		0.30	50		**Mount Bonnie Formation** Grey to tan/green greywacke. Hard drilling. Interbedded with minor grey siltstone.		30.2	3.2	204	7.96			
Air Hammer	5.25"	0.43			**Mount Bonnie Formation** Fresh hard dark-grey siltstone. Occasional quartz veins (major @ 51-52m)		30.6	3.2	248	7.87			
		0.35	60		**Mount Bonnie Formation** Hard, dark grey siltstone. Minor pyrite veining. Quartz vein @ 57-58m		31.3	3.5	354	7.91			
		0.40					31.0	3.5	409	7.98			
		0.40	70		**Mount Bonnie Formation** As above. Quartz and pyrite veining increased. Major quartz vein @ 66-67m		30.7	3.5	469	7.93			
		0.32	80				30.9	3.5	446	7.95			
		0.33					31.3	4.1	455	7.98			
		0.26	90										
							30.6	3.4	533	7.23			
			100		**Mount Bonnie Formation** Quartz rich band, interbedded with light grey siltstone. Pyrite abundant		30.5	3.0	622	7.57			EOH @ 100m

LOGGED BY: MS **DATE:** 20/12/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-20

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Iron Blow
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 7.75", 5.25"
Date Started: 3/12/2017

Total Depth (m bgl): 114
Well Permit Number: n/a
Surface Elevation (m AHD): 130
Static Water Level
Date: 4/12/2017 **Depth (mbRP):** 7.36
Projection: GDA94 Z52
Easting: 776030 **Northing:** 8504545
Date Completed: 5/12/2017

DRILLING INFO.				GEOLOGICAL DESCRIPTION			FIELD RECORDS / CONSTRUCTION INFO.								
METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	GRAPHIC LOG	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS	WELL CONSTRUCTION	WELL DESCRIPTION
Air Hammer	7.75"	0.75	0		**Mount Bonnie Formation** Highly-weathered siltstone/mudstone in a red/orange matrix (60%). Very broken ground.						Stick up 0.98m		0-1m Cement seal 0-6m 6" PVC pre-collar 0-10m 50mm CL.18 PVC slotted casing (0.5mm aperture) 10-114m fallback
		1.50	10		**Clay** As above but clay/silt increasing to 90-95% (white clay)								
		1.50			**Clay** White/grey clay (negligible rock fragments)								
		1.50	20		**Clay** White/grey clay with moderately weathered siltstone and fine-grained sandstone. Sulfides present	18		<0.1					
		1.50			**Clay** As above. Clay content increases to 90%		35.1	1.5	171	7.15			
		0.50	30		**Clay** As above. Clay decreases to 50%		32.3	2.5	273	6.93			
		0.40			**Mount Bonnie Formation** Moderately weathered grey siltstone with minor pyrite veining		30.3	2.0	220	7.07			
		0.43	40		**Mount Bonnie Formation** Slightly-weathered grey sandstone interbedded with dark grey siltstone. Pyrite veining throuhgout. Quartz vein @ 26-27 m. Clayey zone @ 30-31 m.		31.7	2.5	291	7.40			
		0.35	50		**Mount Bonnie Formation** Fresh black, foliated siltstone. Pyrite on fractures (only occasional)		31.5	2.0	343	7.81			
		0.24			**Mount Bonnie Formation** As above. No pyrite and interbedded with minor khaki chert layers		31.3	2.5	303	7.40			
Air Hammer	5.25"	0.29	60		**Mount Bonnie Formation** Fresh dark grey/black siltstone. Very minor pyrite veining throughout. Major pyrite vein @ 40-41 m. Major quartz vein @ 48-49 m		31.7	3.5	533	7.63			
		0.24			**Mount Bonnie Formation** As above but very silicified and cherty texture		31.3	3.5	416	7.85			
		0.30	70		**Mount Bonnie Formation** Layer of lighter coloured (tan/grey) chert/siltstone		31.7	3.0	550	7.94			
		0.18			**Mount Bonnie Formation** Fresh dark grey to black siltstone. Foliation present. Minor pyrite (no veining but crystals in rock matrix) throughout. Quartz vein @ 80-81 m.		31.8	3.0	440	8.21			
		0.17	80		**Mount Bonnie Formation** As above. Pyrite veining also present		31.3	3.0	406	8.56			
		0.13			**Mount Bonnie Formation** Increase in pyrite veining and some quartz veining. Major quartz veins @ 100-101 m and 109-110 m.		32.0	3.0	413	8.07			
		0.11	90				32.5	3.0	470	8.32			
		0.14					32.3	3.0	497	7.87			
		0.07	100				33.2	3.0	805	7.95			
		0.08	110				32.9	3.0	191	7.45			EOH @ 112m

LOGGED BY: MS **DATE:** 20/12/2017

CHECKED BY KH **DATE:** 18/1/2018

COMPOSITE WELL LOG

BOREHOLE / WELL NUMBER: HCM-21

CDM Smith

CDM Smith Australia Pty Ltd

Level 2, 238 Angas St
Adelaide, SA, 5000

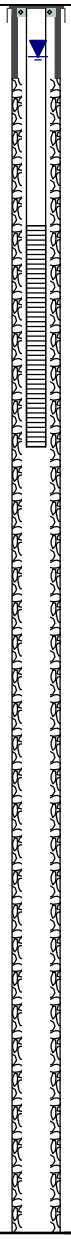
Project Number: AWS170073
Project Name: Hayes Creek Project Water Studies
Location: Iron Blow
Client: PNX Metals
Drilled By: Geo Drilling
Drilling Method: Air Hammer
Bore Diameter: 7.75", 5.25"
Date Started: 1/12/2017

Total Depth (m bgl): 100
Well Permit Number: n/a
Surface Elevation (m AHD): 120
Static Water Level
Date: 2/12/2017 **Depth (mbRP):** 3.77
Projection: GDA94 Z52
Easting: 776141 **Northing:** 8504516
Date Completed: 3/12/2017

DRILLING INFO. | **GEOLOGICAL DESCRIPTION** | **FIELD RECORDS / CONSTRUCTION INFO.**

METHOD	BIT LOG (inches)	PENETRATION RATE (m/minute)	DEPTH (m)	LITHOLOGY	WATER CUT (m bgl)	TEMP (degrees C)	AIRLIFT YIELD (L/s)	EC (µS/cm)	pH	COMMENTS
Air Hammer	7.75"	1.20	0	**Mount Bonnie Formation** Broken, highly-weathered and leached grey mudstone. In a matrix of red/orange silt and clay						Stick up 1.03m
		0.86	10	**Mount Bonnie Formation** Broken and highly-weathered grey mudstone. Iron-stained fractures (orange and red)						
		0.86		**Mount Bonnie Formation** As above but includes a high proportion of clay (40-50%)						
		1.00	20	**Mount Bonnie Formation** Moderately weathered dark grey mudstone. Orange iron-staining on fractures	20	38.1	<0.5 0.6	146	6.74	
		0.55		**Mount Bonnie Formation** Fresh, dark grey mudstone. No iron-staining. Pyrite veining		28.9	0.8	120	6.63	
		0.50	30	**Mount Bonnie Formation** Fresh dark grey mudstone interbedded with khaki/grey fine-grained sandstone (50%)		29.3	1.2	120	6.74	
		0.40		**Mount Bonnie Formation** As above but sandstone content decreased (10-20%)		30.1	3.0	137	6.44	
Air Hammer	5.25"	0.30	40	**Mount Bonnie Formation** Fresh dark grey/black mudstone. Pyrite veining throughout		30.4	5.5	143	6.23	
		0.24	50			29.9	6.7	138	5.97	
		0.20				29.9	6.3	143	5.99	
		0.16	60			30.1	6.3	150	6.20	
		0.13				30.5	6.3	150	6.34	
		0.15	70			30.2	5.5	161	6.36	
		0.10				30.4	5.5	186	6.49	
		0.08	80			30.3	6.0	188	6.47	
		0.07		**Mount Bonnie Formation** As above with minor quartz veining with pyrite		30.5	6.0	158	6.47	
		0.07	90	**Mount Bonnie Formation** As above with quartz veining increasing		30.3	6.2	180	6.40	
			100							

WELL CONSTRUCTION



WELL DESCRIPTION

0-1m Cement seal
0-6m 6" PVC pre-collar
0-24m 50mm Cl.18 PVC blank casing
24-36m 50mm Cl.18 PVC slotted casing (0.5mm aperture)
36-100m 5.25"open hole
EOH @ 100m

LOGGED BY: MS **DATE:** 19/12/2017
CHECKED BY KH **DATE:** 18/1/2018

Appendix B Drilling observation depth profiles

Drilling summary report

Hole: HCT-1

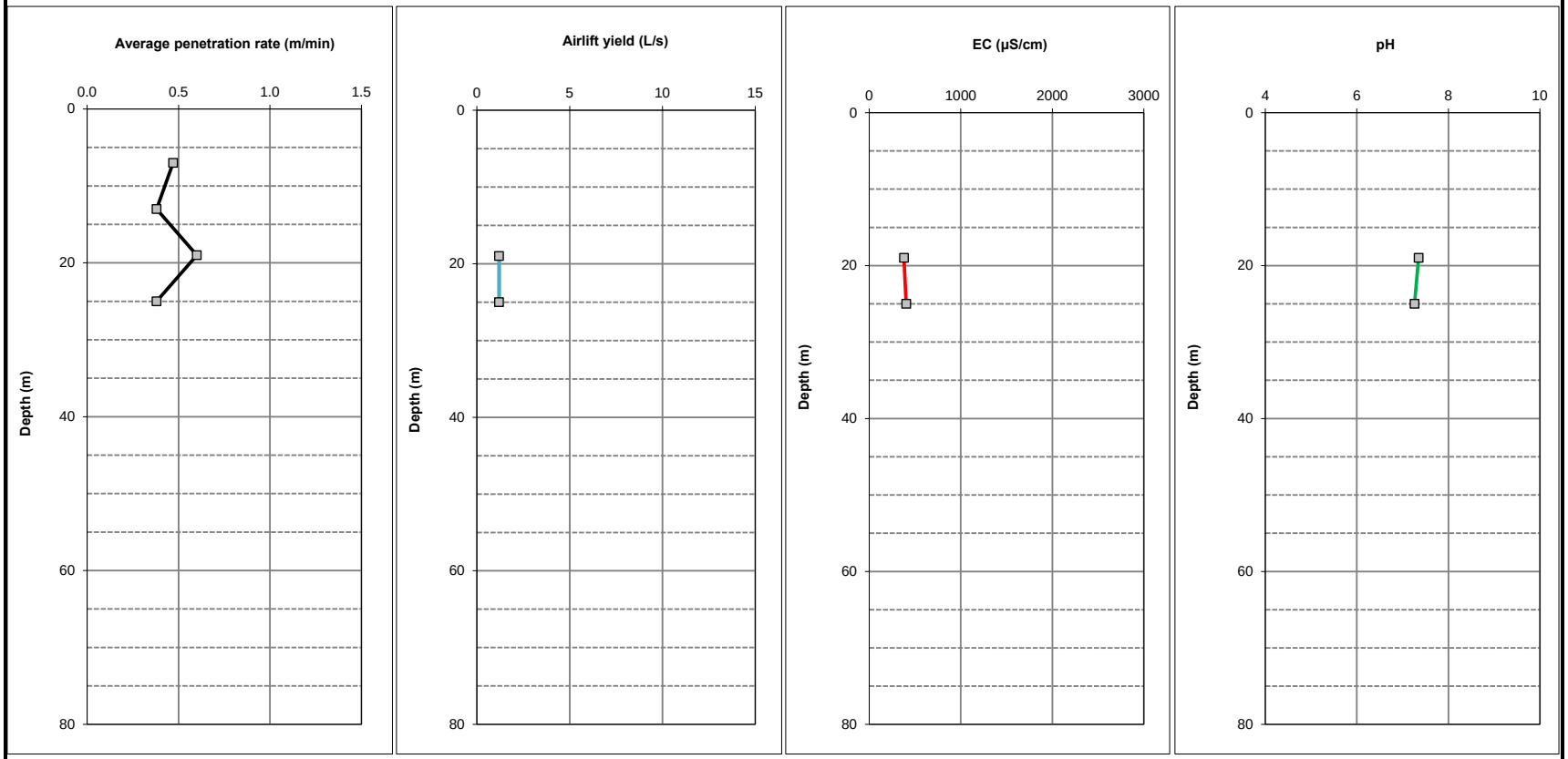
Date started: 30/10/2017

Date completed: 31/10/2017

Client well nomenclature:	HCT-1
Deposit area:	Mount Bonnie
Drilling Co./Rig:	Geo Drilling
Driller:	Stefan

Co-ordinates (GDA94, Z52):	E	776006
	N	8501784
Natural surface elevation. (mAHD)		130

Graphical Log



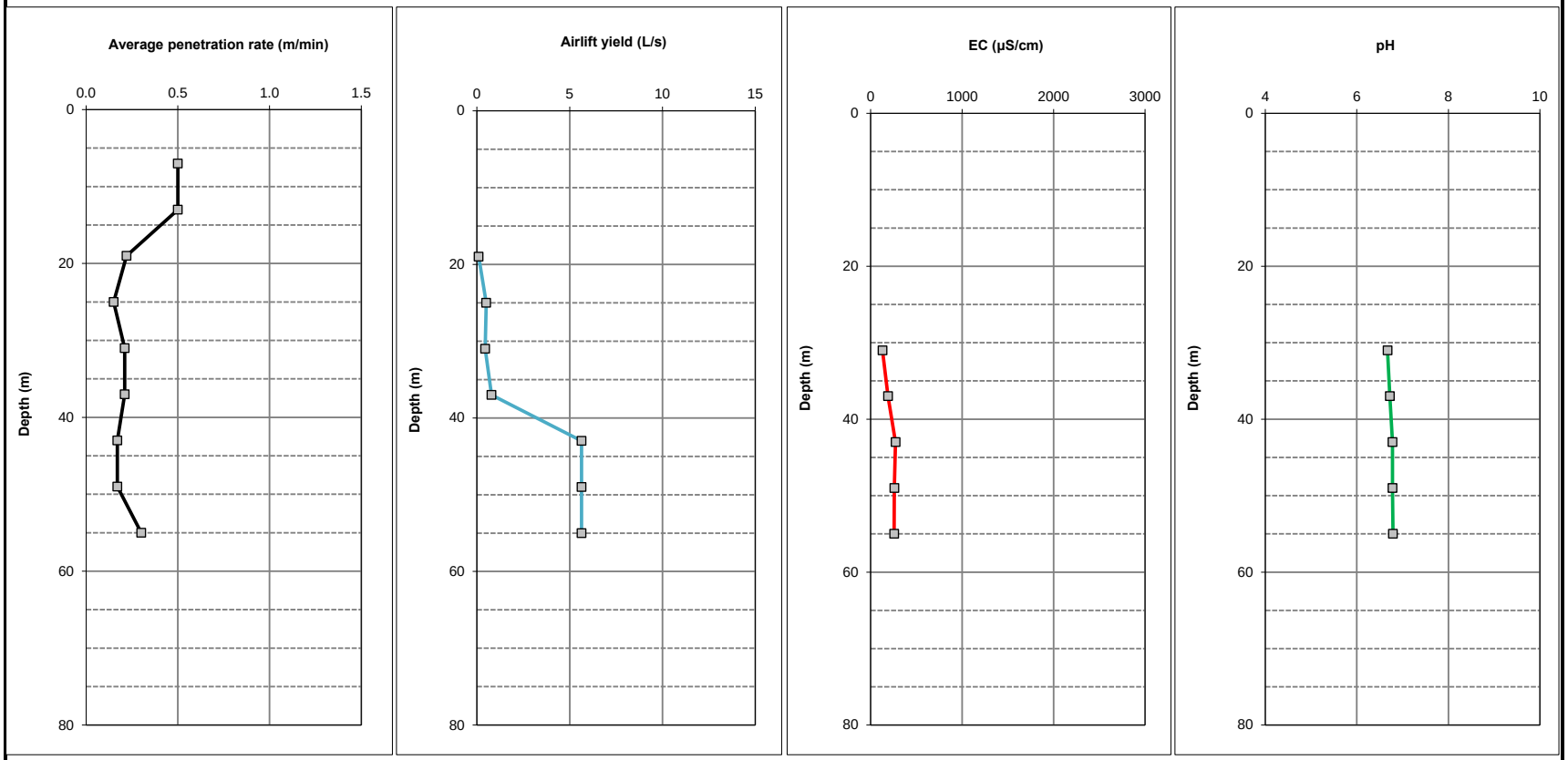
NOTES:

Drilling summary report

Hole: HCT-2 (lost)

Date started:	26/10/2017	**Date completed:**	27/10/2017
Client well nomenclature:	HCT-2 (lost)	**Co-ordinates (GDA94, Z52):** E	776034
Deposit area:	Mount Bonnie	N	8501209
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	148
Driller:	Stefan		

Graphical Log



NOTES:

Drilling summary report

Hole: HCT-2

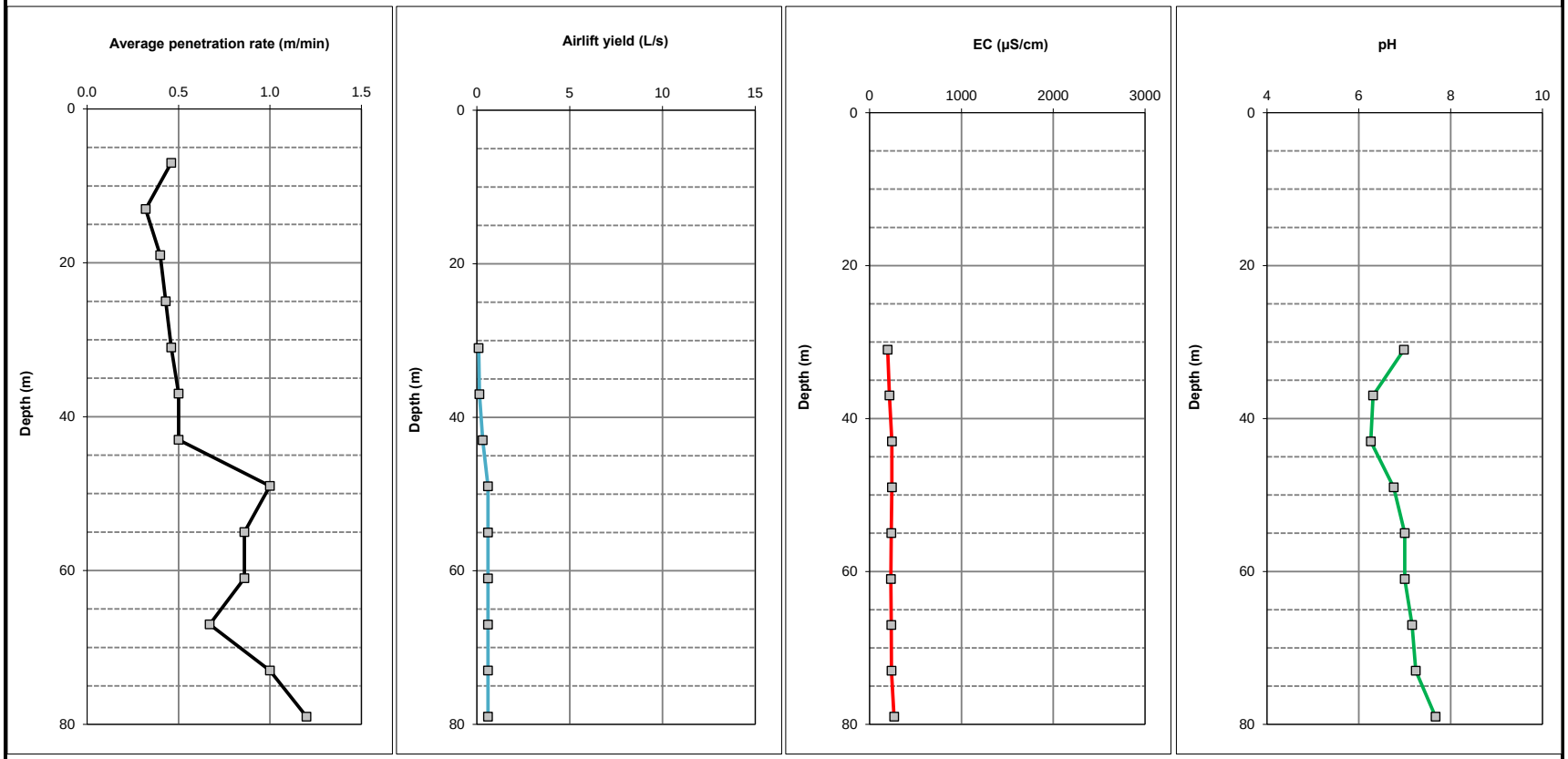
Date started: 28/10/2017

Date completed: 29/10/2017

Client well nomenclature: HCT-2
Deposit area: Mount Bonnie
Drilling Co./Rig: Geo Drilling
Driller: Stefan

Co-ordinates (GDA94, Z52): E 776052
N 8501221
Natural surface elevation. (mAHD) 148

Graphical Log



NOTES:

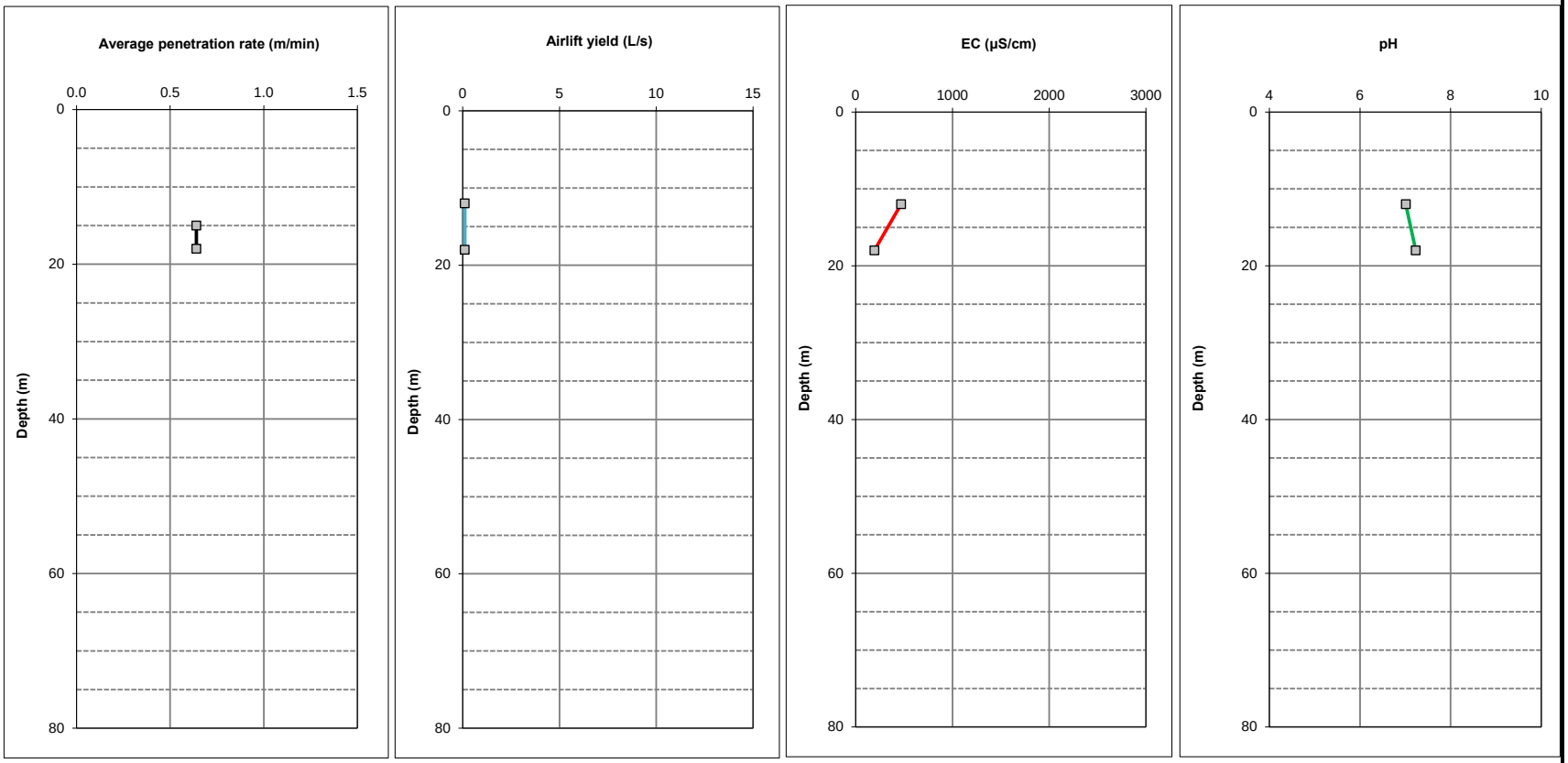
Drilling summary report

Hole: HCM-5

Date started:	12/10/2017	**Date completed:**	12/10/2017

Client well nomenclature:	**HCM-5**	Co-ordinates (GDA94, Z52): E	775854
Deposit area:	**Mount Bonnie**	N	8501538
Drilling Co./Rig:	**Geo Drilling**	Natural surface elevation. (mAHD)	130
Driller:	**Stefan**		

Graphical Log



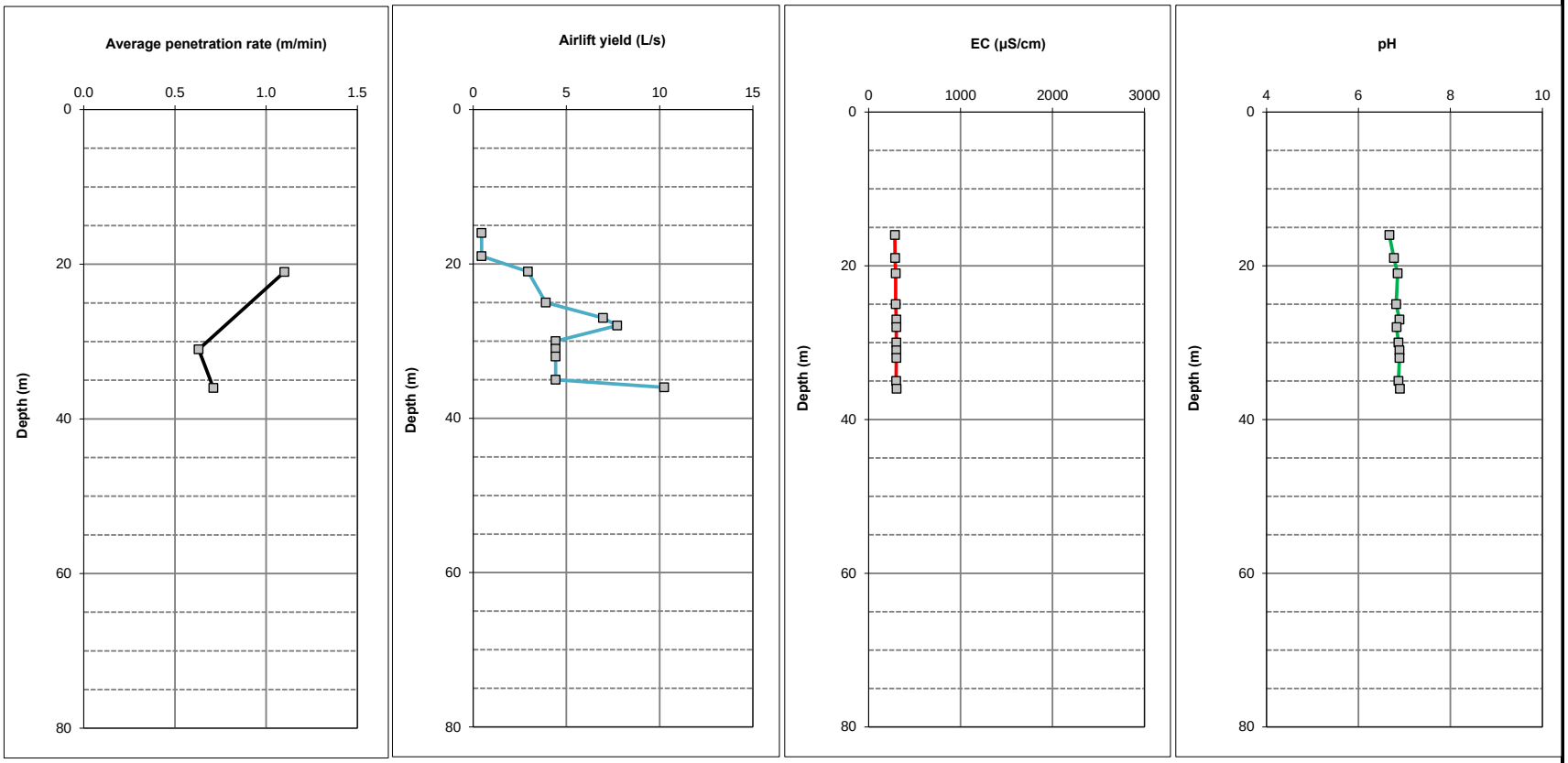
NOTES:

Drilling summary report

Hole: HCM-6

Date started:	15/10/2017	**Date completed:**	15/10/2017
Client well nomenclature:	HCM-6	**Co-ordinates (GDA94, Z52):** E	776365
Deposit area:	Mount Bonnie	N	8501376
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	134
Driller:	Stefan		

Graphical Log



NOTES:

Drilling summary report

Hole: HCM-7

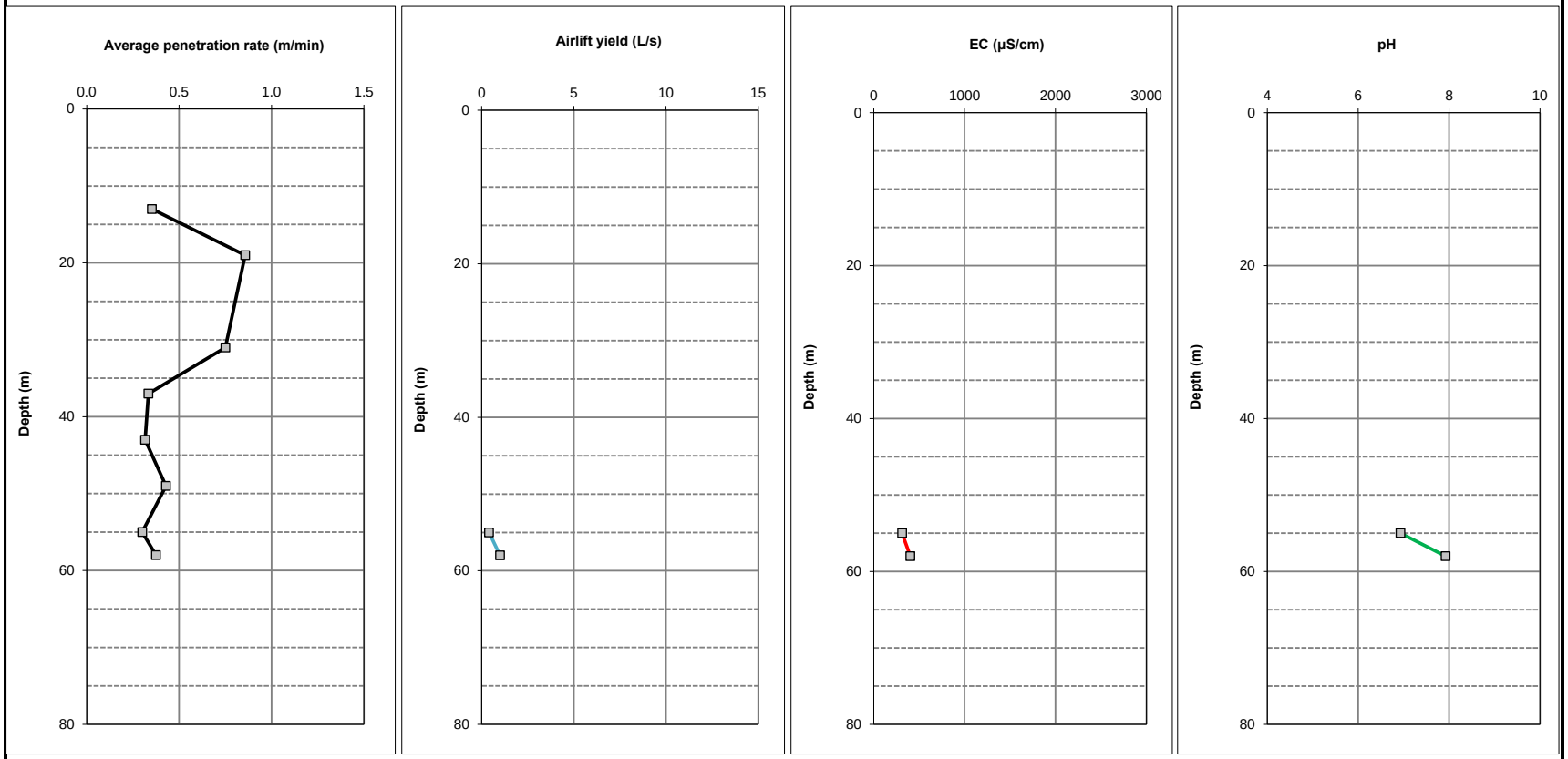
Date started: 21/10/2017

Date completed: 21/10/2017

Client well nomenclature:	HCM-7
Deposit area:	Mount Bonnie
Drilling Co./Rig:	Geo Drilling
Driller:	Stefan

Co-ordinates (GDA94, Z52):	E	776175
	N	8501255
Natural surface elevation. (mAHD)		173

Graphical Log



NOTES:

Drilling summary report

Hole: HCM-8

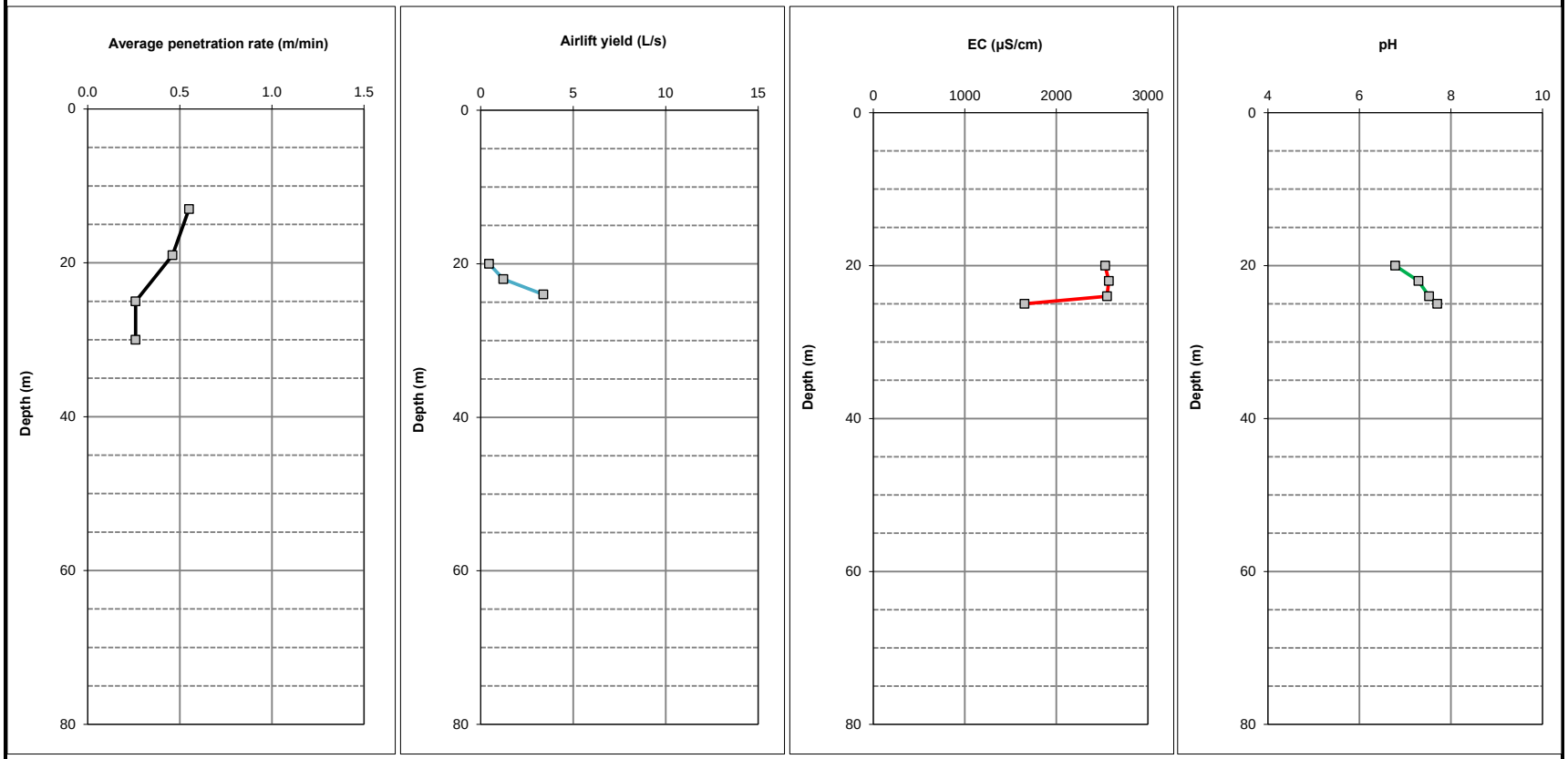
Date started: 16/10/2017

Date completed: 17/10/2017

Client well nomenclature:	HCM-8
Deposit area:	Mount Bonnie
Drilling Co./Rig:	Geo Drilling
Driller:	Stefan

Co-ordinates (GDA94, Z52):	E	776351
	N	850118
Natural surface elevation. (mAHD)		154

Graphical Log



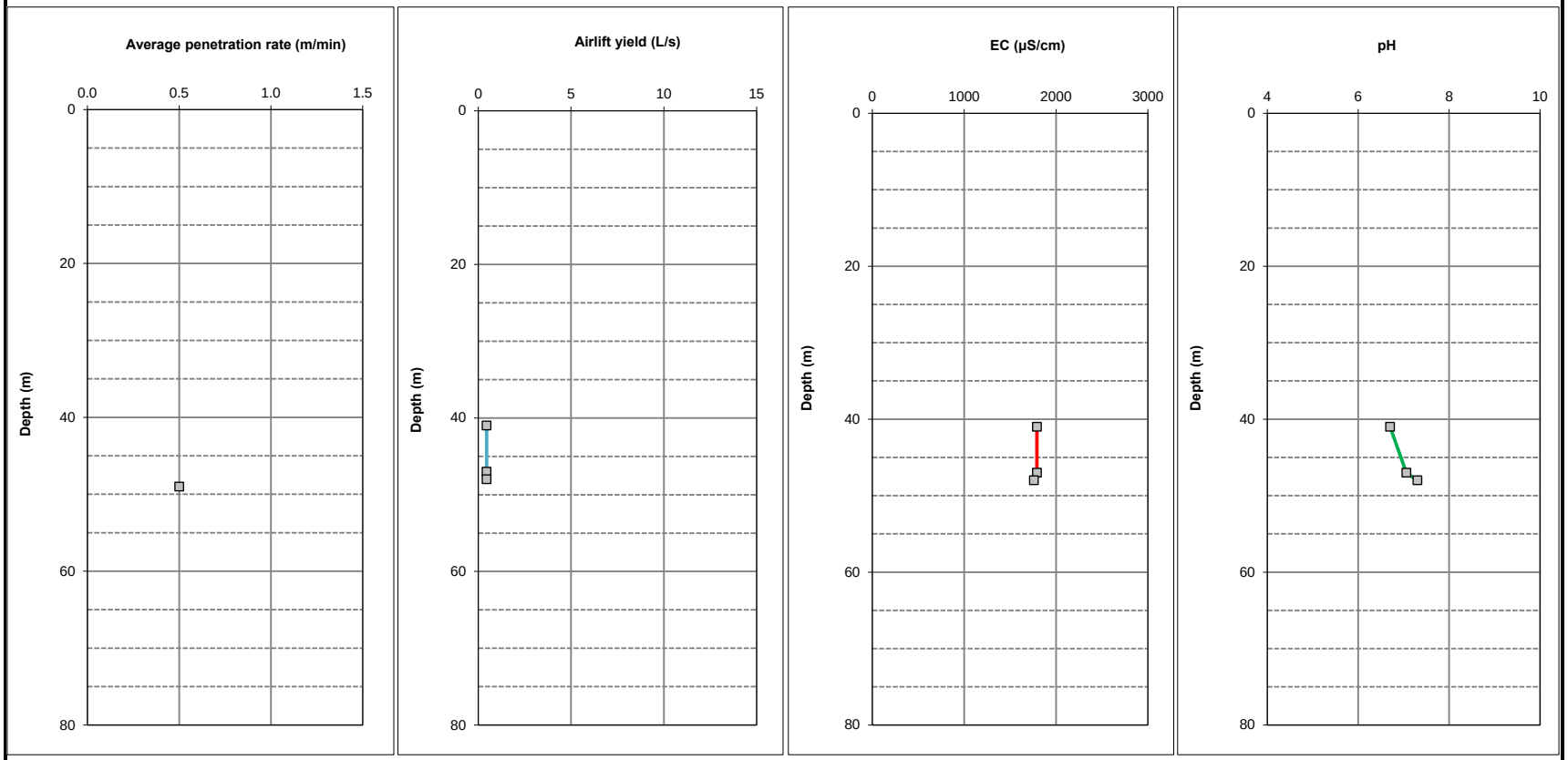
NOTES:

Drilling summary report

Hole: HCM-9

Date started:	18/10/2017	**Date completed:**	18/10/2017
Client well nomenclature:	HCM-9	**Co-ordinates (GDA94, Z52):** E	776166
Deposit area:	Mount Bonnie	N	8500940
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	164
Driller:	Stefan		

Graphical Log



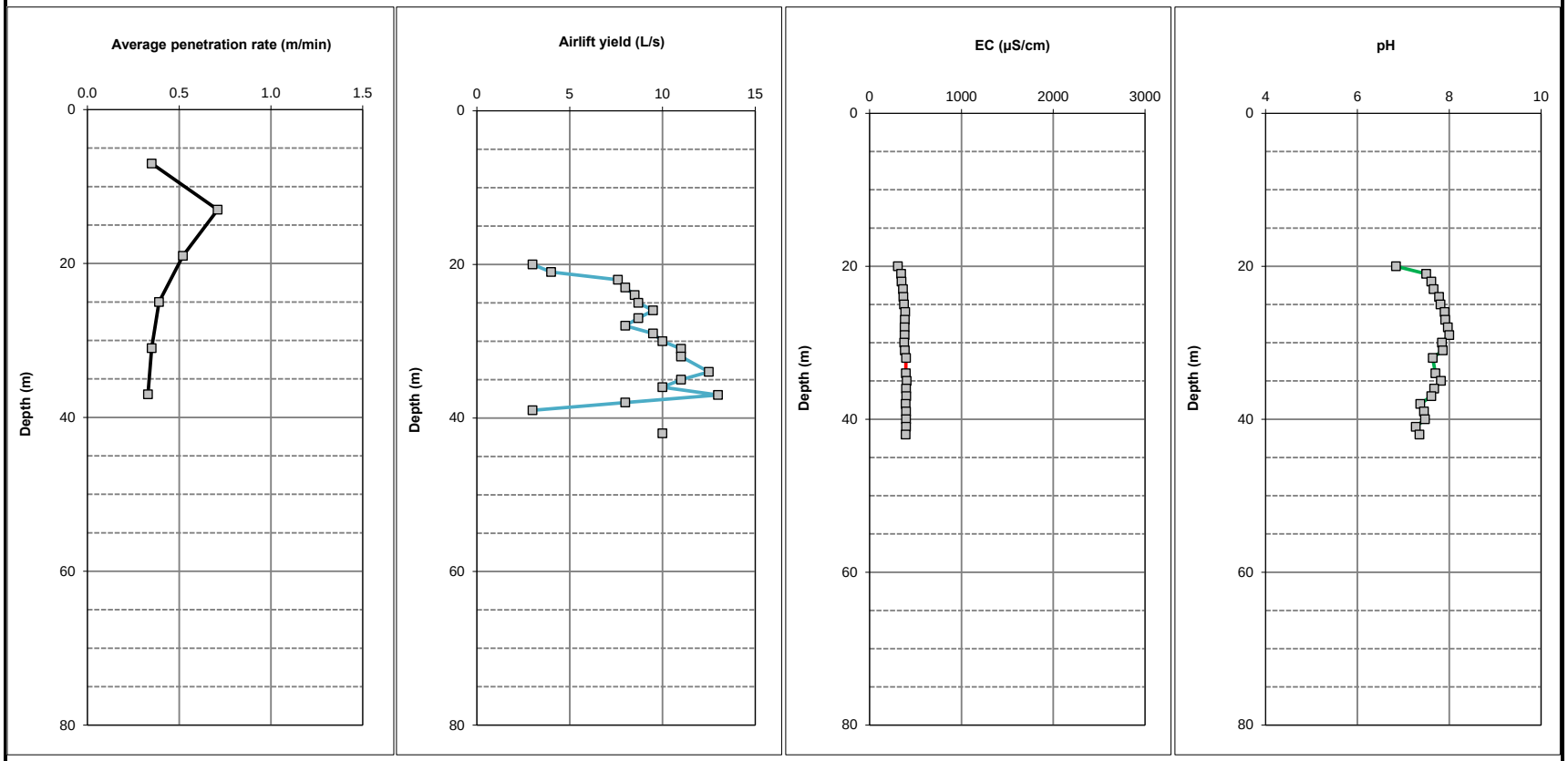
NOTES:

Drilling summary report

Hole: HCM-10

Date started:	19/10/2017	**Date completed:**	19/10/2017
Client well nomenclature:	HCM-10	**Co-ordinates (GDA94, Z52):** E	775890
Deposit area:	Mount Bonnie	N	8500631
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	152
Driller:	Stefan		

Graphical Log



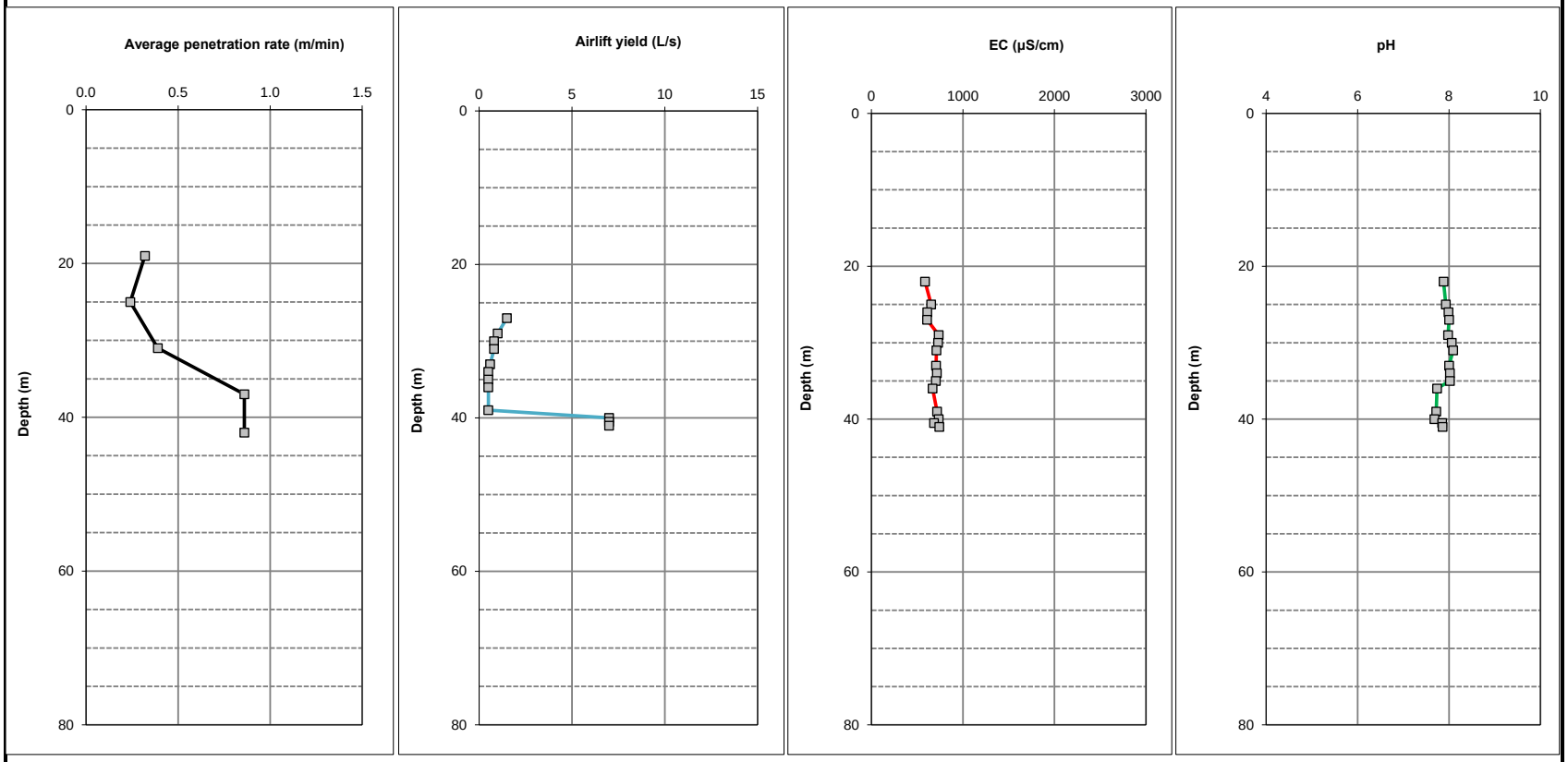
NOTES:

Drilling summary report

Hole: HCM-11

Date started:	17/10/2017	**Date completed:**	18/10/2017
Client well nomenclature:	HCM-11	**Co-ordinates (GDA94, Z52):** E	776365
Deposit area:	Mount Bonnie	N	8500485
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	164
Driller:	Stefan		

Graphical Log



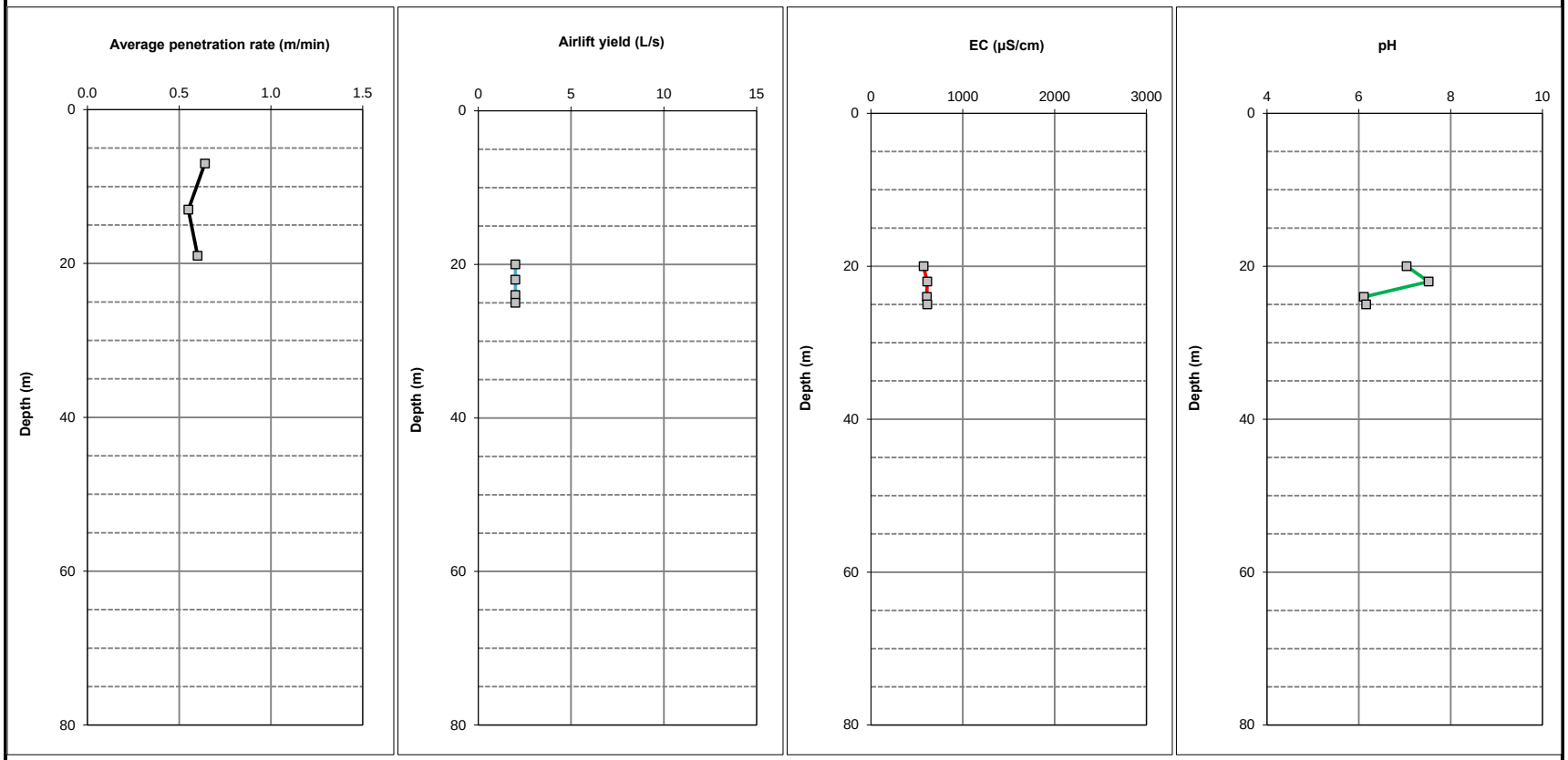
NOTES:

Drilling summary report

Hole: HCM-12

Date started:	13/10/2017	**Date completed:**	14/10/2017
Client well nomenclature:	HCM-12	**Co-ordinates (GDA94, Z52):** E	776010
Deposit area:	Mount Bonnie	N	8501795
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	130
Driller:	Stefan		

Graphical Log



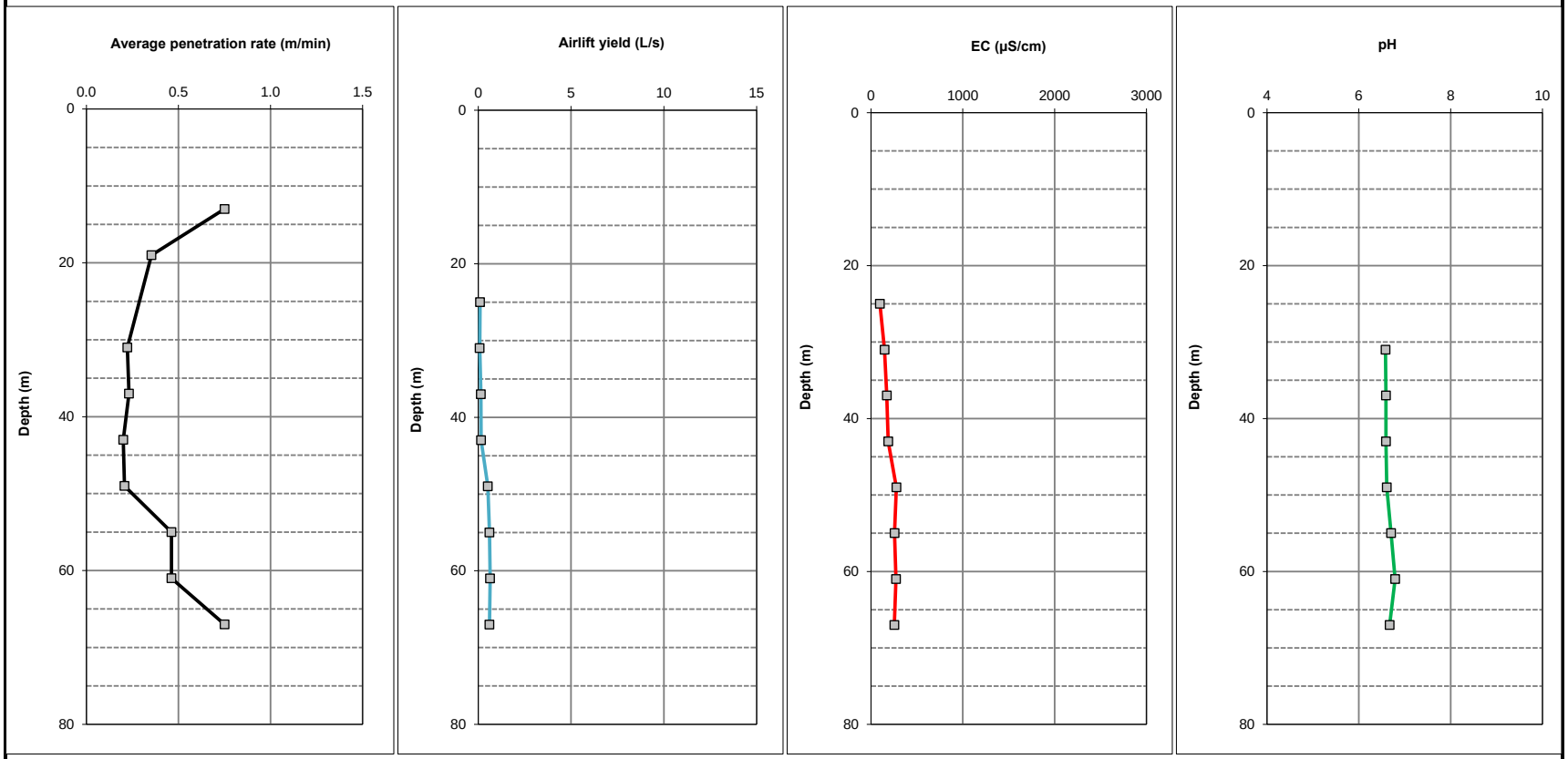
NOTES:

Drilling summary report

Hole: HCM-13

Date started:	22/10/2017	**Date completed:**	22/10/2017
Client well nomenclature:	HCM-13	**Co-ordinates (GDA94, Z52):** E	776040
Deposit area:	Mount Bonnie	N	8501215
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	148
Driller:	Stefan		

Graphical Log



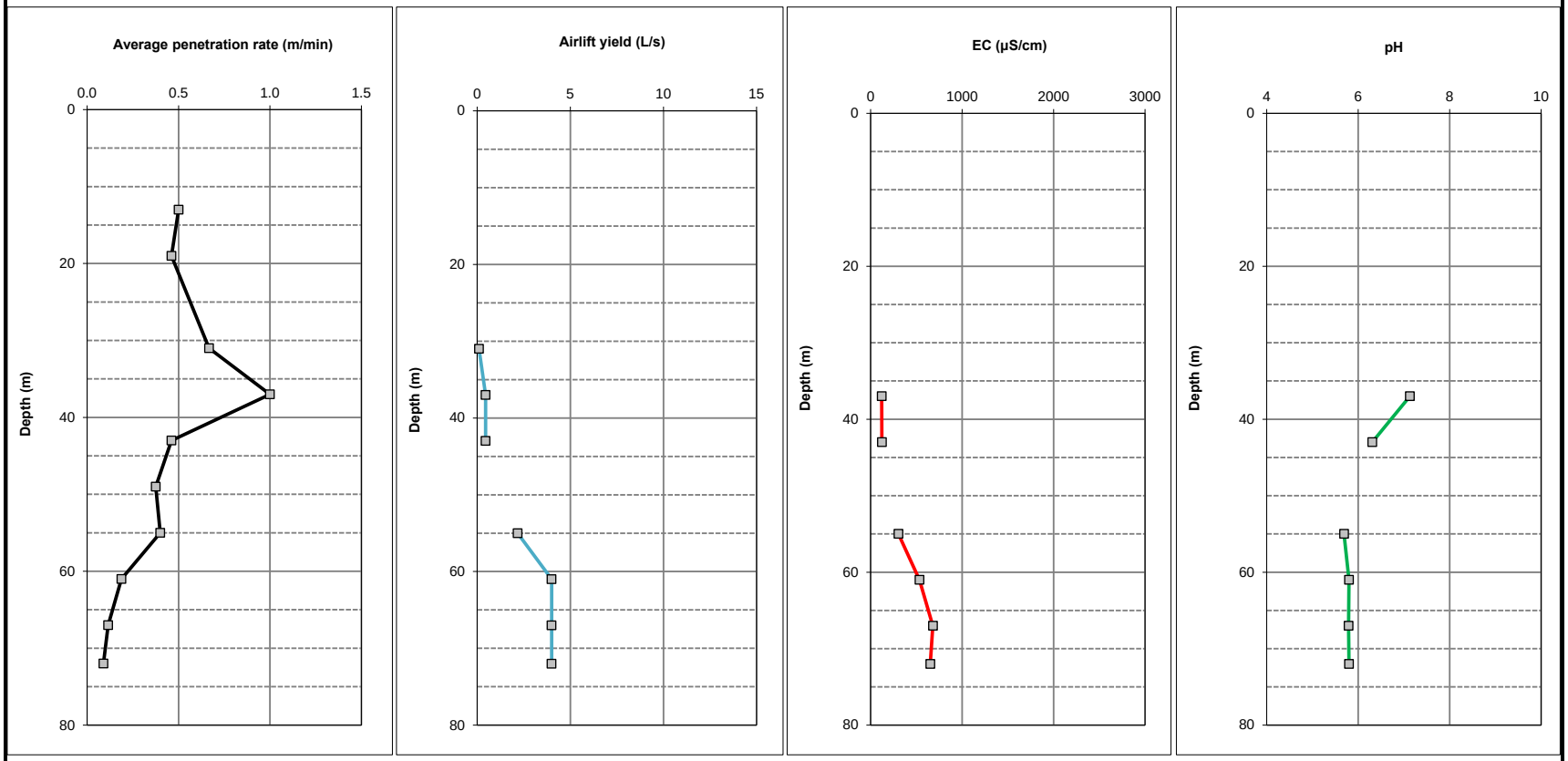
NOTES:

Drilling summary report

Hole: HCM-14

Date started:	24/10/2017	**Date completed:**	25/10/2017
Client well nomenclature:	HCM-14	**Co-ordinates (GDA94, Z52):** E	776152
Deposit area:	Mount Bonnie	N	8501452
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	147
Driller:	Stefan		

Graphical Log



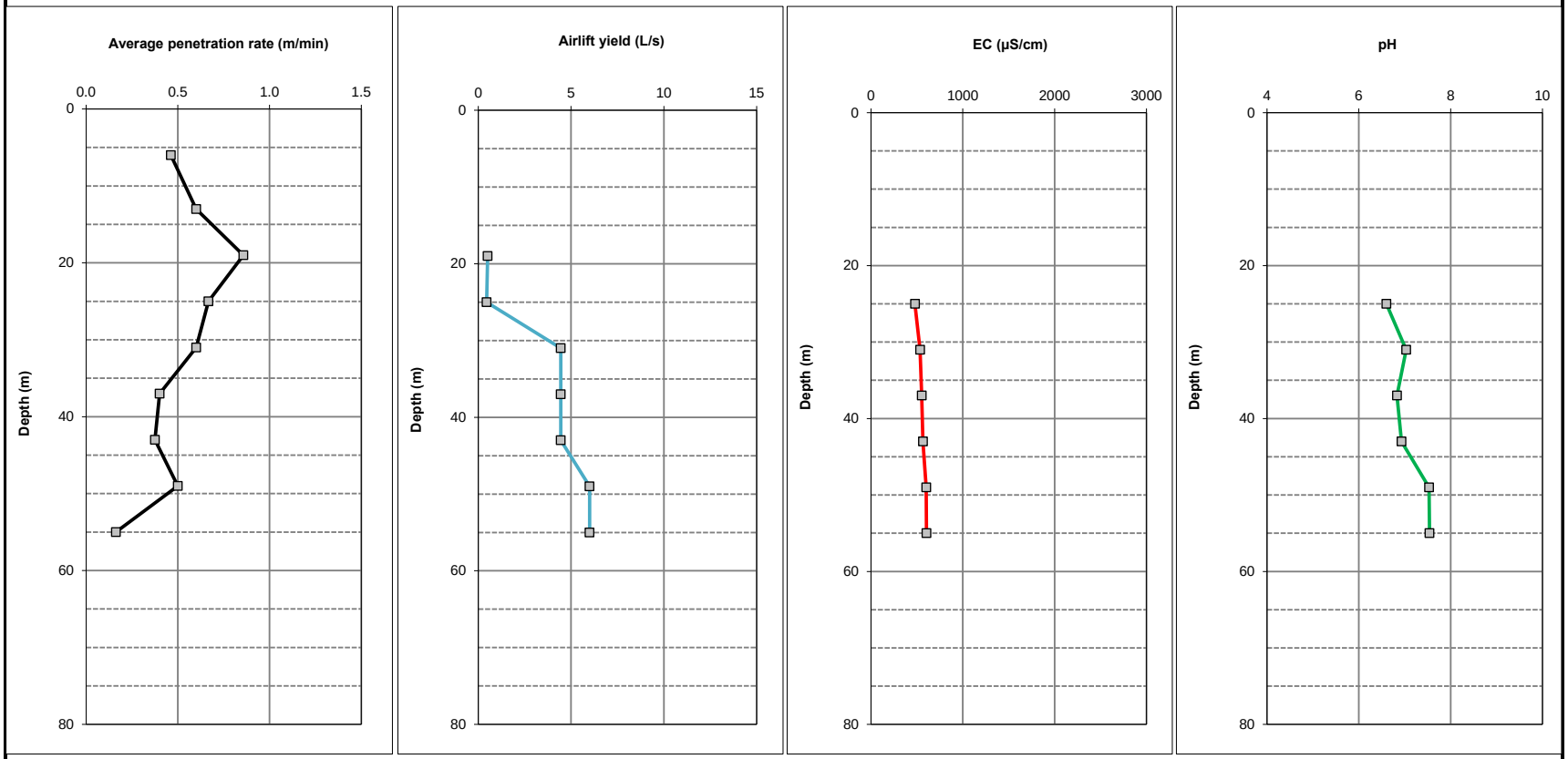
NOTES:

Drilling summary report

Hole: HCM-15

Date started:	23/10/2017	**Date completed:**	23/10/2017
Client well nomenclature:	HCM-15	**Co-ordinates (GDA94, Z52):** E	775936
Deposit area:	Mount Bonnie	N	8501093
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	144
Driller:	Stefan		

Graphical Log



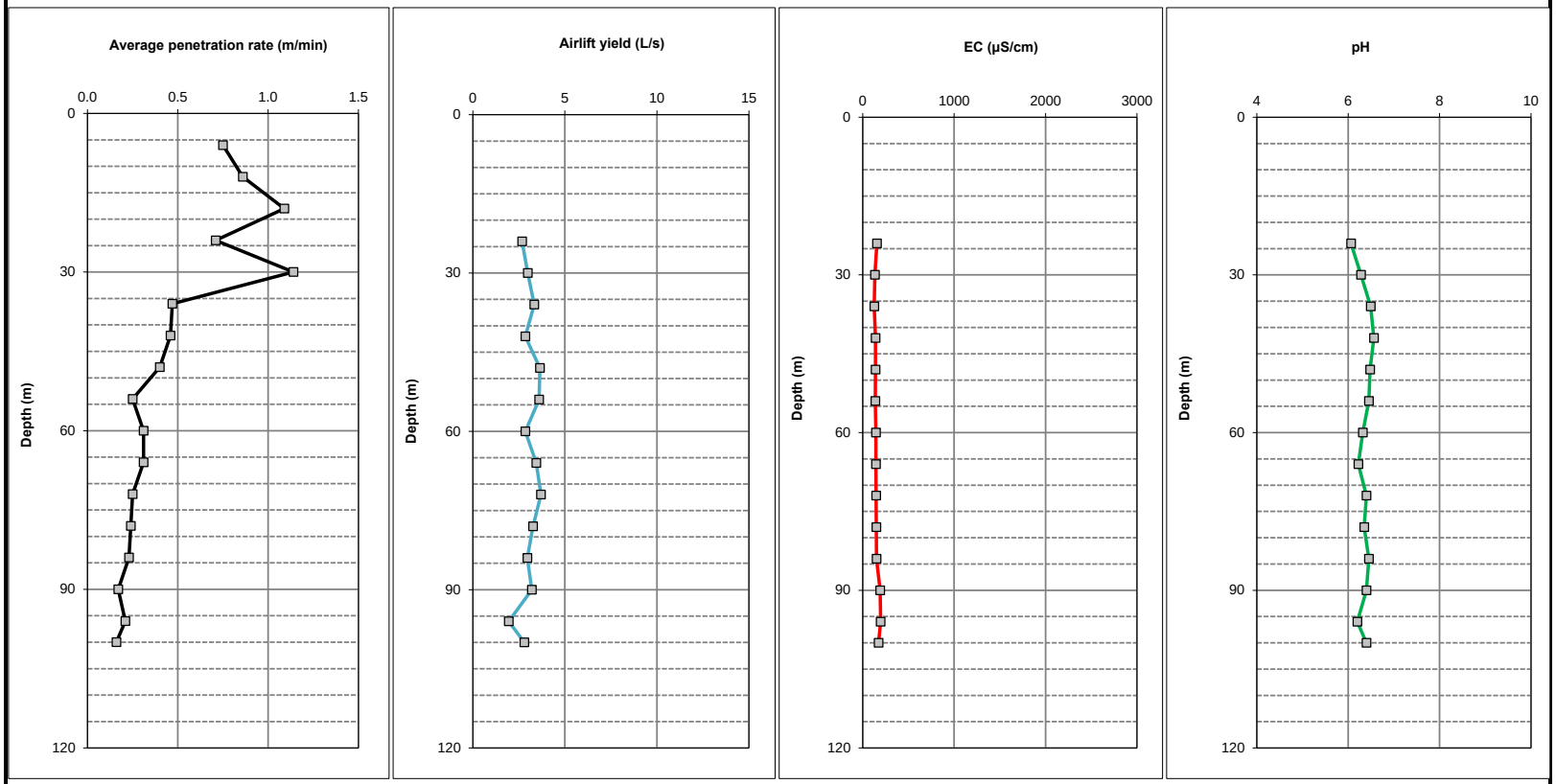
NOTES:

Drilling summary report

Hole: HCM-16

Date started:	9/12/2017	Date completed:	10/12/2017
Client well nomenclature:	HCM-16	Co-ordinates (GDA94, Z52): E	776145
Deposit area:	Iron Blow	N	8504691
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	121
Driller:	Steve		

Graphical Log



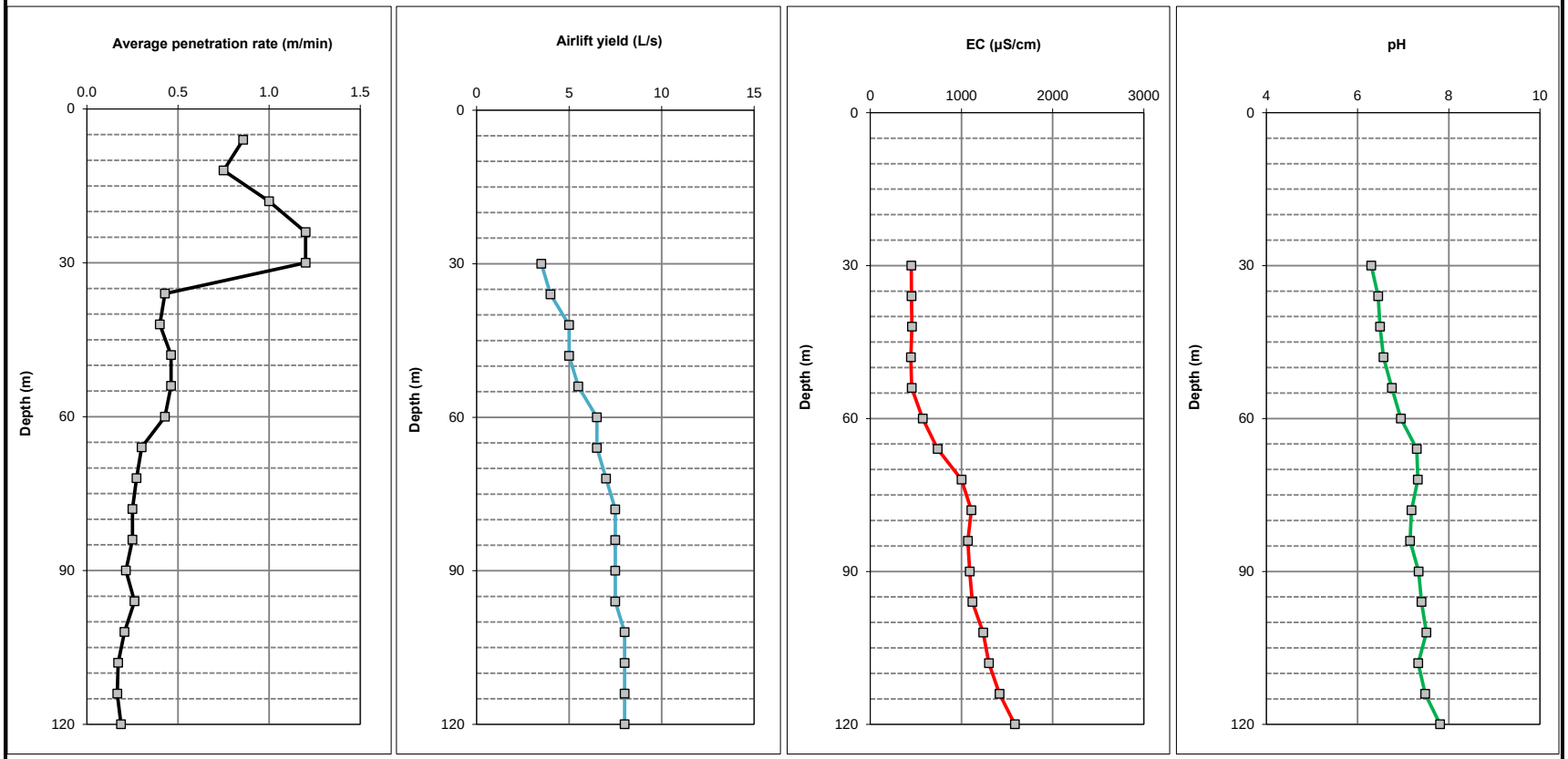
NOTES:

Drilling summary report

Hole: HCM-17

Date started:	5/12/2017	**Date completed:**	7/12/2017
Client well nomenclature:	HCM-17	**Co-ordinates (GDA94, Z52):** E	776249
Deposit area:	Iron Blow	N	8504519
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	118
Driller:	Steve		

Graphical Log



NOTES:

Drilling summary report

Hole: HCM-19

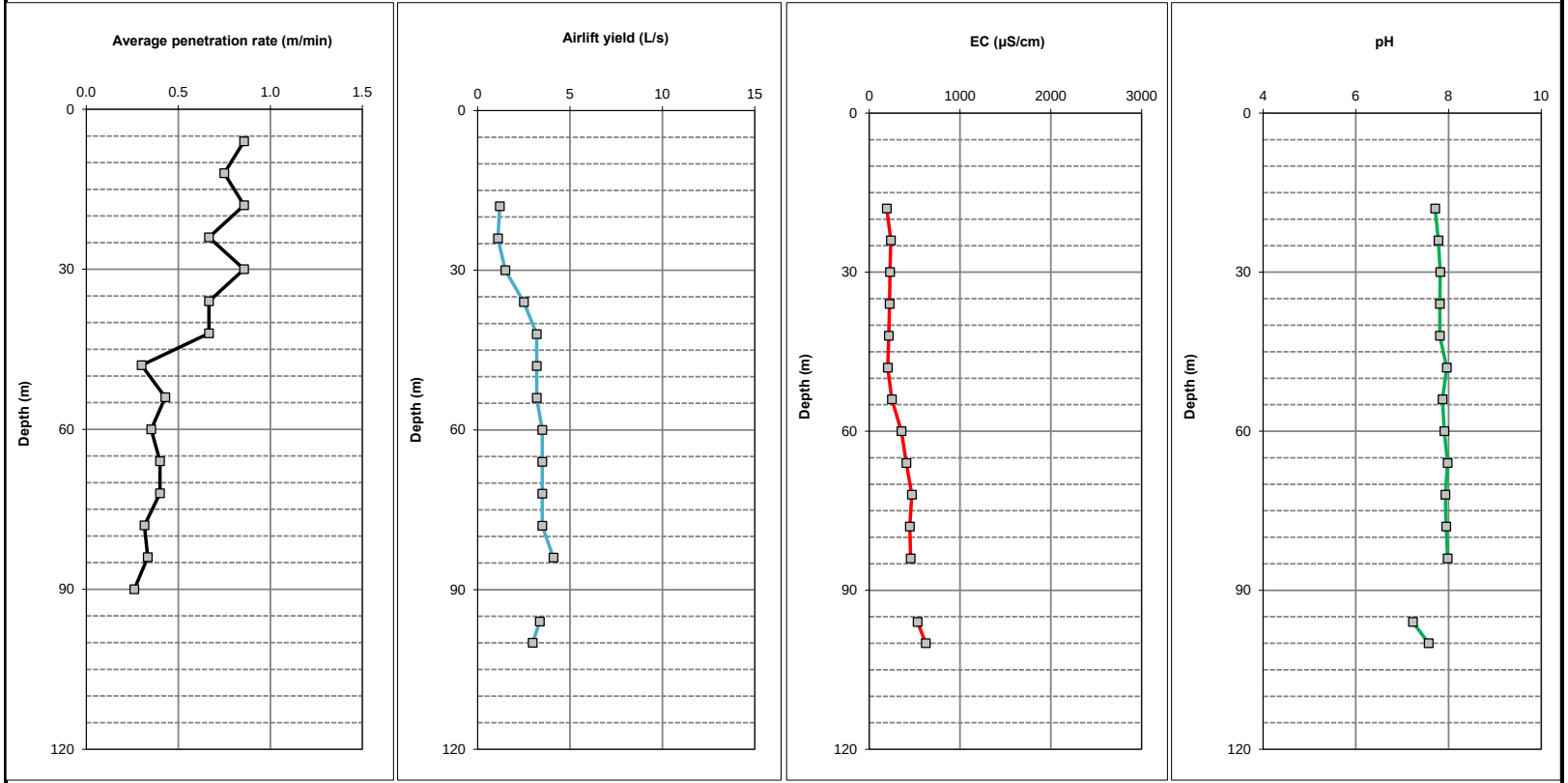
Date started: 7/12/2017

Date completed: 8/12/2017

Client well nomenclature:	HCM-19
Deposit area:	Iron Blow
Drilling Co./Rig:	Geo Drilling
Driller:	Steve

Co-ordinates (GDA94, Z52):	E	776138
	N	8504412
Natural surface elevation. (mAHD)		122

Graphical Log



NOTES:

Drilling summary report

Hole: HCM-20

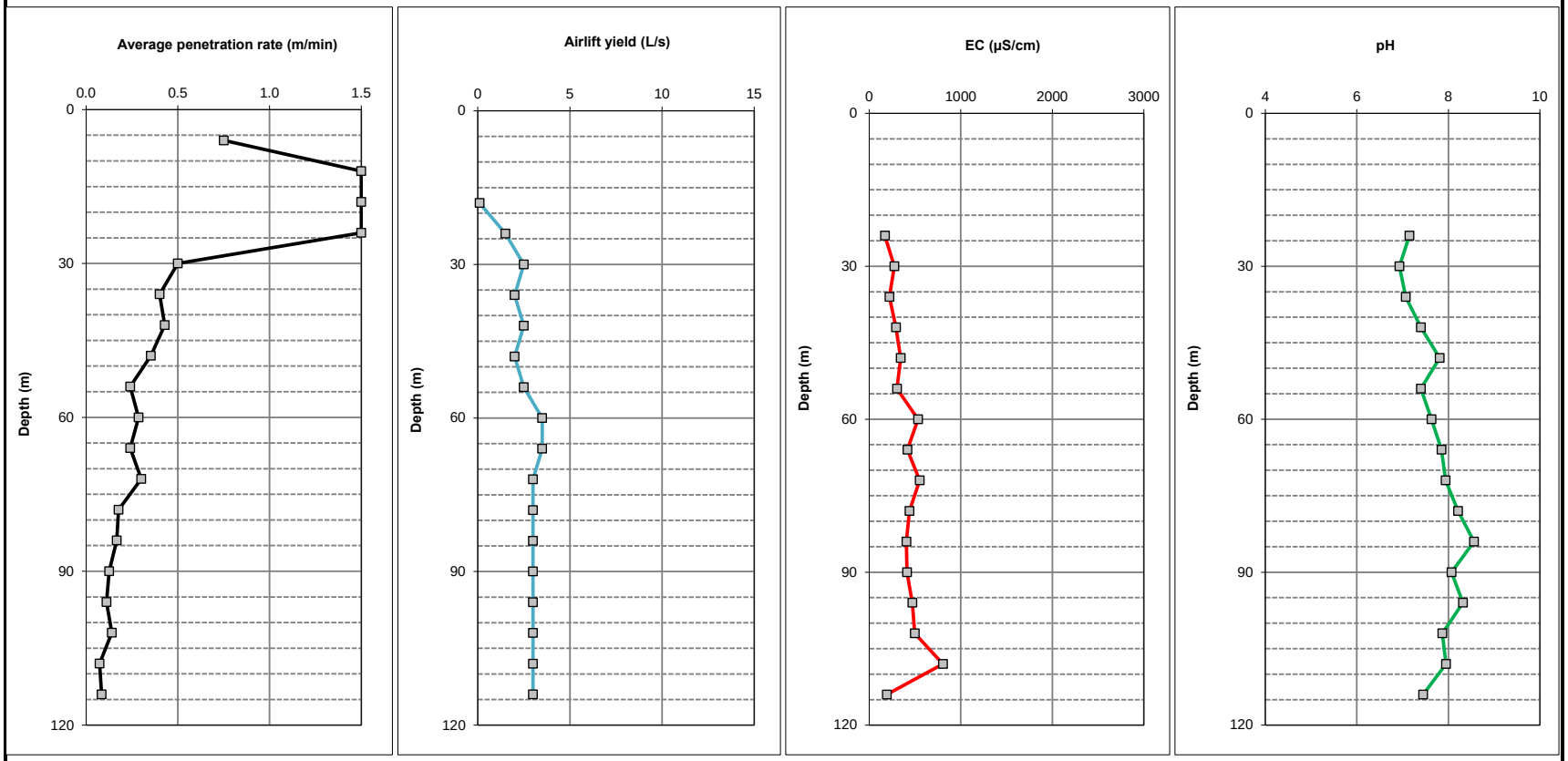
Date started: 3/12/2017

Date completed: 5/12/2017

Client well nomenclature:	HCM-20
Deposit area:	Iron Blow
Drilling Co./Rig:	Geo Drilling
Driller:	Steve

Co-ordinates (GDA94, Z52):	E	776030
	N	8504545
Natural surface elevation. (mAHD)		130

Graphical Log



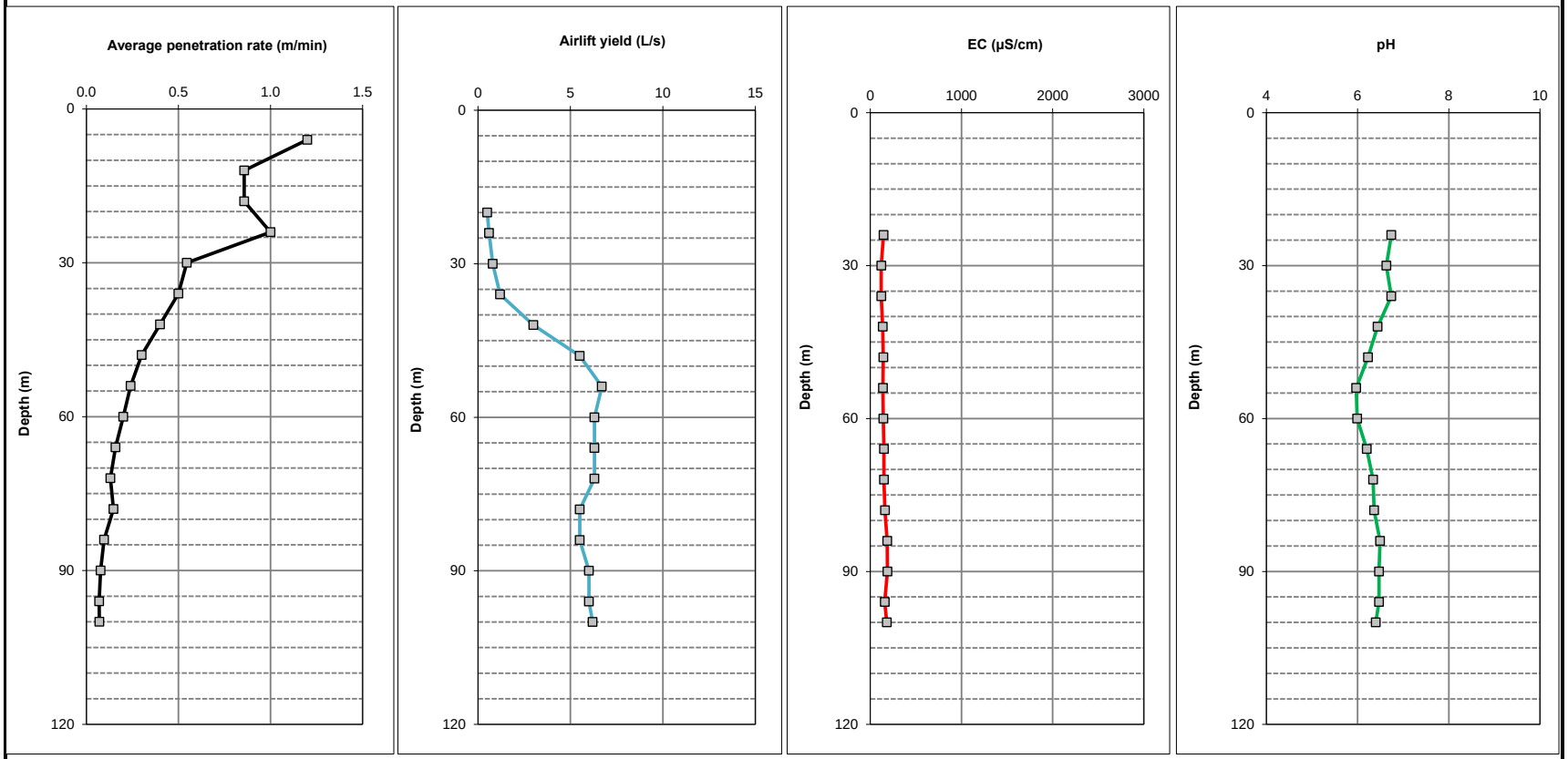
NOTES:

Drilling summary report

Hole: HCM-21

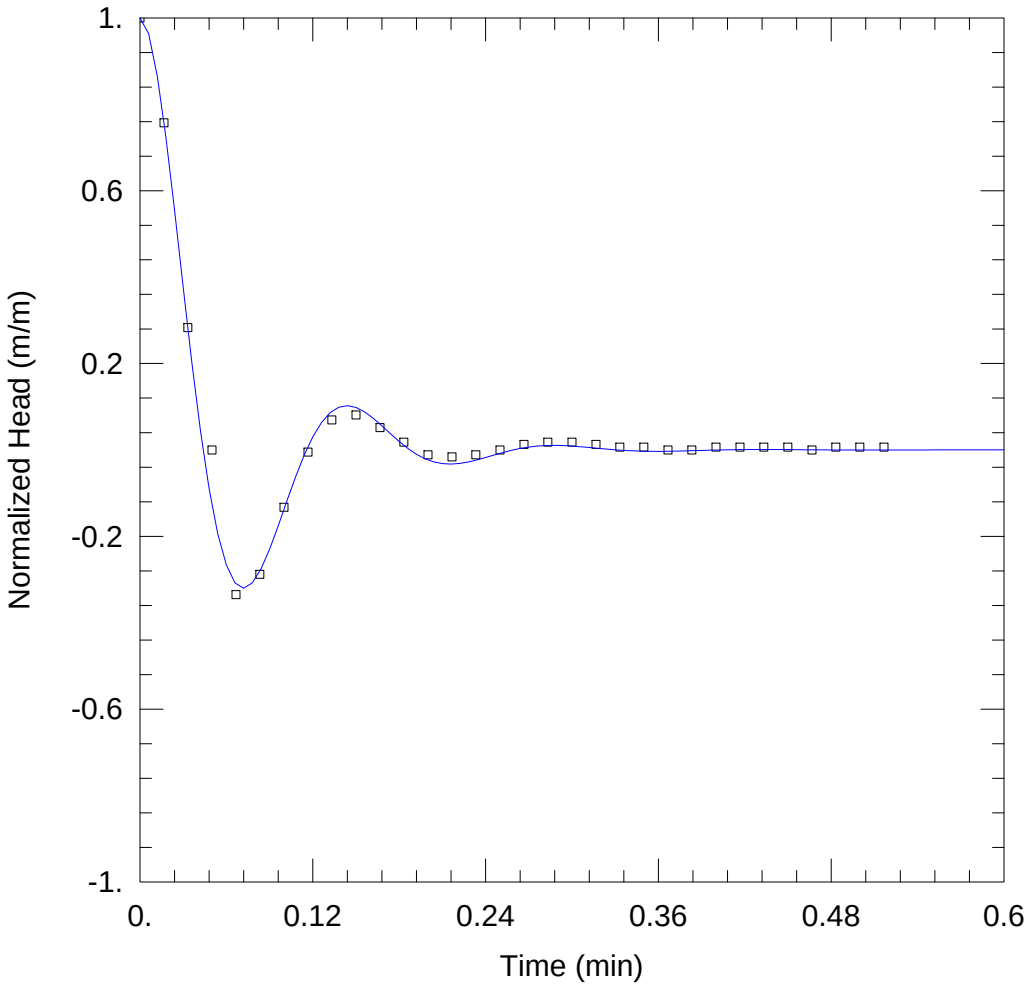
Date started:	1/12/2017	**Date completed:**	3/12/2017
Client well nomenclature:	HCM-21	**Co-ordinates (GDA94, Z52):** E	776141
Deposit area:	Iron Blow	N	8504516
Drilling Co./Rig:	Geo Drilling	Natural surface elevation. (mAHD)	120
Driller:	Steve		

Graphical Log



NOTES:

Appendix C AQTESOLV outputs



WELL TEST ANALYSIS

Data Set: \...\HCM-5_slug_in_1.aqt
Date: 01/16/18 Time: 14:39:40

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-5
Test Date: 1/11/2017

AQUIFER DATA

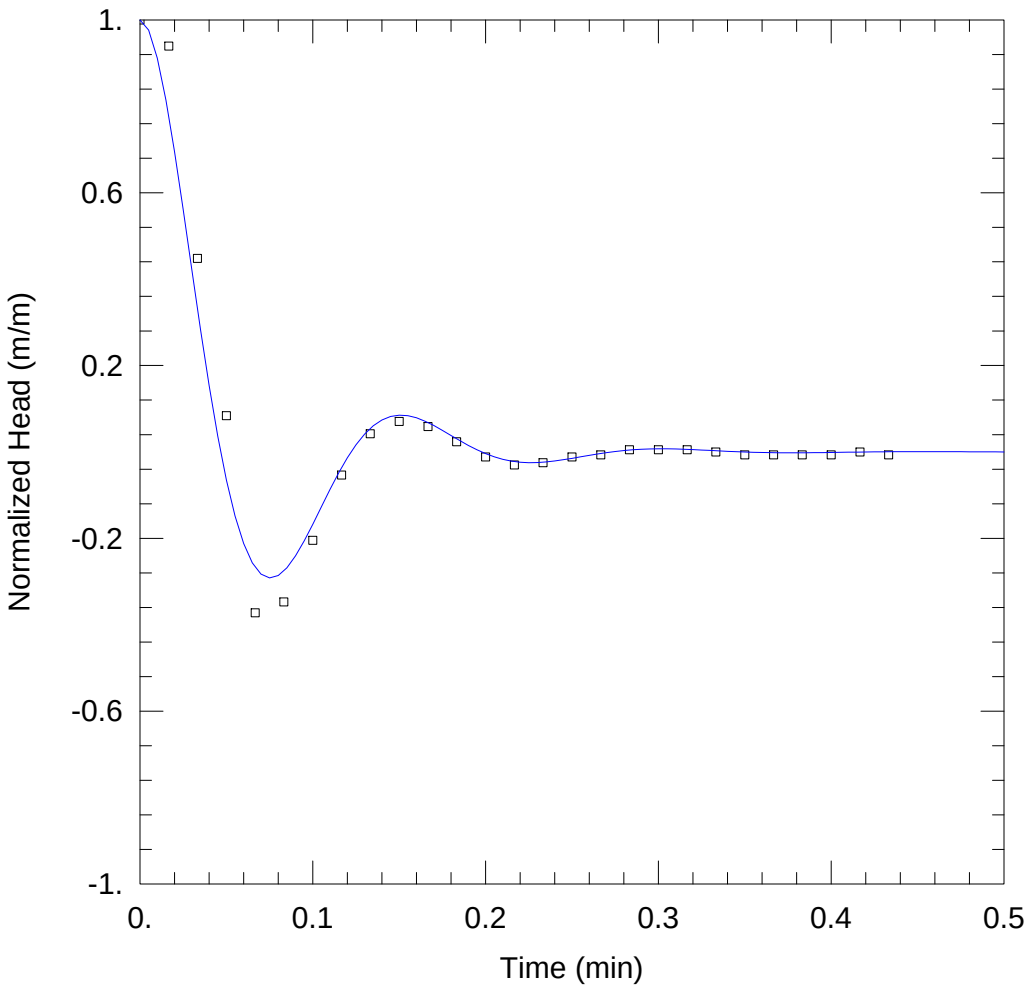
Saturated Thickness: 6. m Anisotropy Ratio (Kz/Kr): 0.09886

WELL DATA (HCM-5)

Initial Displacement: 0.618 m Static Water Column Height: 16.72 m
Total Well Penetration Depth: 16.72 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 19.95 m/day Le = 16.3 m



WELL TEST ANALYSIS

Data Set: \...\HCM-5_slug_in_2.aqt
Date: 01/16/18 Time: 14:39:52

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-5
Test Date: 1/11/2017

AQUIFER DATA

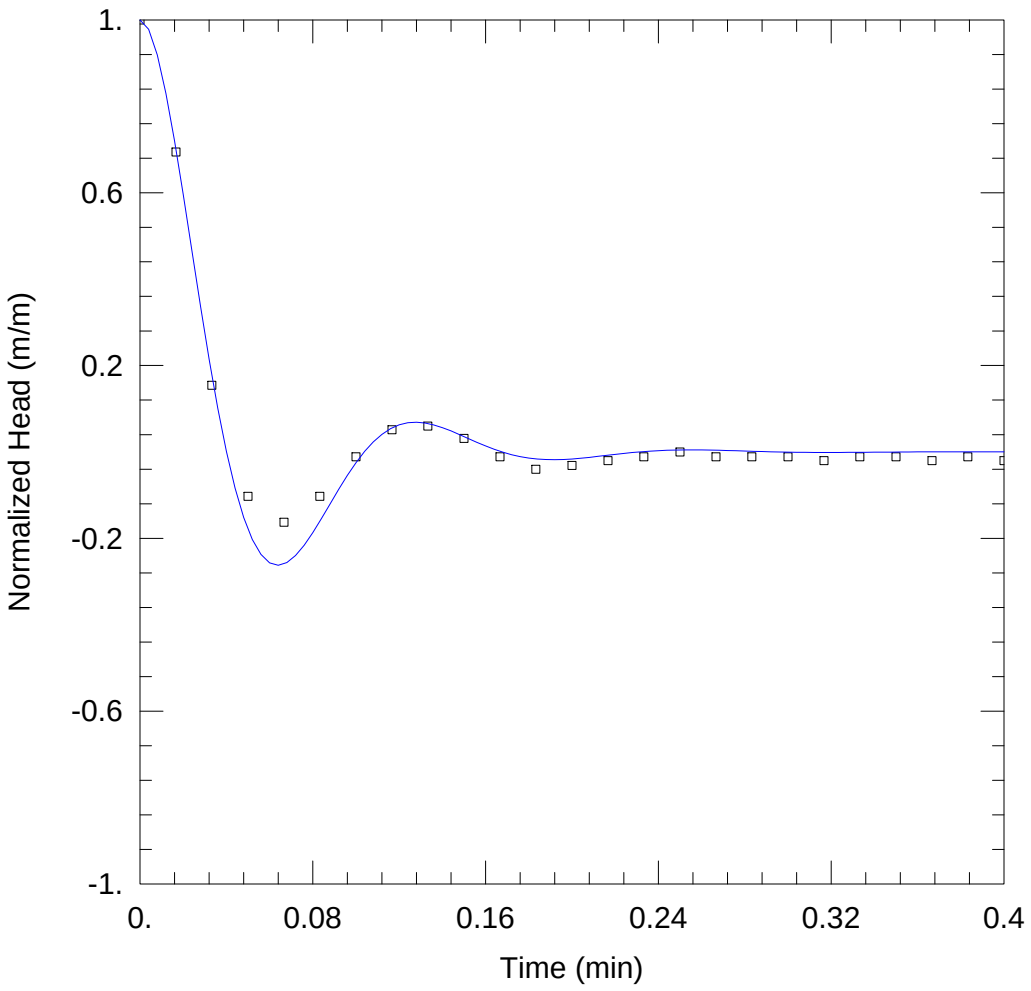
Saturated Thickness: 6. m Anisotropy Ratio (Kz/Kr): 0.09886

WELL DATA (HCM-5)

Initial Displacement: 0.596 m Static Water Column Height: 16.72 m
Total Well Penetration Depth: 16.72 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 17.82 m/day Le = 17.66 m



WELL TEST ANALYSIS

Data Set: \...\HCM-5_slug_out_1.aqt
Date: 01/16/18 Time: 14:40:10

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-5
Test Date: 1/11/2017

AQUIFER DATA

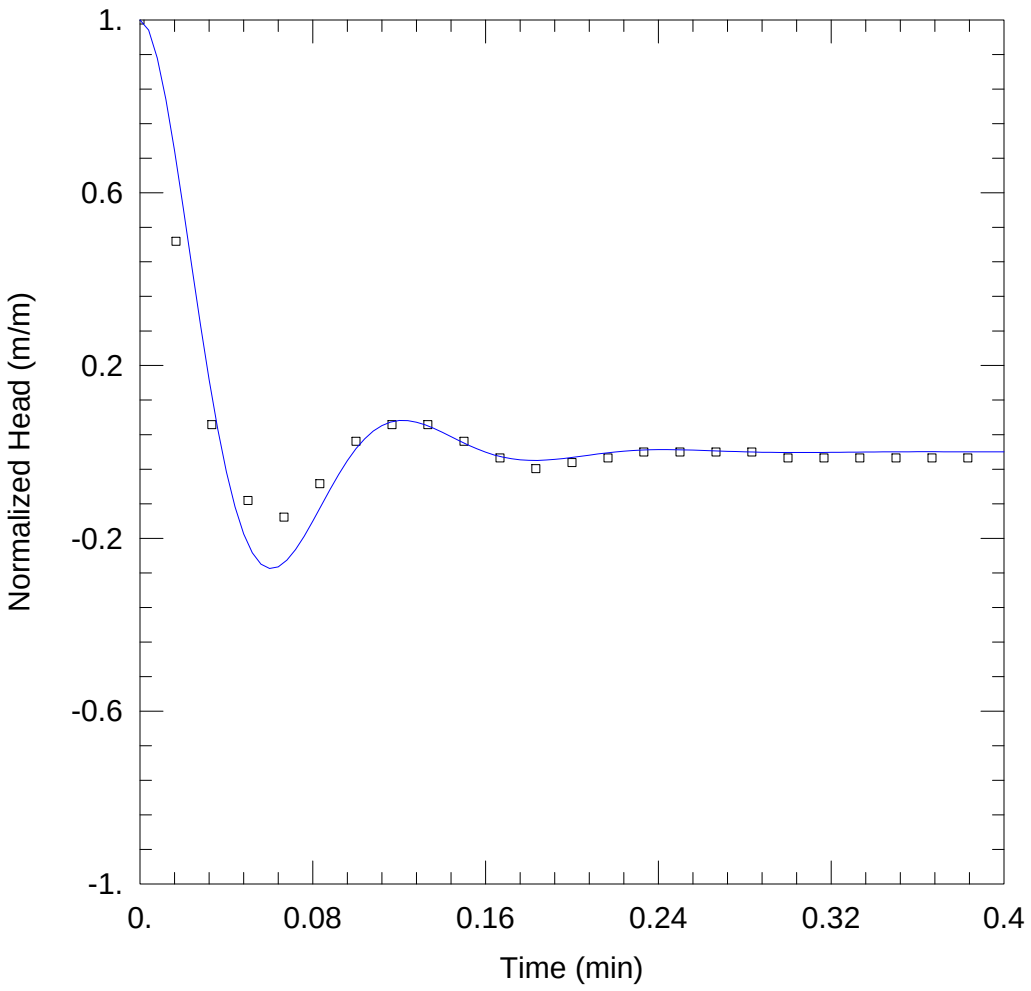
Saturated Thickness: 6. m Anisotropy Ratio (Kz/Kr): 0.09886

WELL DATA (HCM-5)

Initial Displacement: 0.35 m Static Water Column Height: 16.72 m
Total Well Penetration Depth: 16.72 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 19.97 m/day Le = 12.31 m



WELL TEST ANALYSIS

Data Set: \...\HCM-5_slug_out_2.aqt
Date: 01/16/18 Time: 14:40:46

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-5
Test Date: 1/11/2017

AQUIFER DATA

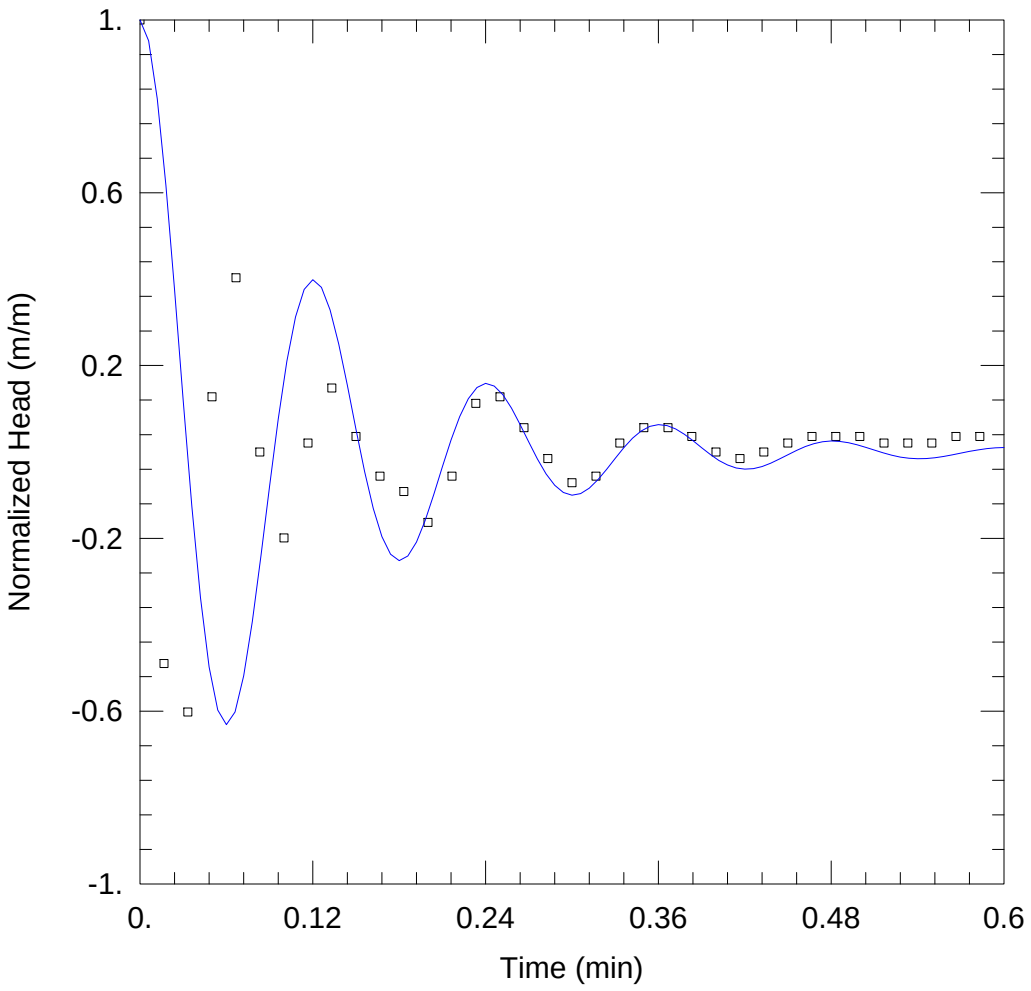
Saturated Thickness: 6. m Anisotropy Ratio (Kz/Kr): 0.09886

WELL DATA (HCM-5)

Initial Displacement: 0.285 m Static Water Column Height: 16.72 m
Total Well Penetration Depth: 16.72 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 21.32 m/day Le = 11.27 m



WELL TEST ANALYSIS

Data Set: \...\HCM-6_slug_in_1.aqt
Date: 01/16/18 Time: 14:41:13

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-6
Test Date: 2/11/2017

AQUIFER DATA

Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

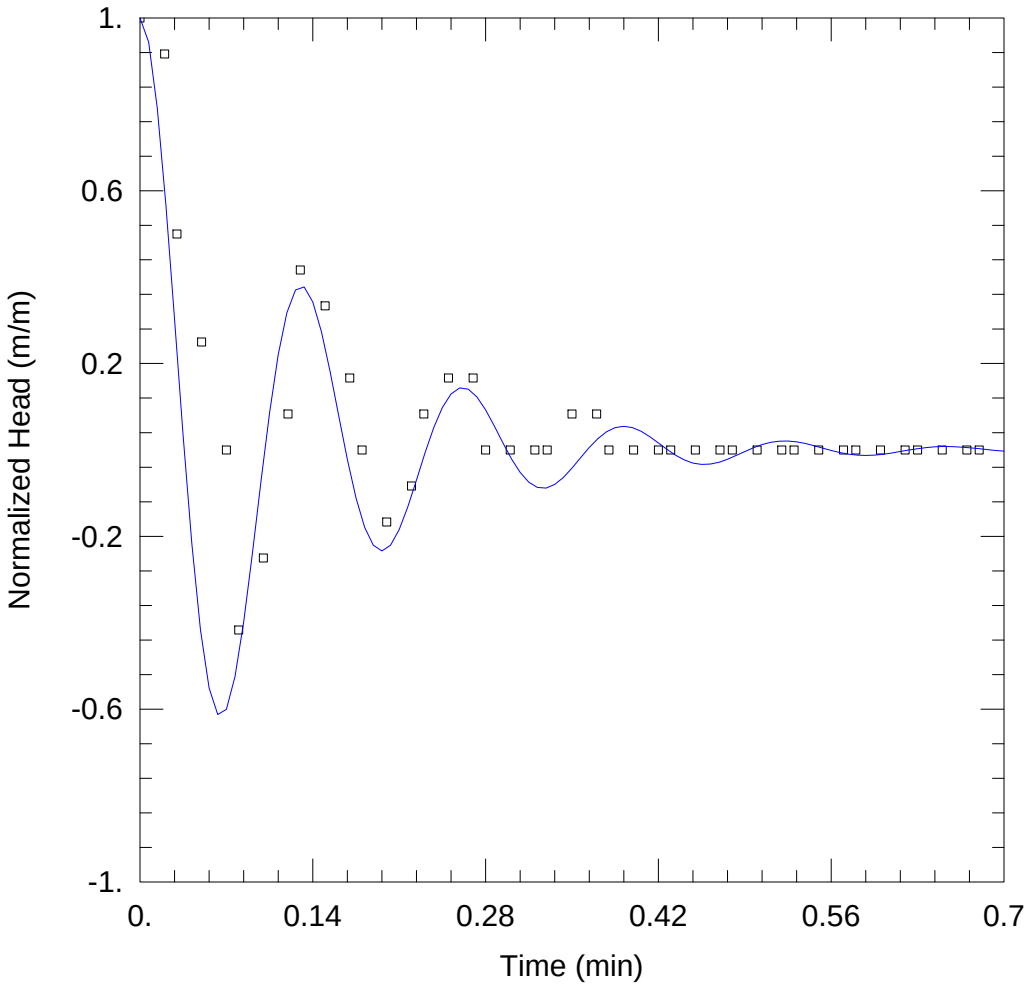
WELL DATA (HCM-6)

Initial Displacement: 0.196 m
Total Well Penetration Depth: 27.24 m
Casing Radius: 0.025 m
Static Water Column Height: 27.24 m
Screen Length: 18. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 21.94 m/day
Le = 12.66 m



WELL TEST ANALYSIS

Data Set: \...\HCM-6_slug_out_1.aqt
Date: 01/16/18 Time: 14:41:28

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-6
Test Date: 2/11/2017

AQUIFER DATA

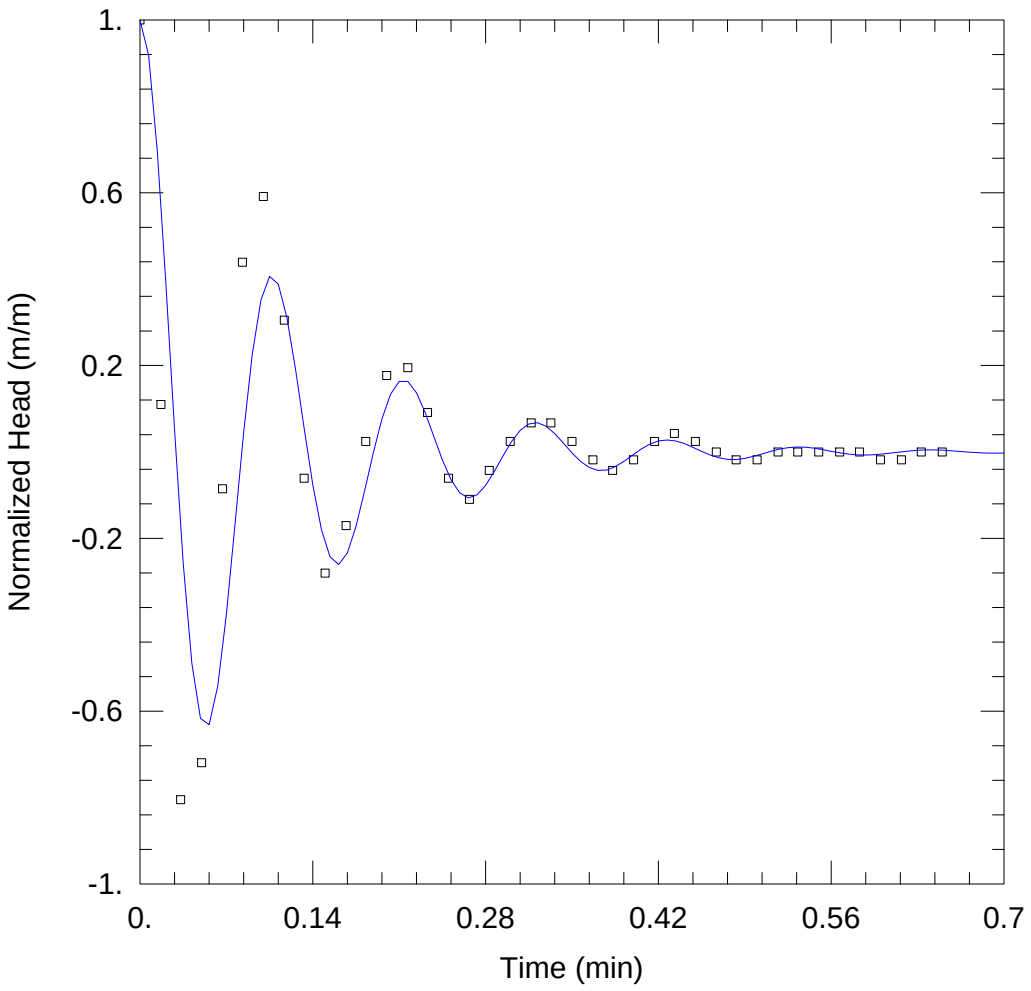
Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-6)

Initial Displacement: 0.12 m Static Water Column Height: 27.24 m
Total Well Penetration Depth: 27.24 m Screen Length: 18. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 18.96 m/day Le = 14.9 m



WELL TEST ANALYSIS

Data Set: \...\HCM-6_slug_out_2.aqt
Date: 01/16/18 Time: 14:41:41

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-6
Test Date: 2/11/2017

AQUIFER DATA

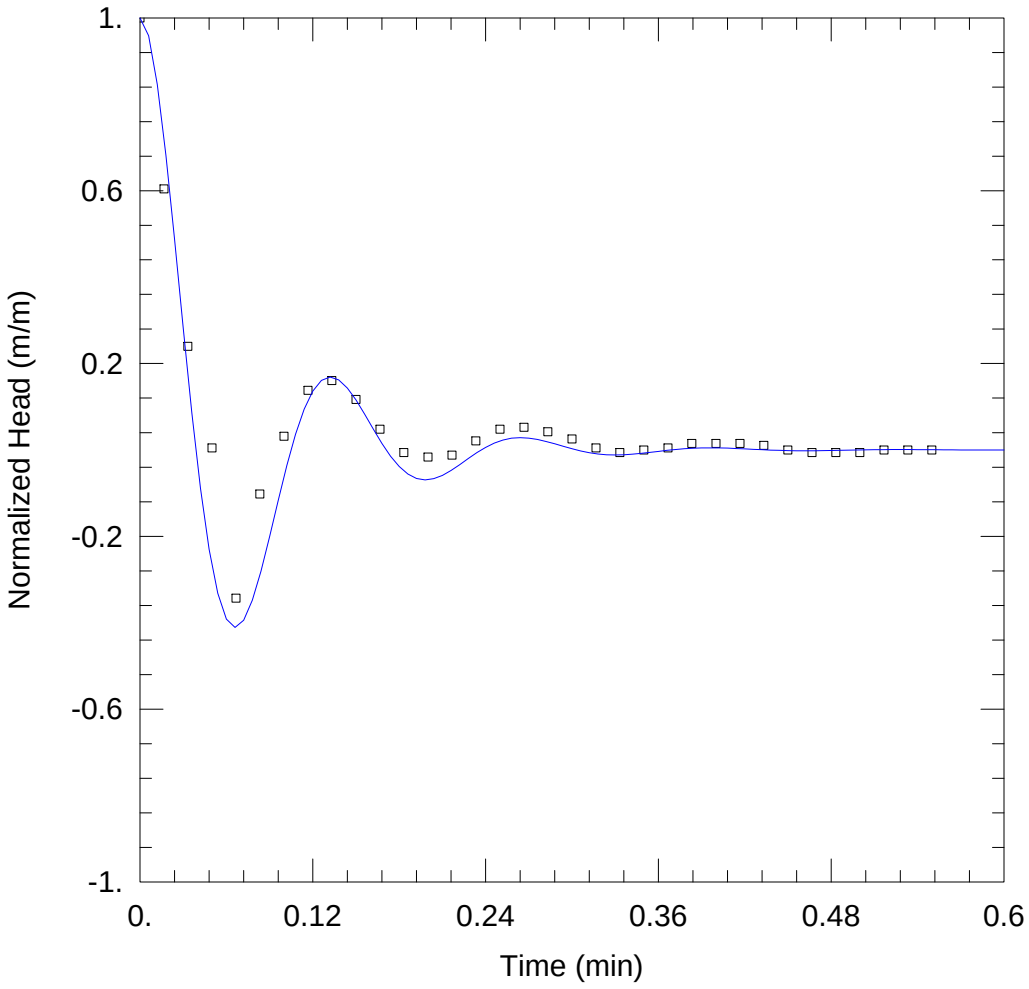
Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-6)

Initial Displacement: 0.164 m Static Water Column Height: 27.24 m
Total Well Penetration Depth: 27.24 m Screen Length: 18. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 25.85 m/day Le = 9.984 m



WELL TEST ANALYSIS

Data Set: \...\HCM-7_slug_in_1.aqt
Date: 01/16/18 Time: 14:41:57

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-7
Test Date: 1/11/2017

AQUIFER DATA

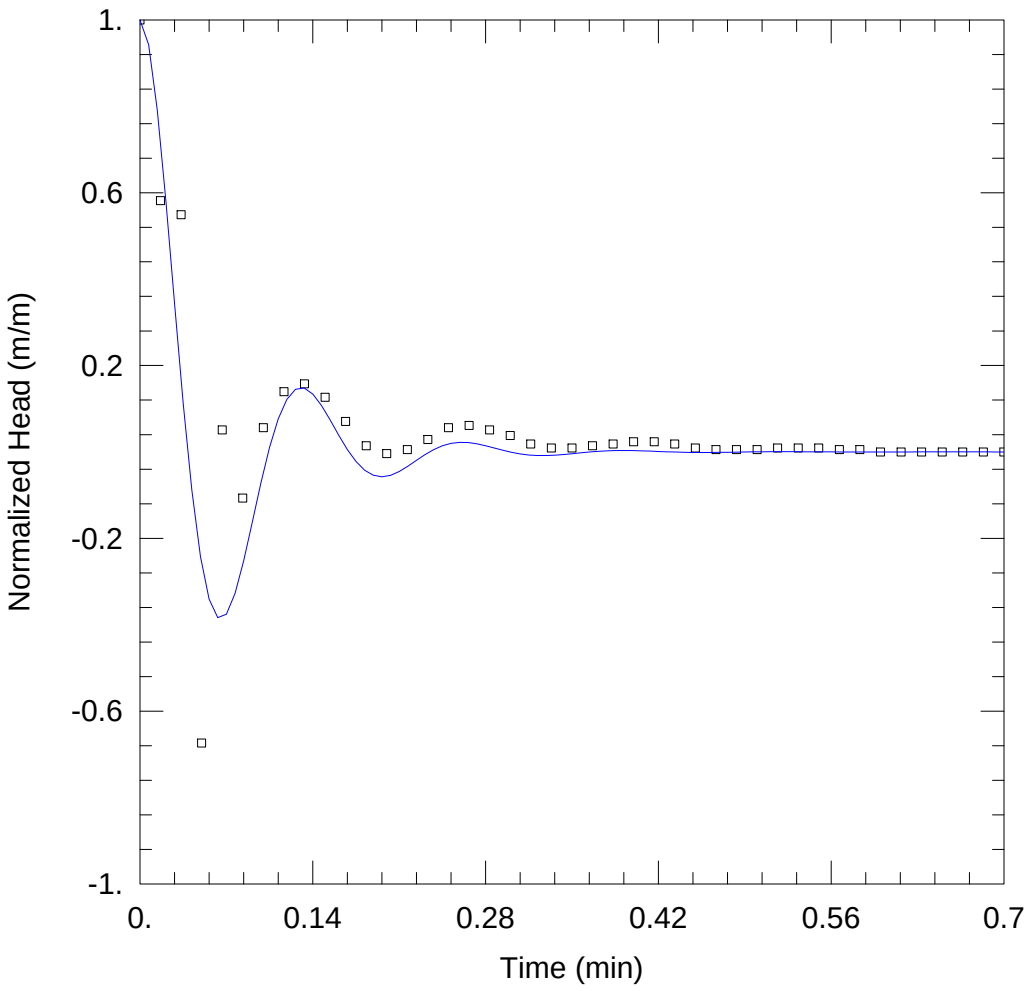
Saturated Thickness: 3. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-7)

Initial Displacement: 0.667 m Static Water Column Height: 26.52 m
Total Well Penetration Depth: 26.52 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 41.37 m/day Le = 14.45 m



WELL TEST ANALYSIS

Data Set: \...\HCM-7_slug_in_2.aqt
Date: 01/16/18 Time: 14:42:14

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-7
Test Date: 1/11/2017

AQUIFER DATA

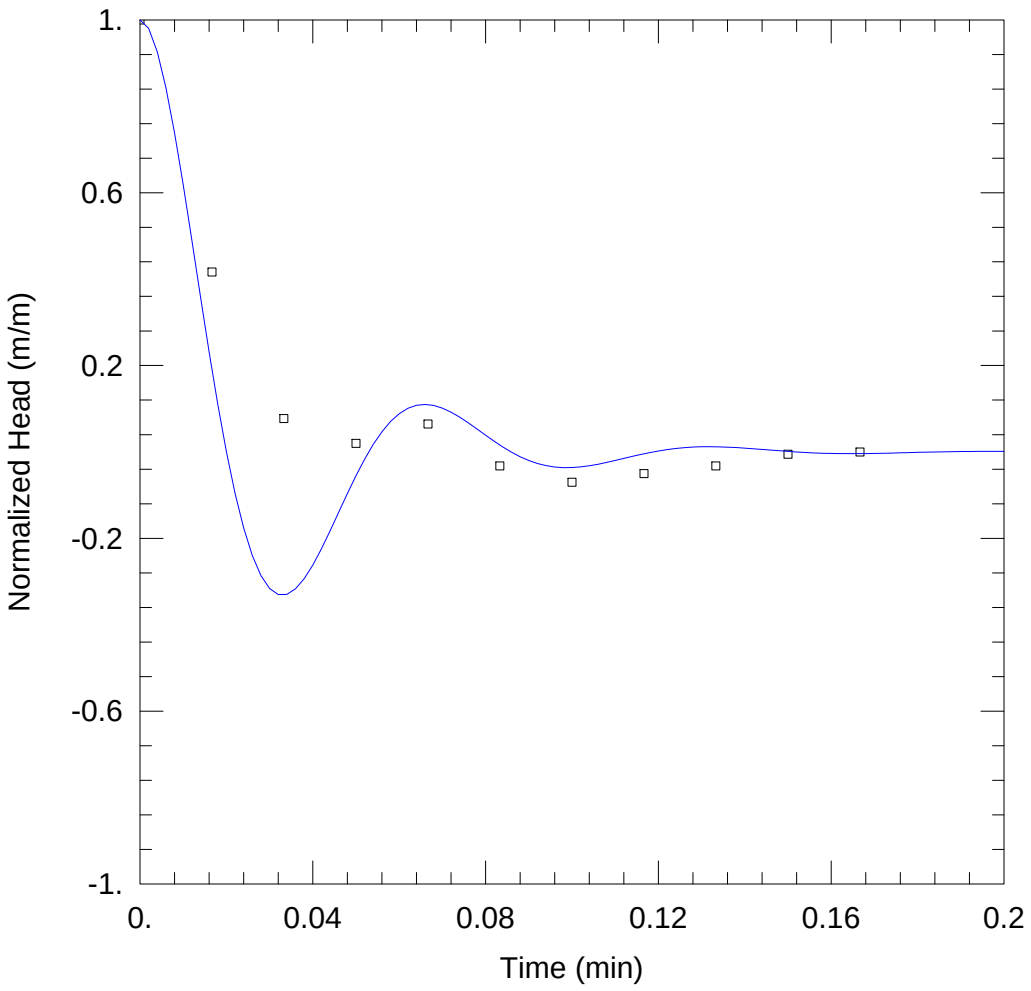
Saturated Thickness: 3. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-7)

Initial Displacement: 0.767 m Static Water Column Height: 26.52 m
Total Well Penetration Depth: 26.52 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 39.34 m/day Le = 13.96 m



WELL TEST ANALYSIS

Data Set: \...\HCM-8_slug_in_1.aqt
Date: 01/16/18 Time: 14:43:20

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-8
Test Date: 2/11/2017

AQUIFER DATA

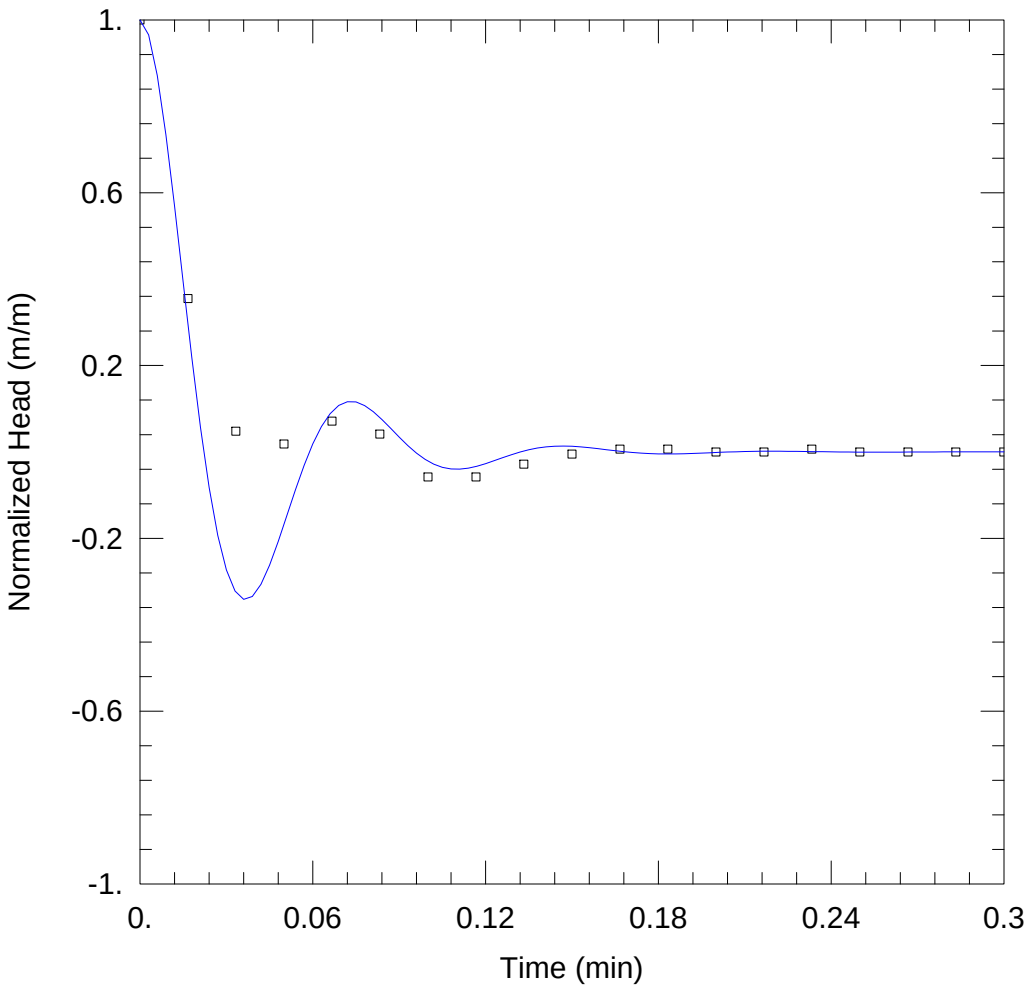
Saturated Thickness: 12. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-8)

Initial Displacement: 0.557 m Static Water Column Height: 19.66 m
Total Well Penetration Depth: 19.66 m Screen Length: 12. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 16.65 m/day Le = 3.454 m



WELL TEST ANALYSIS

Data Set: \...\HCM-8_slug_in_2.aqt
Date: 01/16/18 Time: 14:43:37

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-8
Test Date: 2/11/2017

AQUIFER DATA

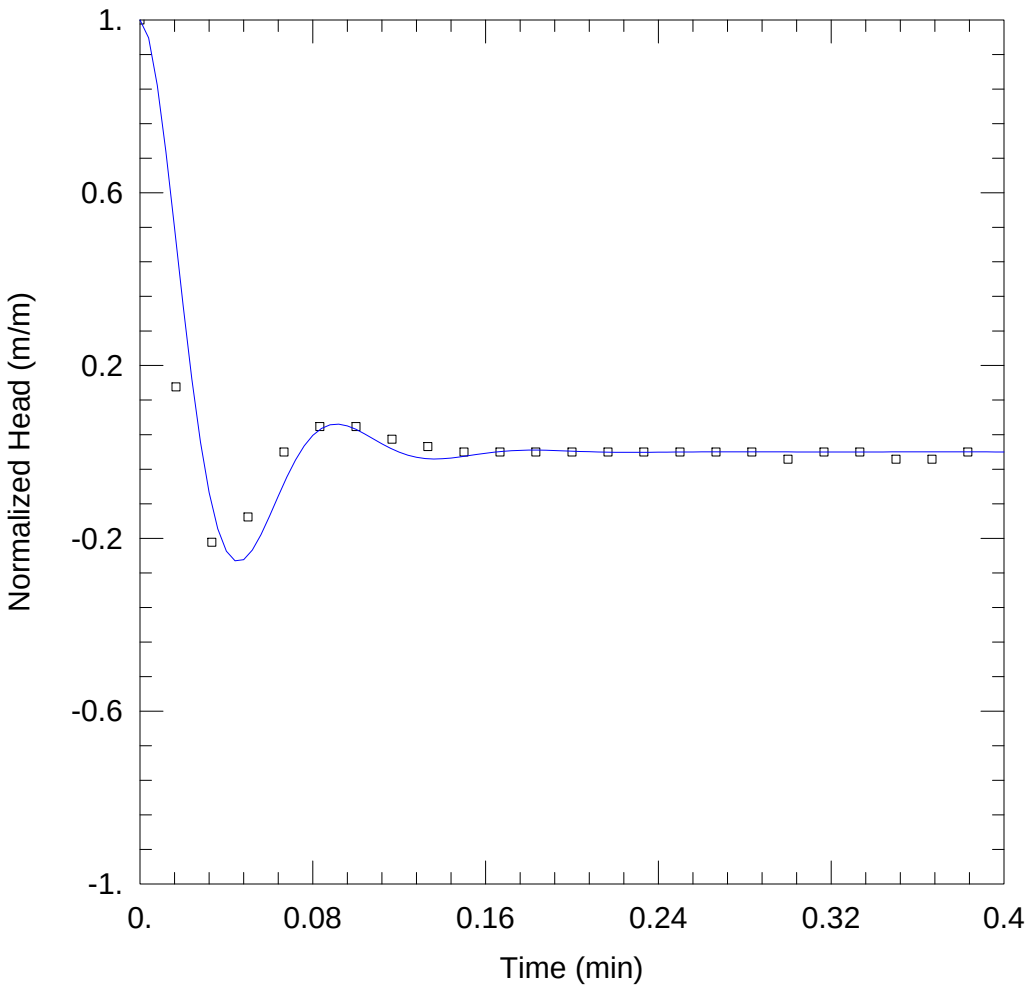
Saturated Thickness: 12. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-8)

Initial Displacement: 0.603 m Static Water Column Height: 19.66 m
Total Well Penetration Depth: 19.66 m Screen Length: 12. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 15.2 m/day Le = 4.302 m



WELL TEST ANALYSIS

Data Set: \...\HCM-8_slug_out_1.aqt
Date: 01/16/18 Time: 14:43:49

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-8
Test Date: 2/11/2017

AQUIFER DATA

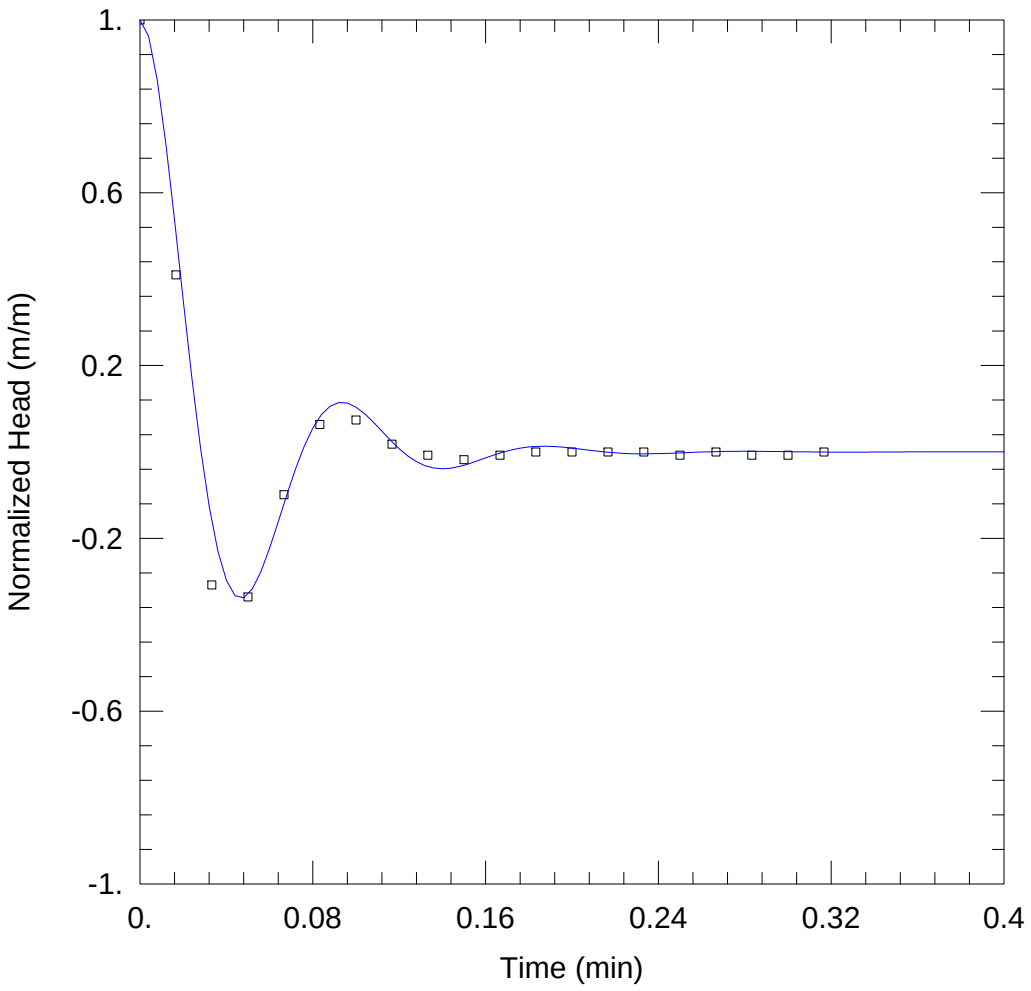
Saturated Thickness: 12. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-8)

Initial Displacement: 0.239 m Static Water Column Height: 19.66 m
Total Well Penetration Depth: 19.66 m Screen Length: 12. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 9.987 m/day Le = 6.215 m



WELL TEST ANALYSIS

Data Set: \...\HCM-8_slug_out_2.aqt
Date: 01/16/18 Time: 14:44:00

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-8
Test Date: 2/11/2017

AQUIFER DATA

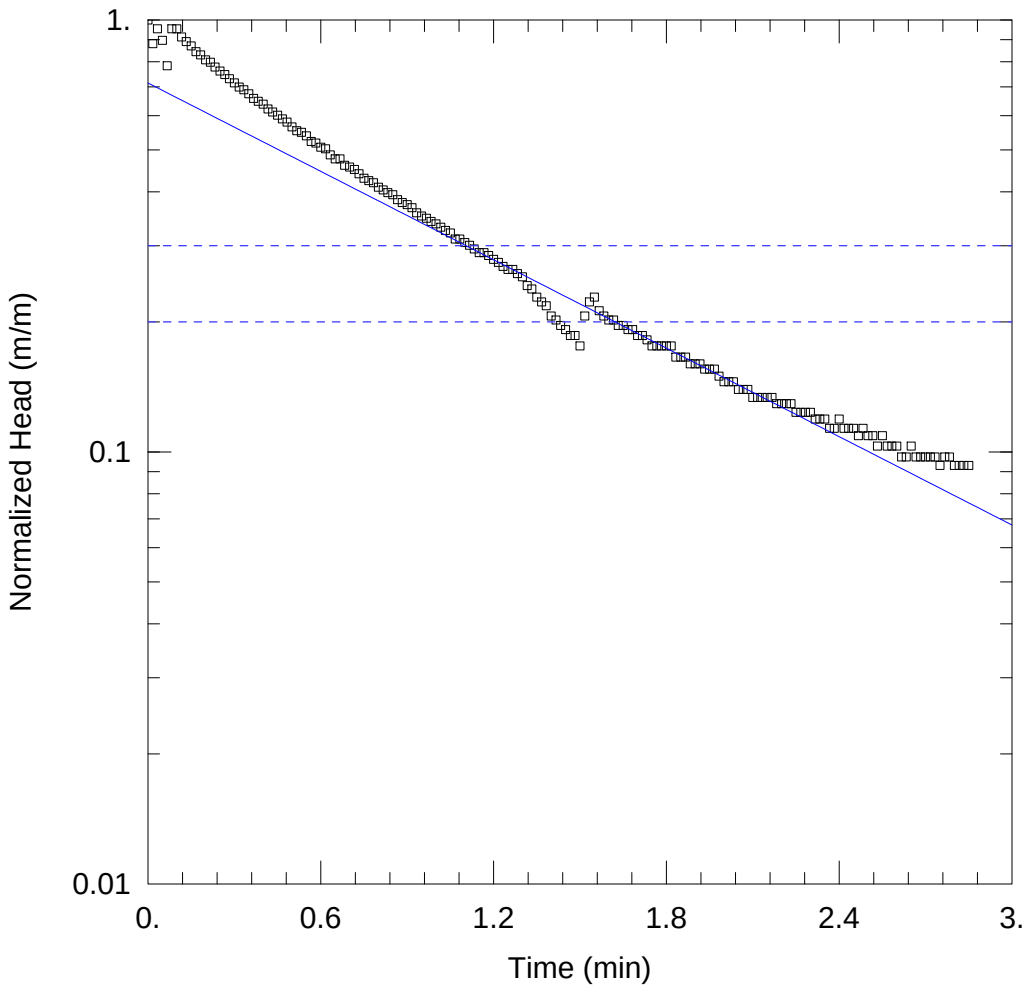
Saturated Thickness: 12. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-8)

Initial Displacement: 0.393 m Static Water Column Height: 19.66 m
Total Well Penetration Depth: 19.66 m Screen Length: 12. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 11.68 m/day Le = 6.973 m



WELL TEST ANALYSIS

Data Set: \...\HCM-9_slug_in_1_B&R.aqt
Date: 01/16/18 Time: 14:44:53

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-9
Test Date: 2/11/2017

AQUIFER DATA

Saturated Thickness: 8. m Anisotropy Ratio (Kz/Kr): 0.1

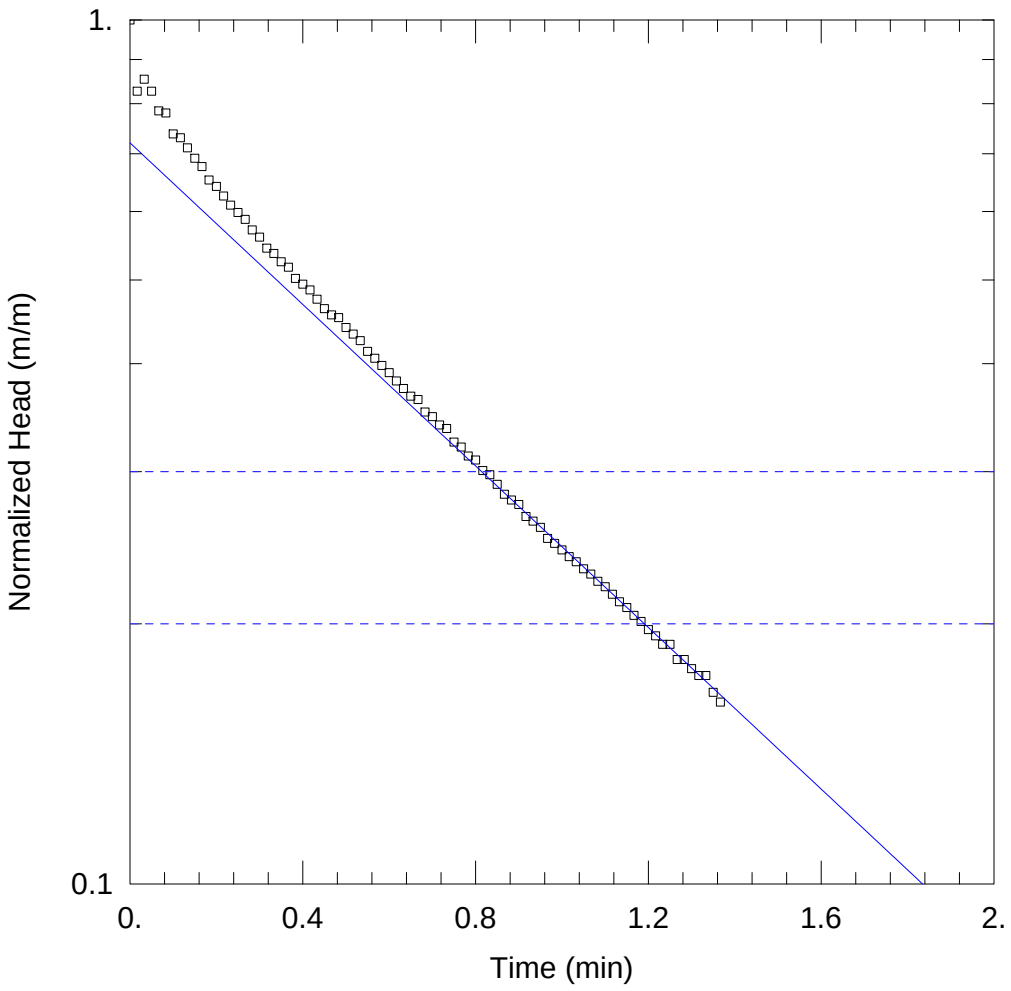
WELL DATA (HCM-9)

Initial Displacement: 0.688 m
Total Well Penetration Depth: 28.47 m
Casing Radius: 0.025 m
Static Water Column Height: 28.47 m
Screen Length: 6. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.2004 m/day y0 = 0.4916 m



WELL TEST ANALYSIS

Data Set: \...\HCM-9_slug_out_1_B&R.aqt
Date: 01/16/18 Time: 14:45:26

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-9
Test Date: 2/11/2017

AQUIFER DATA

Saturated Thickness: 8. m Anisotropy Ratio (Kz/Kr): 0.1

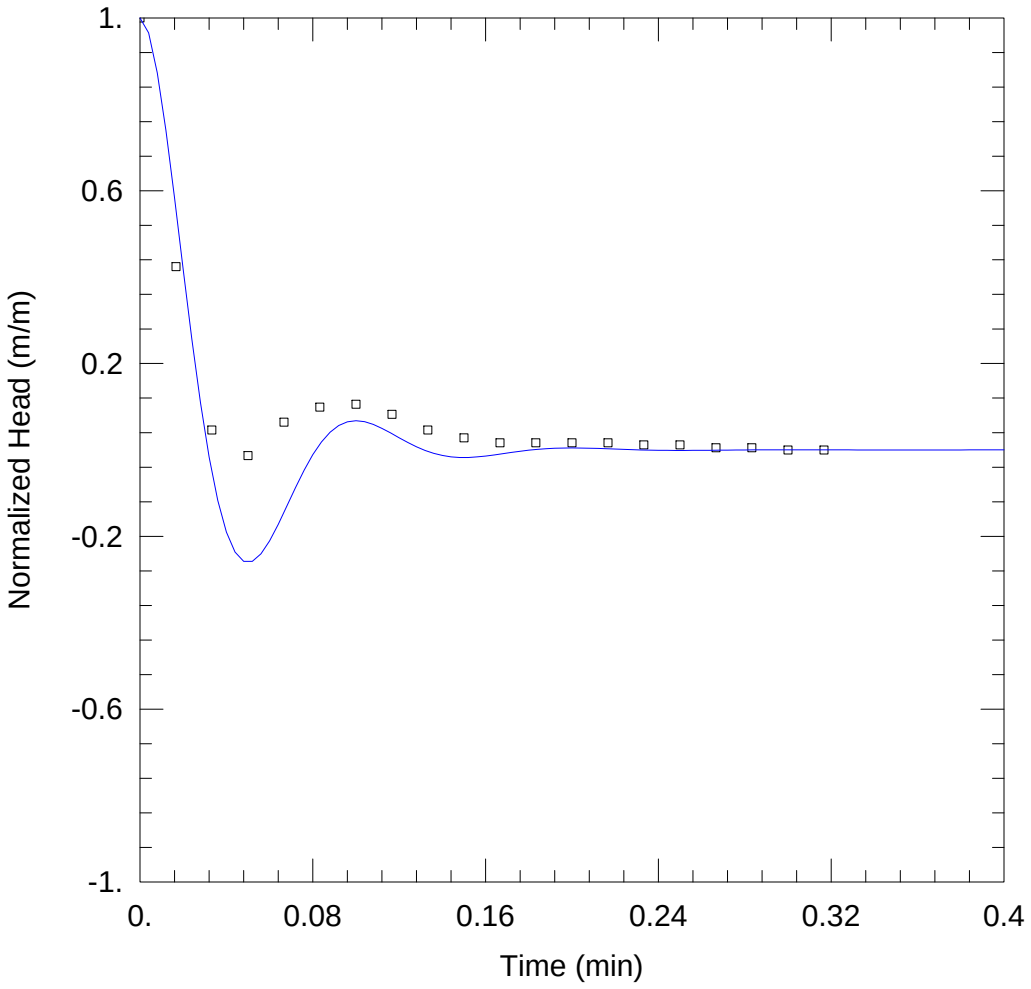
WELL DATA (HCM-9)

Initial Displacement: 0.924 m
Total Well Penetration Depth: 28.47 m
Casing Radius: 0.025 m
Static Water Column Height: 28.47 m
Screen Length: 6. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.2746 m/day y0 = 0.6658 m



WELL TEST ANALYSIS

Data Set: \...\HCM-10_slug_in_1.aqt
Date: 01/16/18 Time: 14:45:51

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-10
Test Date: 2/11/2017

AQUIFER DATA

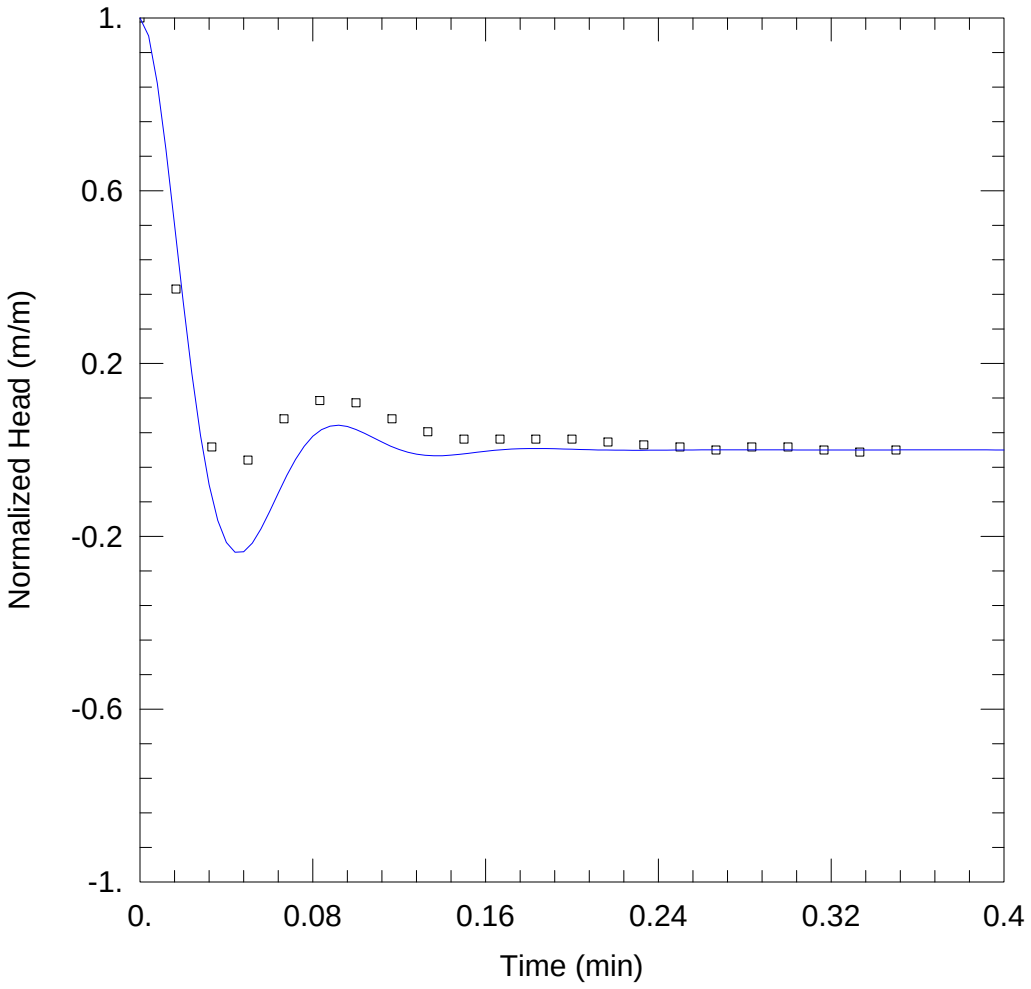
Saturated Thickness: 25. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-10)

Initial Displacement: 0.606 m Static Water Column Height: 32.85 m
Total Well Penetration Depth: 32.85 m Screen Length: 24. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 7.64 m/day Le = 7.546 m



WELL TEST ANALYSIS

Data Set: \...\HCM-10_slug_in_2.aqt
Date: 01/16/18 Time: 14:46:02

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-10
Test Date: 2/11/2017

AQUIFER DATA

Saturated Thickness: 25. m Anisotropy Ratio (Kz/Kr): 0.1

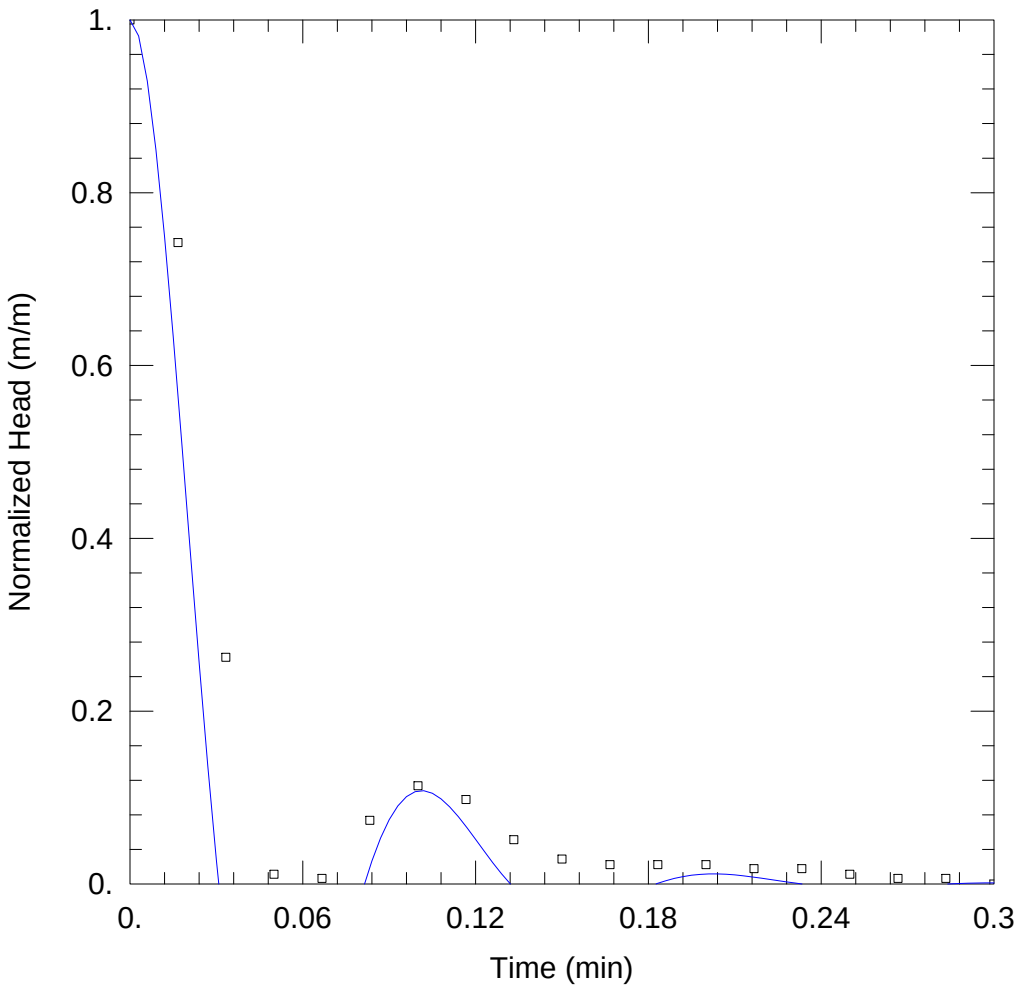
WELL DATA (HCM-10)

Initial Displacement: 0.596 m
Total Well Penetration Depth: 32.85 m
Casing Radius: 0.025 m
Static Water Column Height: 32.85 m
Screen Length: 24. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 8.037 m/day Le = 6.19 m



WELL TEST ANALYSIS

Data Set: \...\HCM-10_slug_out_1.aqt
Date: 01/16/18 Time: 14:46:30

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-10
Test Date: 2/11/2017

AQUIFER DATA

Saturated Thickness: 25. m Anisotropy Ratio (Kz/Kr): 0.1

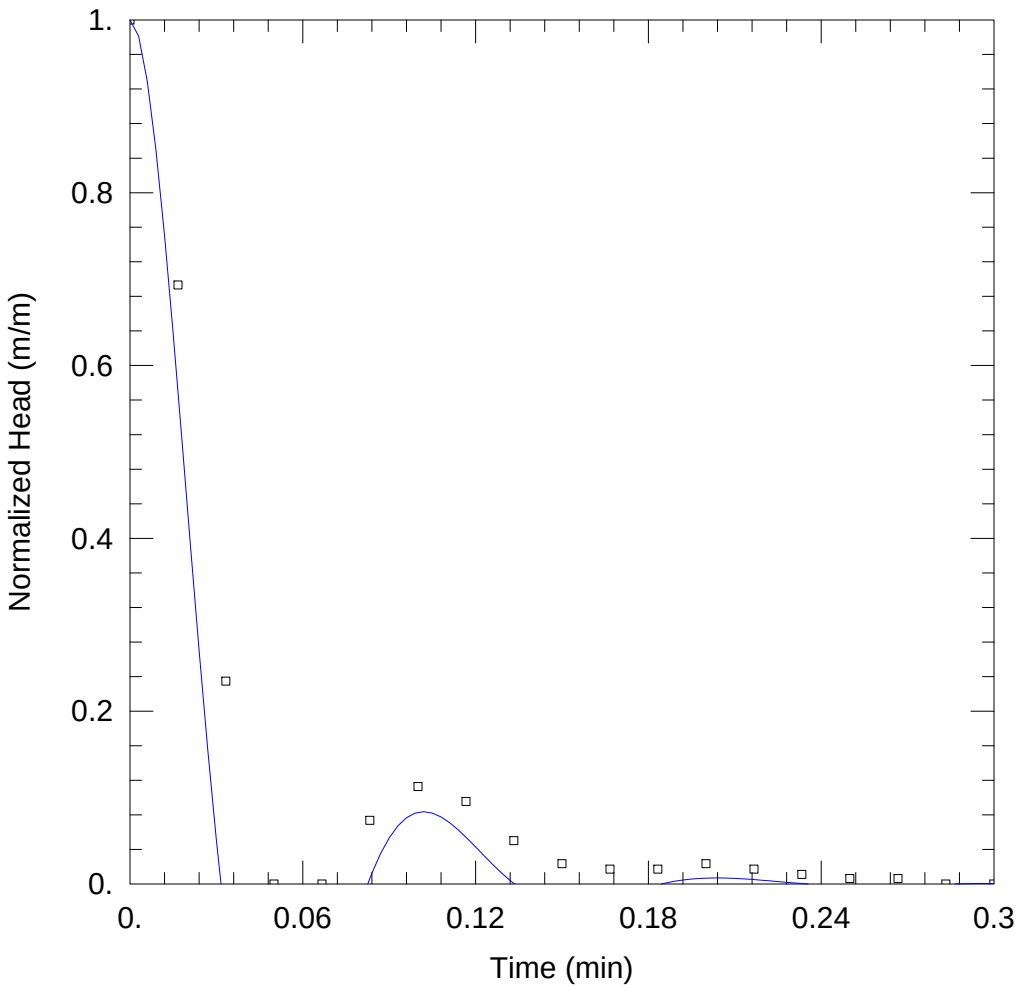
WELL DATA (HCM-10)

Initial Displacement: 0.625 m
Total Well Penetration Depth: 32.85 m
Casing Radius: 0.025 m
Static Water Column Height: 32.85 m
Screen Length: 24. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 8.739 m/day Le = 8.146 m



WELL TEST ANALYSIS

Data Set: \...\HCM-10_slug_out_2.aqt
Date: 01/16/18 Time: 14:46:49

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-10
Test Date: 2/11/2017

AQUIFER DATA

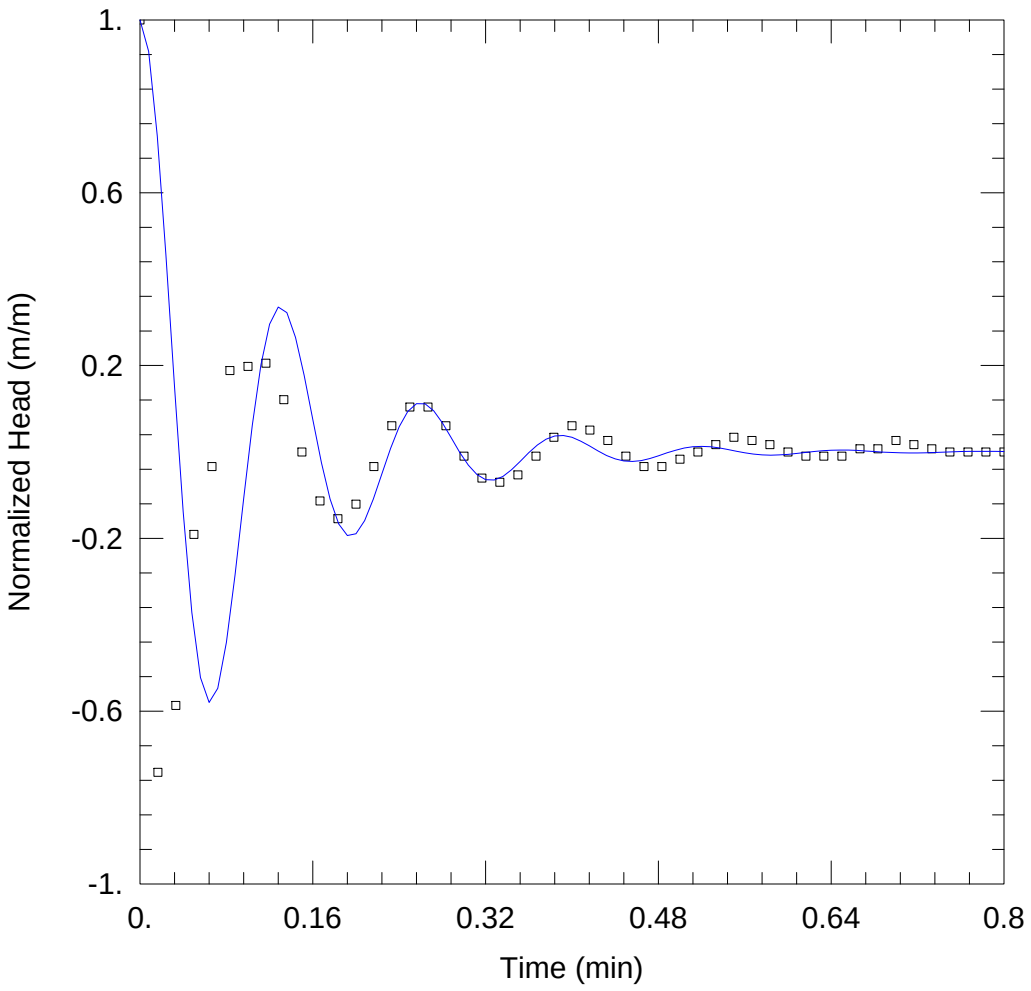
Saturated Thickness: 25. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-10)

Initial Displacement: 0.639 m Static Water Column Height: 32.85 m
Total Well Penetration Depth: 32.85 m Screen Length: 24. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 7.953 m/day Le = 8.036 m



WELL TEST ANALYSIS

Data Set: \...\HCM-11_slug_in_1.aqt
Date: 01/16/18 Time: 14:47:13

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-11
Test Date: 2/11/2017

AQUIFER DATA

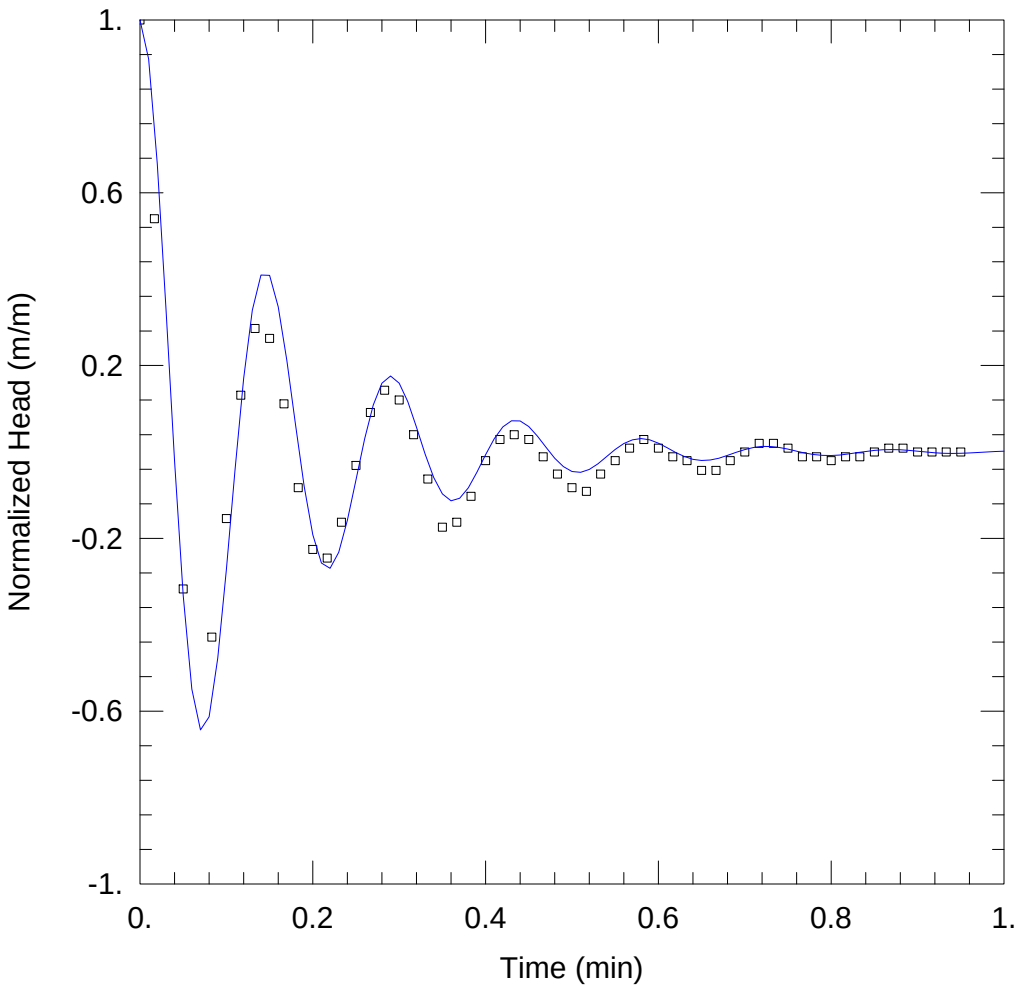
Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-11)

Initial Displacement: 0.414 m Static Water Column Height: 24.66 m
Total Well Penetration Depth: 24.66 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 47.05 m/day Le = 14.65 m



WELL TEST ANALYSIS

Data Set: \...\HCM-11_slug_in_2.aqt
Date: 01/16/18 Time: 14:47:24

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-11
Test Date: 2/11/2017

AQUIFER DATA

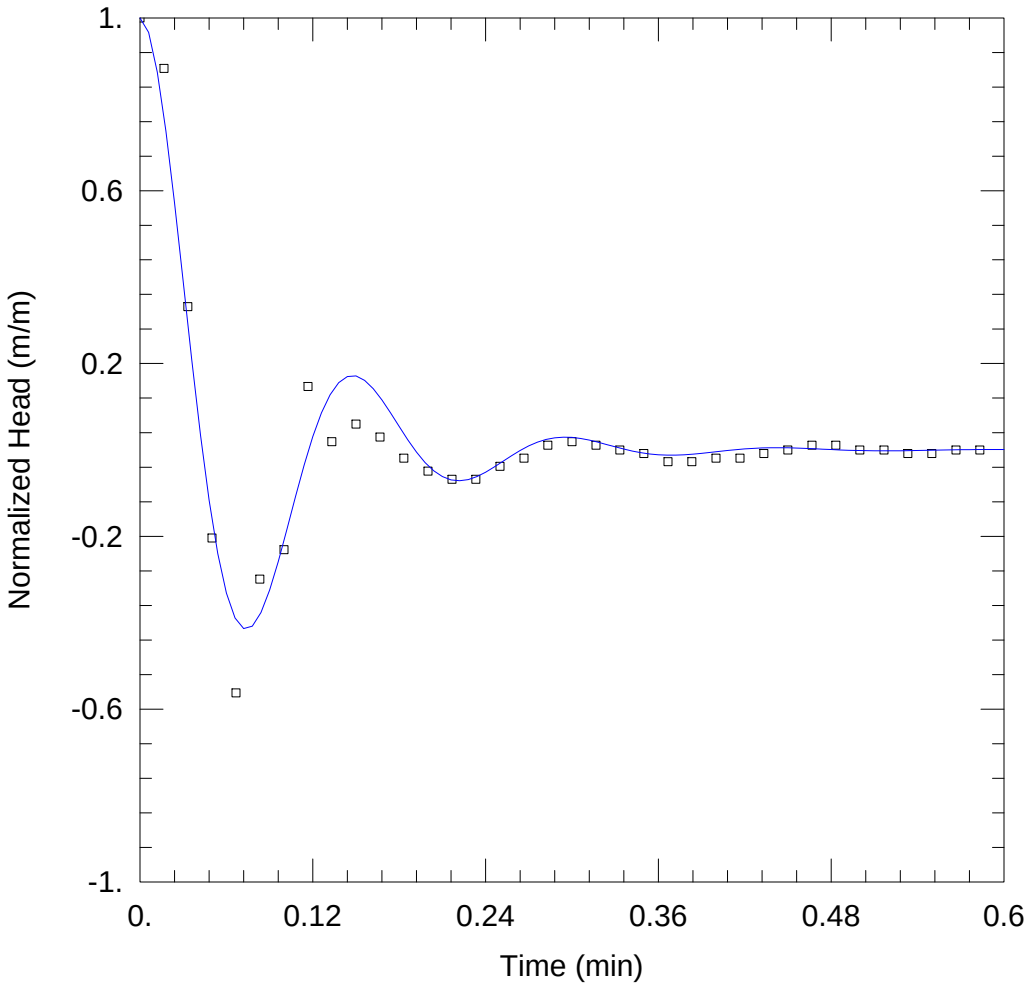
Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-11)

Initial Displacement: 0.35 m Static Water Column Height: 24.66 m
Total Well Penetration Depth: 24.66 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 53.19 m/day Le = 18.42 m



WELL TEST ANALYSIS

Data Set: \...\HCM-11_slug_out_1.aqt
Date: 01/16/18 Time: 14:47:35

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-11
Test Date: 2/11/2017

AQUIFER DATA

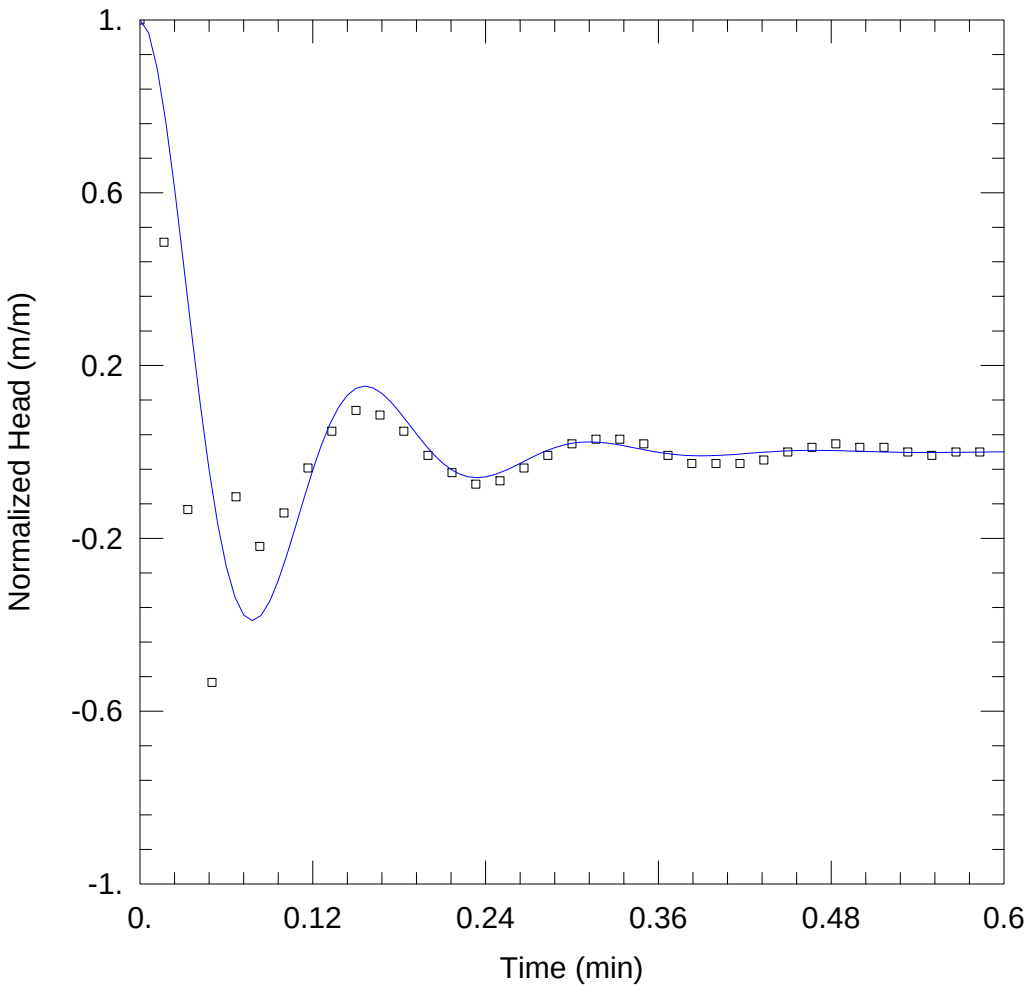
Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-11)

Initial Displacement: 0.368 m Static Water Column Height: 24.66 m
Total Well Penetration Depth: 24.66 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 25.02 m/day Le = 18.06 m



WELL TEST ANALYSIS

Data Set: \...\HCM-11_slug_out_2.aqt
Date: 01/16/18 Time: 14:48:54

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-11
Test Date: 2/11/2017

AQUIFER DATA

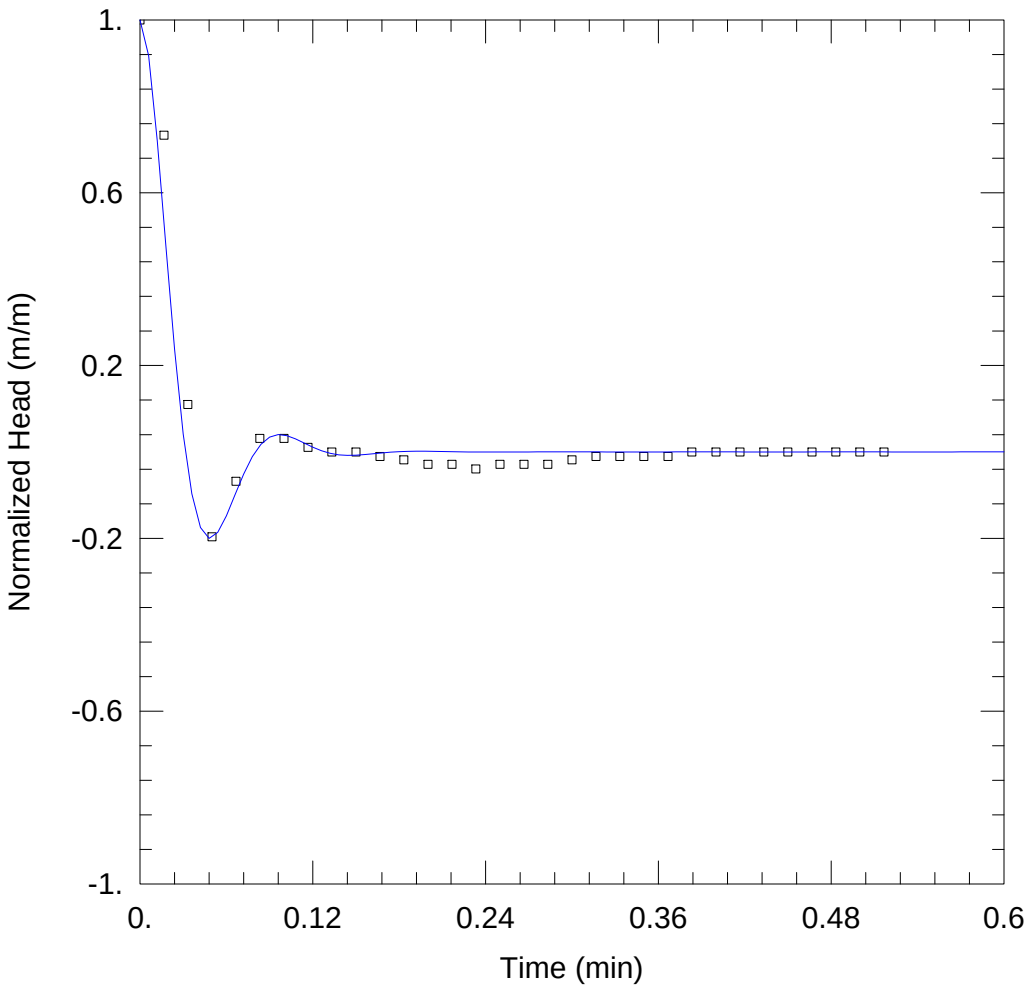
Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-11)

Initial Displacement: 0.375 m Static Water Column Height: 24.66 m
Total Well Penetration Depth: 24.66 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 22.15 m/day Le = 19.99 m



WELL TEST ANALYSIS

Data Set: \...\HCM-12_slug_in_1.aqt
Date: 01/16/18 Time: 14:49:11

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-12
Test Date: 2/11/2017

AQUIFER DATA

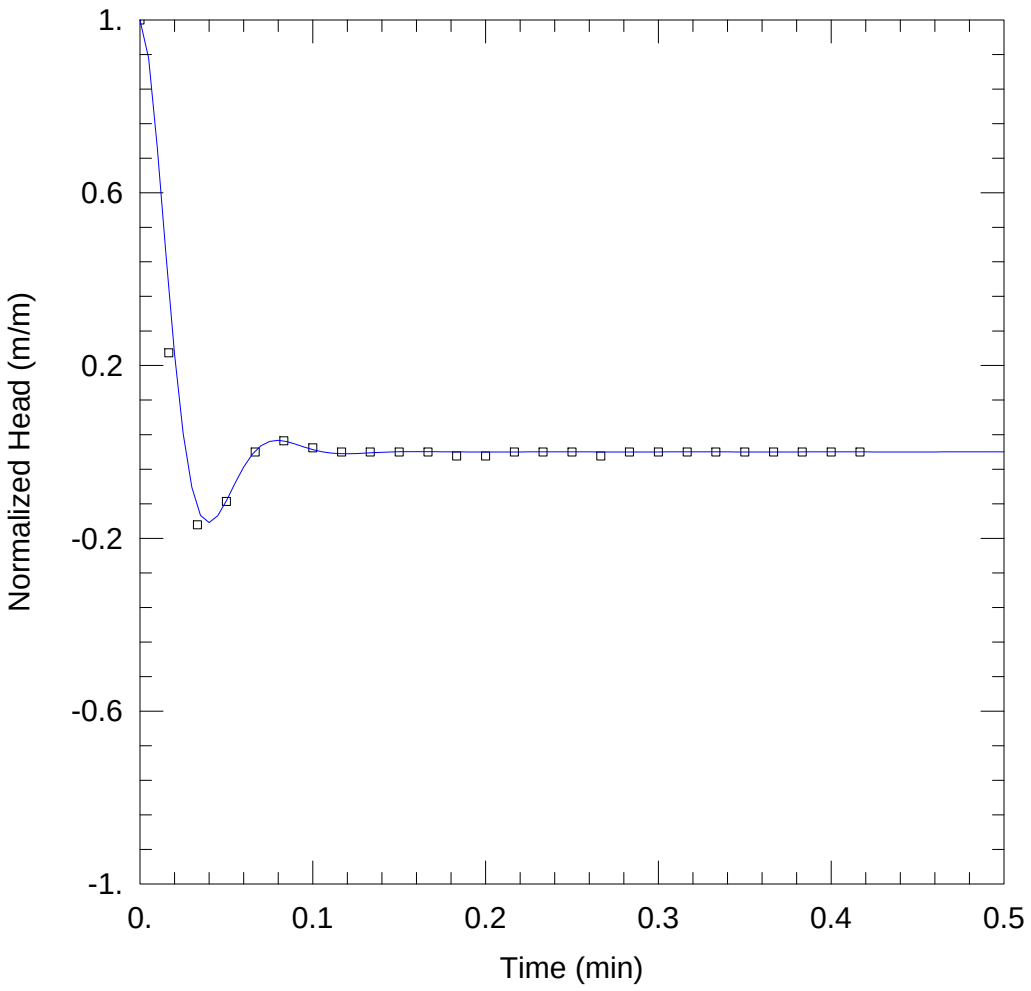
Saturated Thickness: 17.3 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-12)

Initial Displacement: 0.382 m Static Water Column Height: 21.38 m
Total Well Penetration Depth: 21.38 m Screen Length: 18. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 5.764 m/day Le = 6.662 m



WELL TEST ANALYSIS

Data Set: \...\HCM-12_slug_in_2.aqt
Date: 01/16/18 Time: 14:49:21

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-12
Test Date: 2/11/2017

AQUIFER DATA

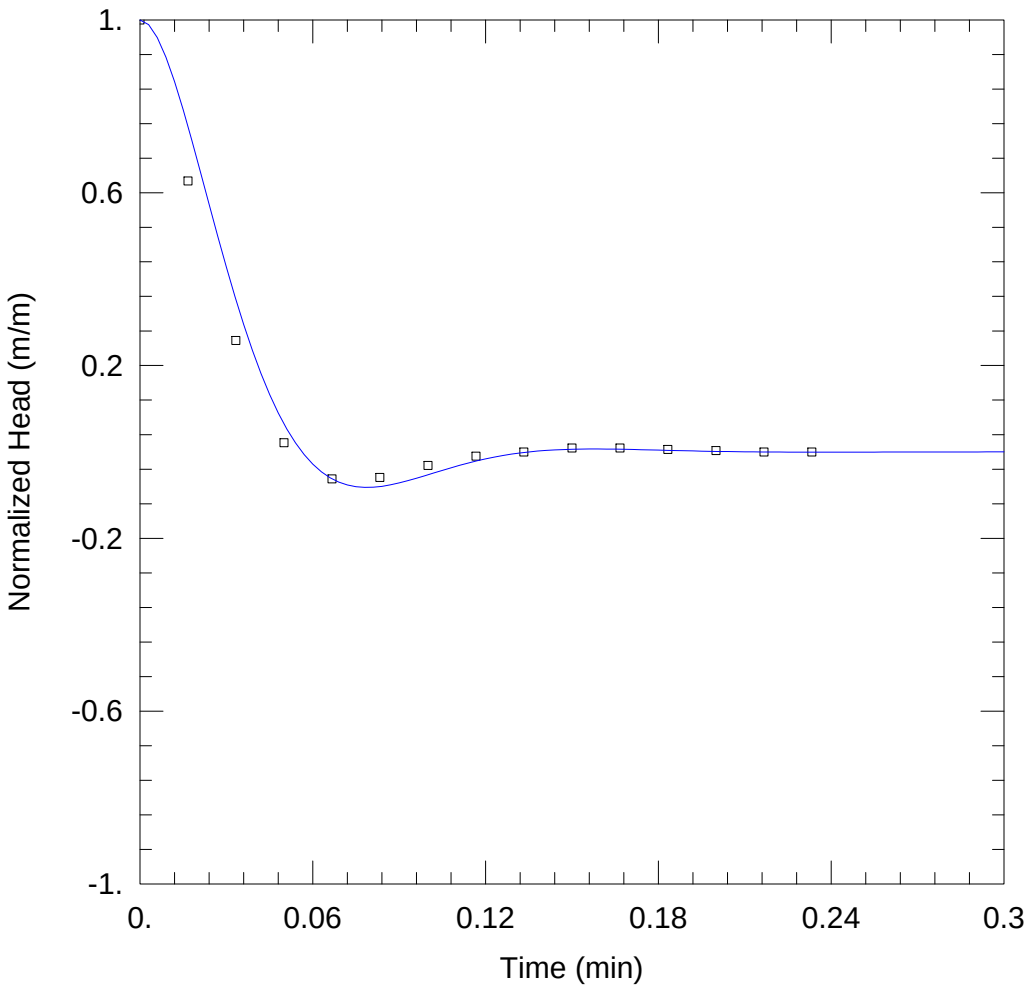
Saturated Thickness: 17.3 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-12)

Initial Displacement: 0.427 m Static Water Column Height: 21.38 m
Total Well Penetration Depth: 21.38 m Screen Length: 18. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 6.63 m/day Le = 4.229 m



WELL TEST ANALYSIS

Data Set: \...\HCM-13_slug_in_1.aqt
Date: 01/16/18 Time: 14:49:36

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-13
Test Date: 1/11/2017

AQUIFER DATA

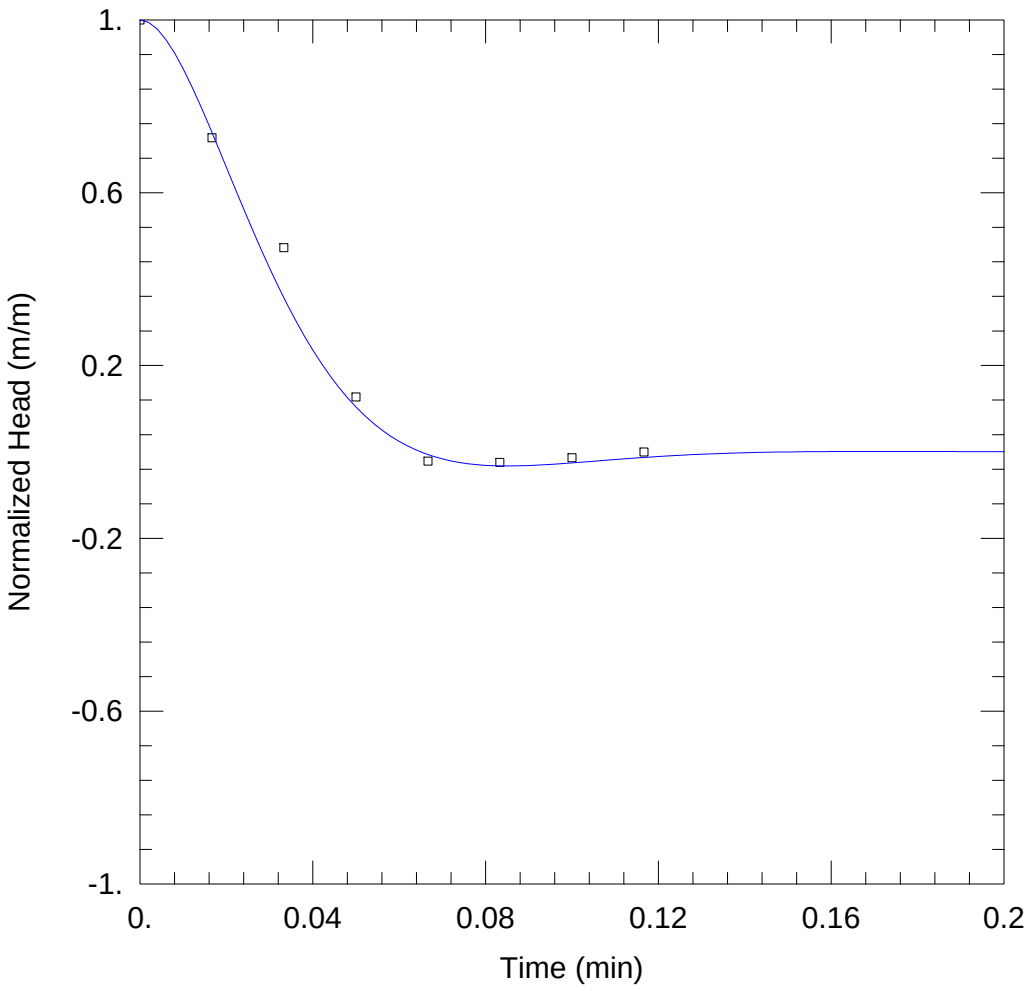
Saturated Thickness: 33.5 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-13)

Initial Displacement: 1.218 m Static Water Column Height: 37.38 m
Total Well Penetration Depth: 37.38 m Screen Length: 12. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 6.648 m/day Le = 13.62 m



WELL TEST ANALYSIS

Data Set: \...\HCM-13_slug_in_2.aqt
Date: 01/16/18 Time: 14:49:51

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-13
Test Date: 1/11/2017

AQUIFER DATA

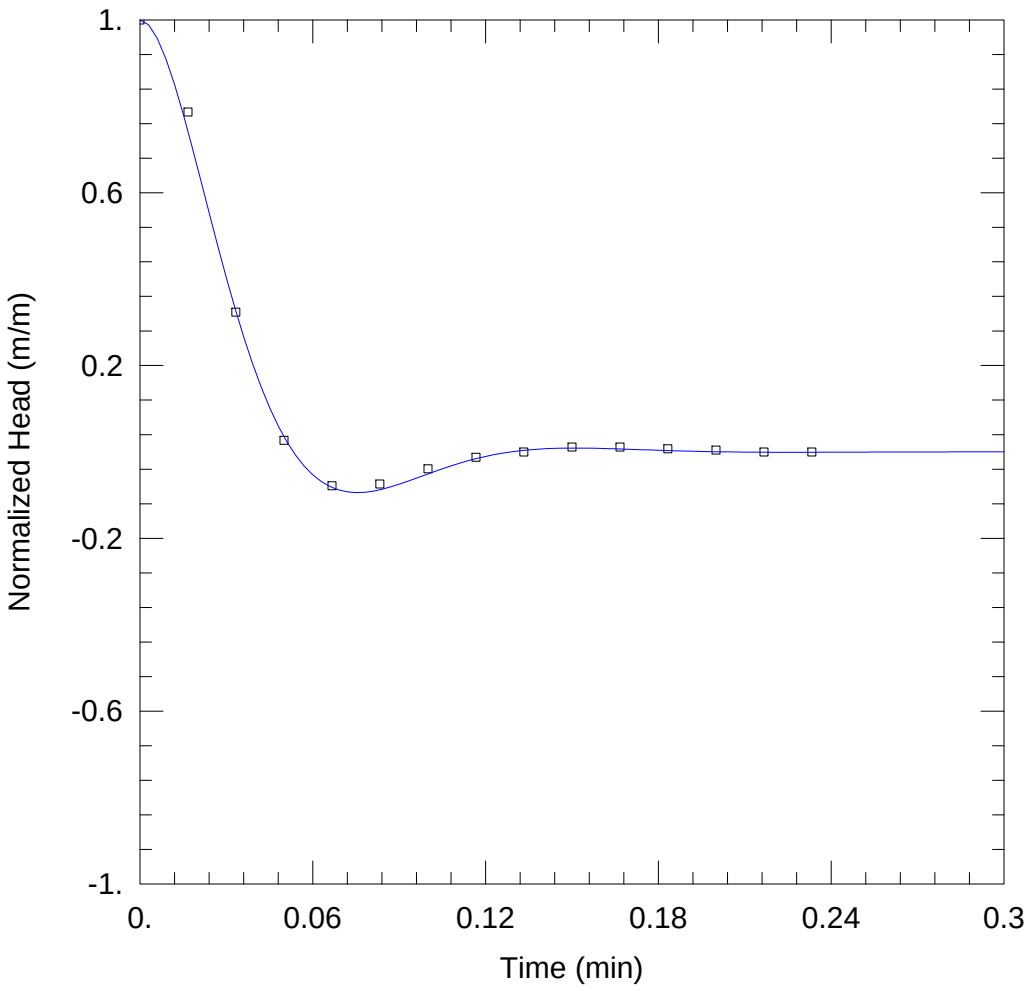
Saturated Thickness: 33.5 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-13)

Initial Displacement: 1.4 m Static Water Column Height: 37.38 m
Total Well Penetration Depth: 37.38 m Screen Length: 12. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 5.987 m/day Le = 11.84 m



WELL TEST ANALYSIS

Data Set: \...\HCM-14_slug_in_1.aqt
Date: 01/16/18 Time: 14:50:13

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-14
Test Date: 2/11/2017

AQUIFER DATA

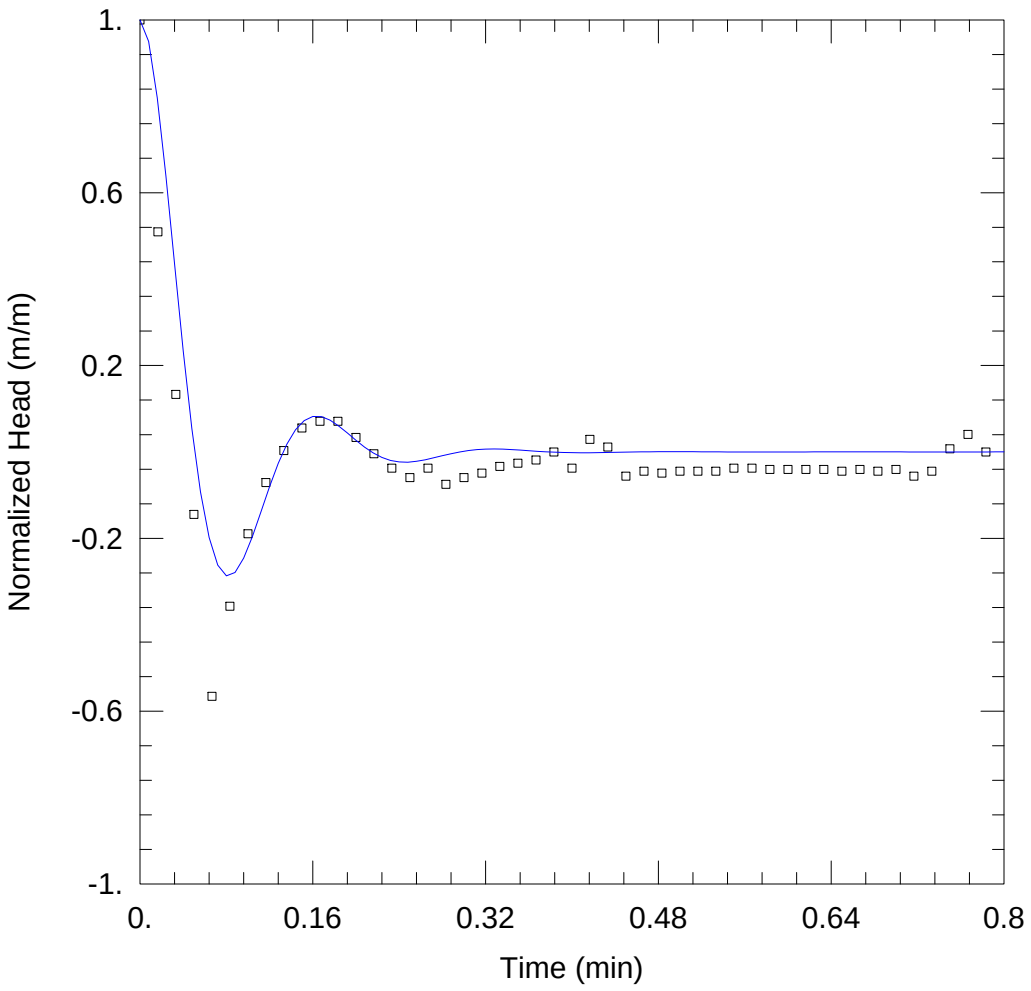
Saturated Thickness: 25.5 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-14)

Initial Displacement: 0.971 m Static Water Column Height: 42.46 m
Total Well Penetration Depth: 42.46 m Screen Length: 21. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 4.291 m/day Le = 13.02 m



WELL TEST ANALYSIS

Data Set: \...\HCM-14_slug_in_2.aqt
Date: 01/16/18 Time: 14:50:30

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-14
Test Date: 2/11/2017

AQUIFER DATA

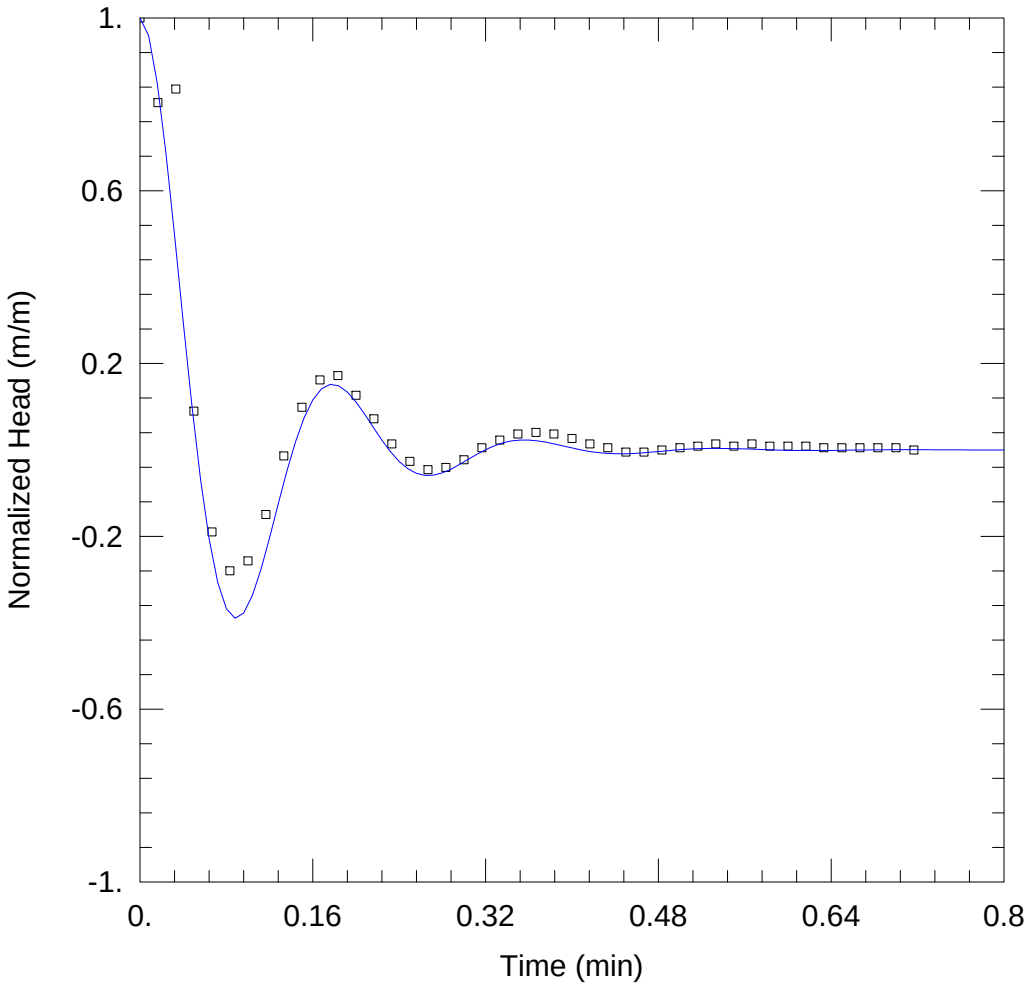
Saturated Thickness: 25.5 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-14)

Initial Displacement: 0.96 m Static Water Column Height: 42.46 m
Total Well Penetration Depth: 42.46 m Screen Length: 21. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 5.646 m/day Le = 20.68 m



WELL TEST ANALYSIS

Data Set: \...\HCM-14_slug_out_1.aqt
Date: 01/16/18 Time: 14:50:40

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-14
Test Date: 2/11/2017

AQUIFER DATA

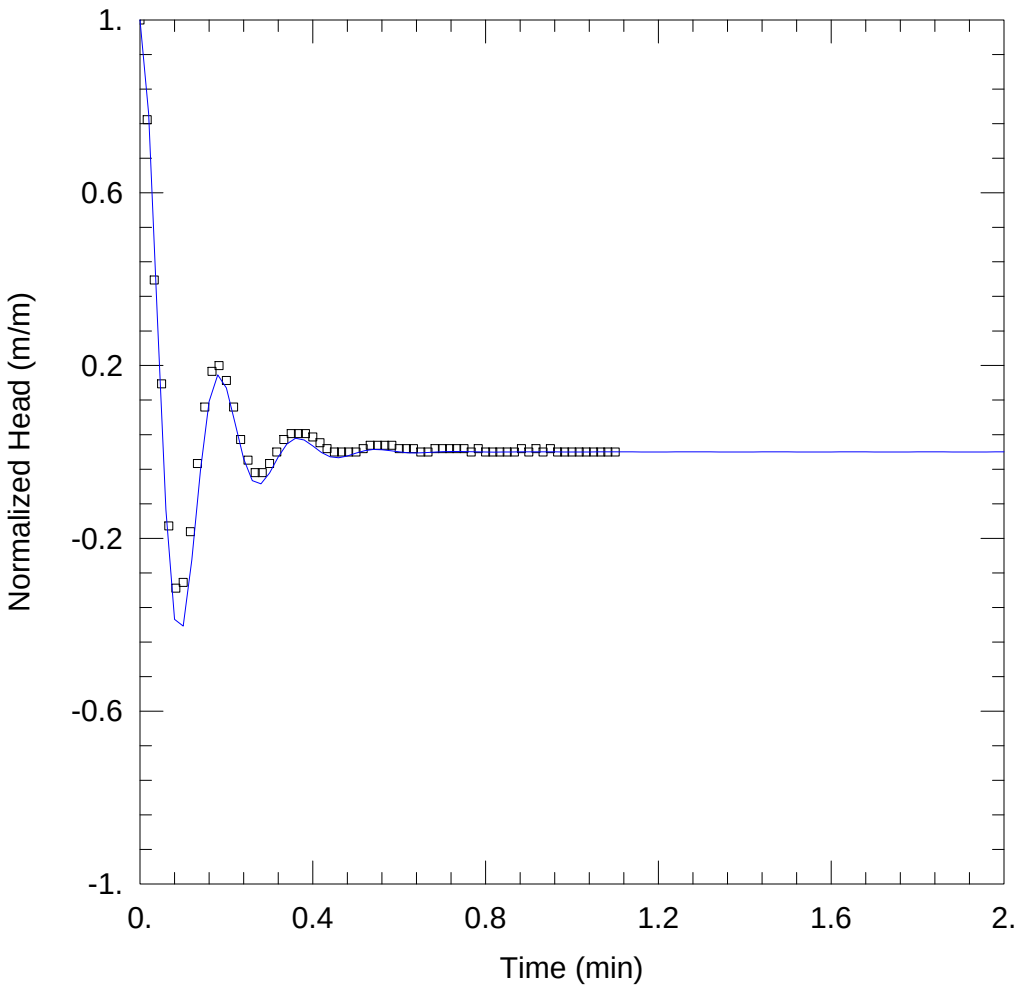
Saturated Thickness: 25.5 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-14)

Initial Displacement: 0.79 m Static Water Column Height: 42.46 m
Total Well Penetration Depth: 42.46 m Screen Length: 21. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 6.54 m/day Le = 25.97 m



WELL TEST ANALYSIS

Data Set: \...\HCM-14_slug_out_2.aqt
Date: 01/16/18 Time: 14:50:55

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-14
Test Date: 2/11/2017

AQUIFER DATA

Saturated Thickness: 25.5 m Anisotropy Ratio (Kz/Kr): 0.1

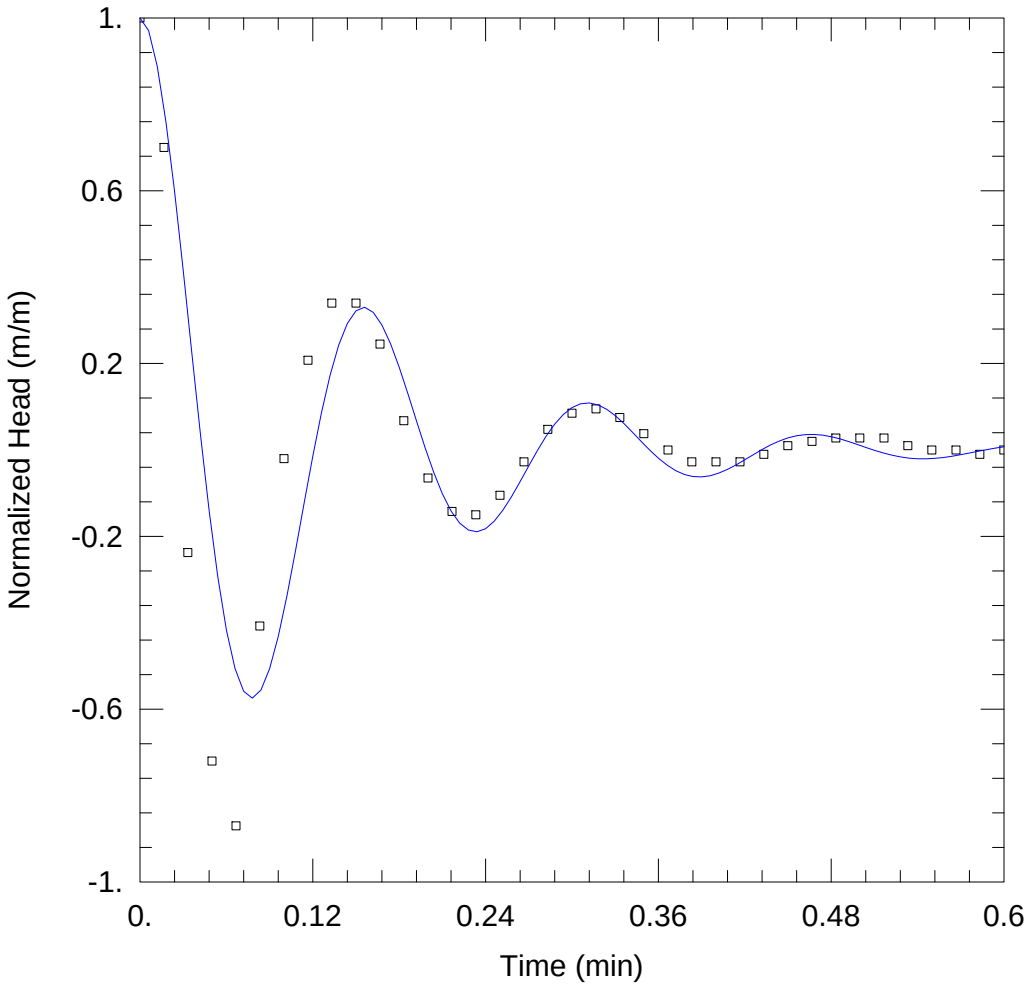
WELL DATA (HCM-14)

Initial Displacement: 0.52 m Static Water Column Height: 42.46 m
Total Well Penetration Depth: 42.46 m Screen Length: 21. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 6.924 m/day Le = 27.65 m



WELL TEST ANALYSIS

Data Set: \...\HCM-15_slug_in_1.aqt
Date: 01/16/18 Time: 14:51:12

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-15
Test Date: 1/11/2017

AQUIFER DATA

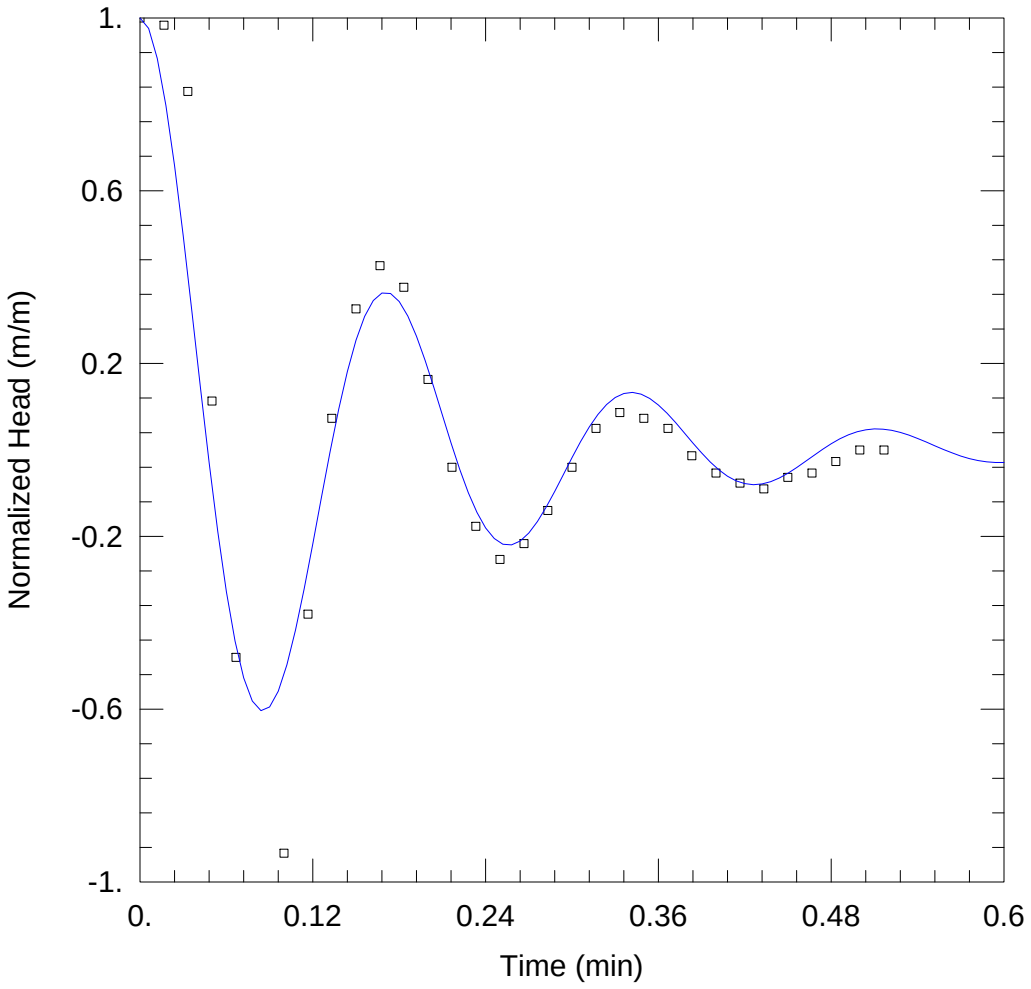
Saturated Thickness: 30. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-15)

Initial Displacement: 0.4 m Static Water Column Height: 38.48 m
Total Well Penetration Depth: 38.48 m Screen Length: 27. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 9.757 m/day Le = 20.93 m



WELL TEST ANALYSIS

Data Set: \...\HCM-15_slug_in_2.aqt
Date: 01/16/18 Time: 14:51:21

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-15
Test Date: 1/11/2017

AQUIFER DATA

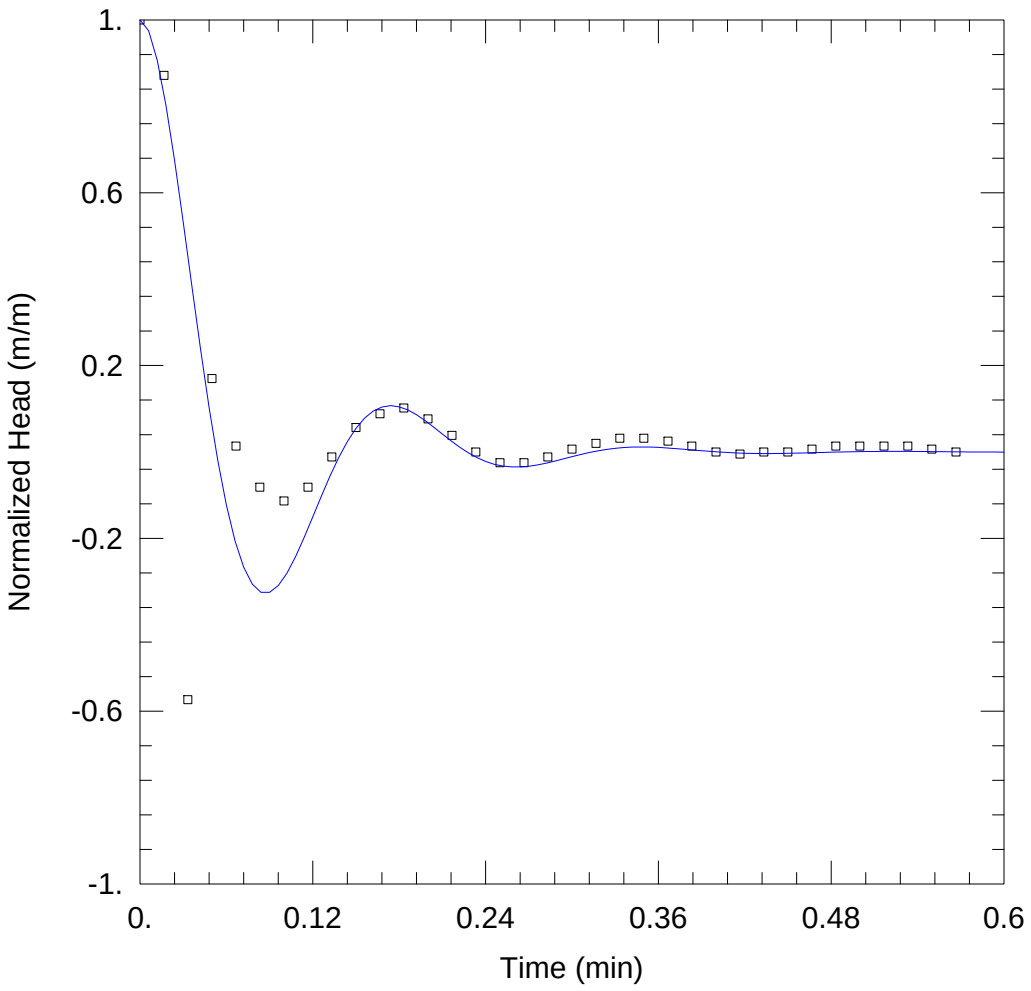
Saturated Thickness: 30. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (HCM-15)

Initial Displacement: 0.3 m Static Water Column Height: 38.48 m
Total Well Penetration Depth: 38.48 m Screen Length: 27. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler
K = 9.717 m/day Le = 25.37 m



WELL TEST ANALYSIS

Data Set: \...\HCM-15_slug_out_1.aqt
Date: 01/16/18 Time: 14:51:34

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCM-15
Test Date: 1/11/2017

AQUIFER DATA

Saturated Thickness: 30. m Anisotropy Ratio (Kz/Kr): 0.1

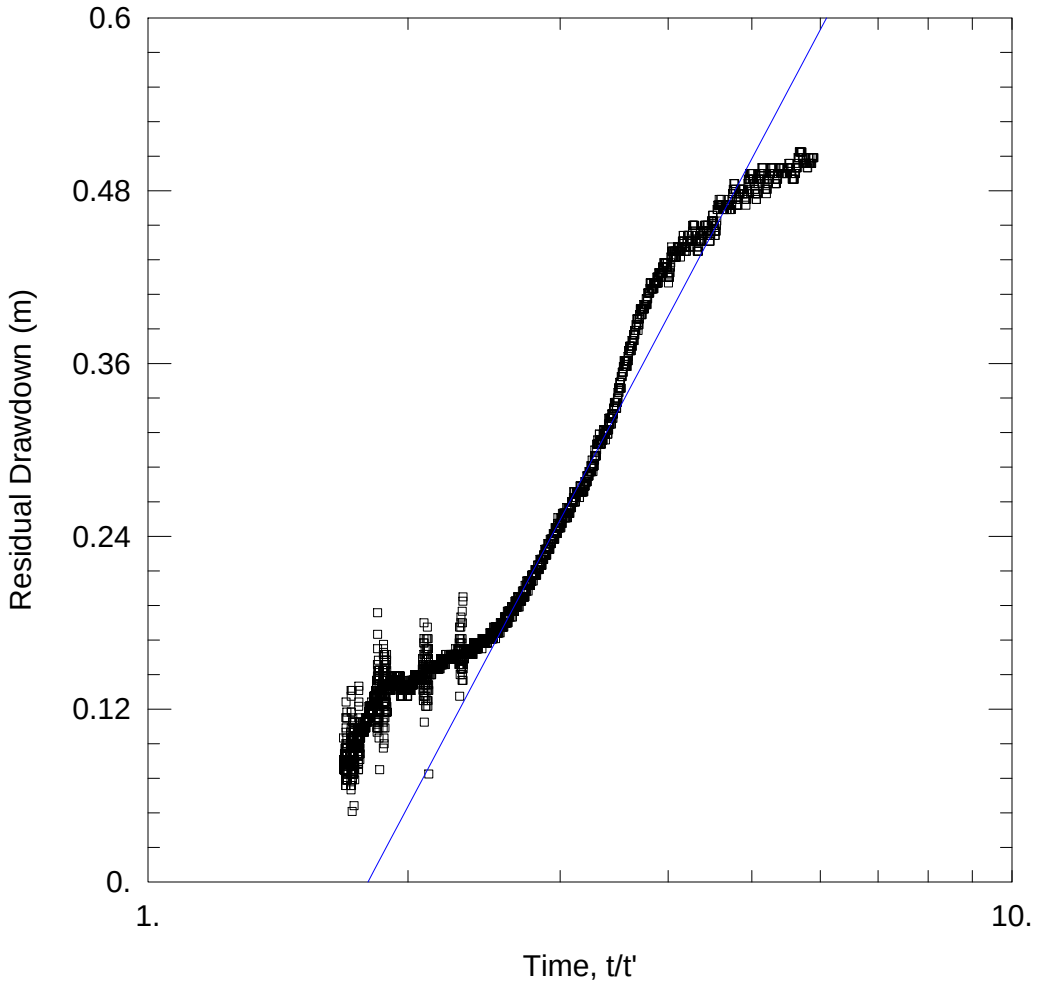
WELL DATA (HCM-15)

Initial Displacement: 0.6 m
Total Well Penetration Depth: 38.48 m
Casing Radius: 0.025 m
Static Water Column Height: 38.48 m
Screen Length: 27. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 4.488 m/day Le = 24.05 m



WELL TEST ANALYSIS

Data Set: \...\HCM-16_theis_rec.aqt
Date: 01/16/18 Time: 14:31:55

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Iron Blow
Test Well: HCM-16
Test Date: 10/12/2017

AQUIFER DATA

Saturated Thickness: 33. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCM-16	776145	8504691

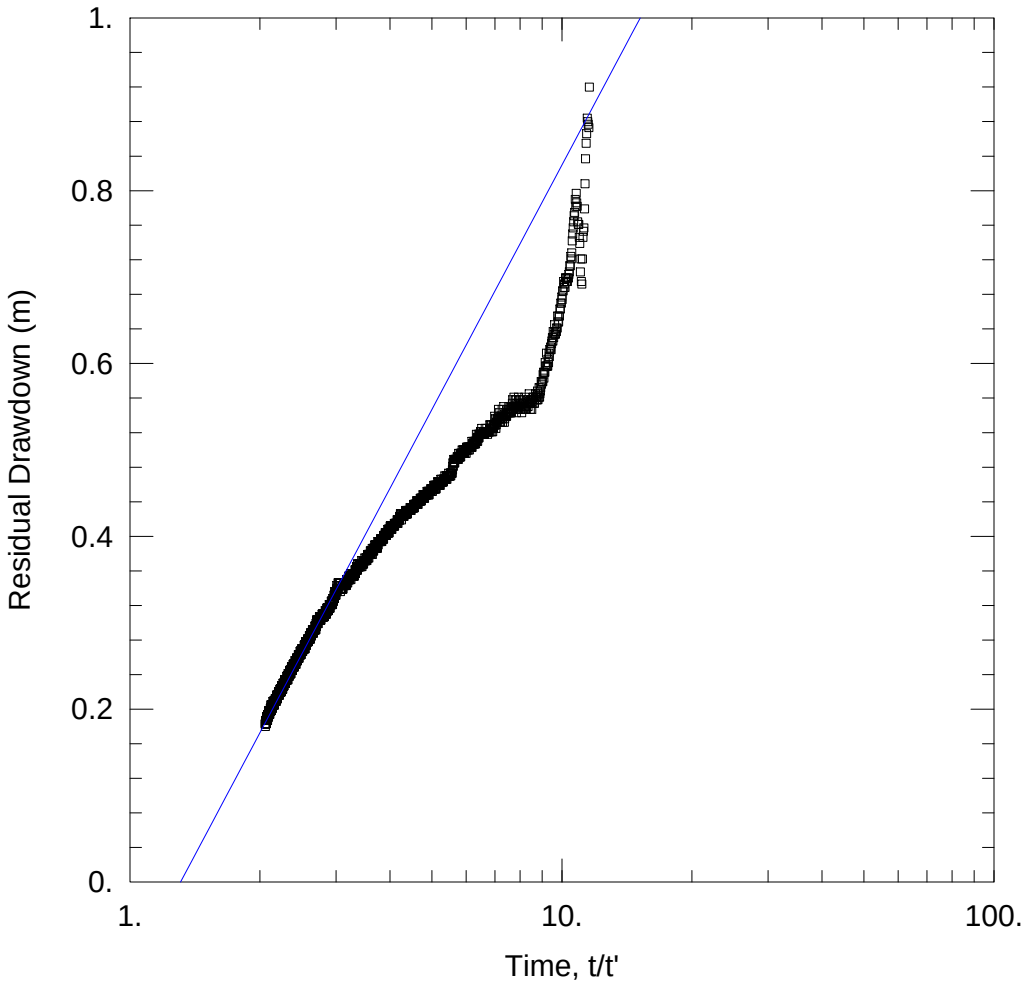
Observation Wells

Well Name	X (m)	Y (m)
HCM-16	776145	8504691

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 50.43 m^2/day S/S' = 1.797



WELL TEST ANALYSIS

Data Set: \...\HCM-17_theis_rec.aqt
Date: 01/16/18 Time: 14:32:18

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Iron Blow
Test Well: HCM-17
Test Date: 6/12/2017

AQUIFER DATA

Saturated Thickness: 56. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCM-17	776249	8504519

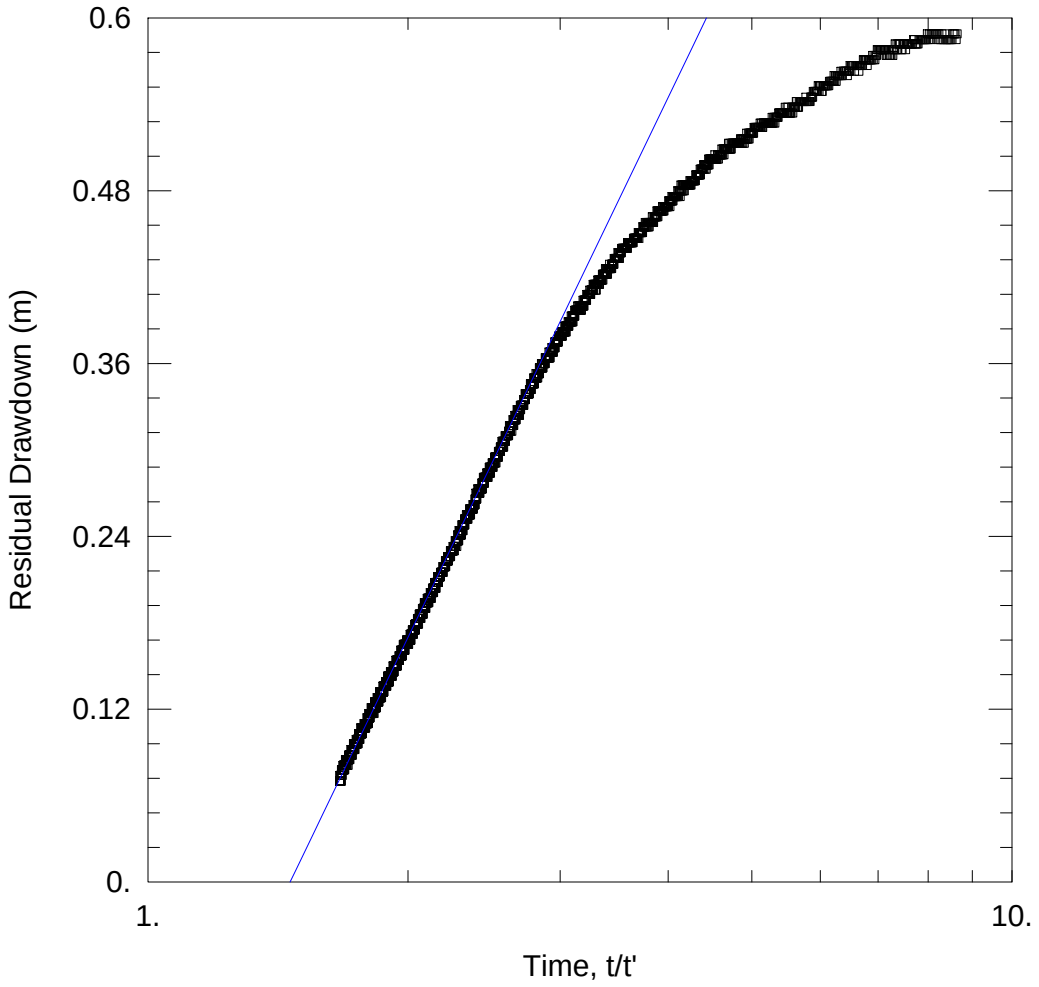
Observation Wells

Well Name	X (m)	Y (m)
HCM-17	776249	8504519

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 168.4 m^2/day S/S' = 1.31



WELL TEST ANALYSIS

Data Set: \...\HCM-19_theis_rec.aqt
Date: 01/16/18 Time: 14:30:57

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Iron Blow
Test Well: HCM-19
Test Date: 8/12/2017

AQUIFER DATA

Saturated Thickness: 42. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCM-19	776138	8504412

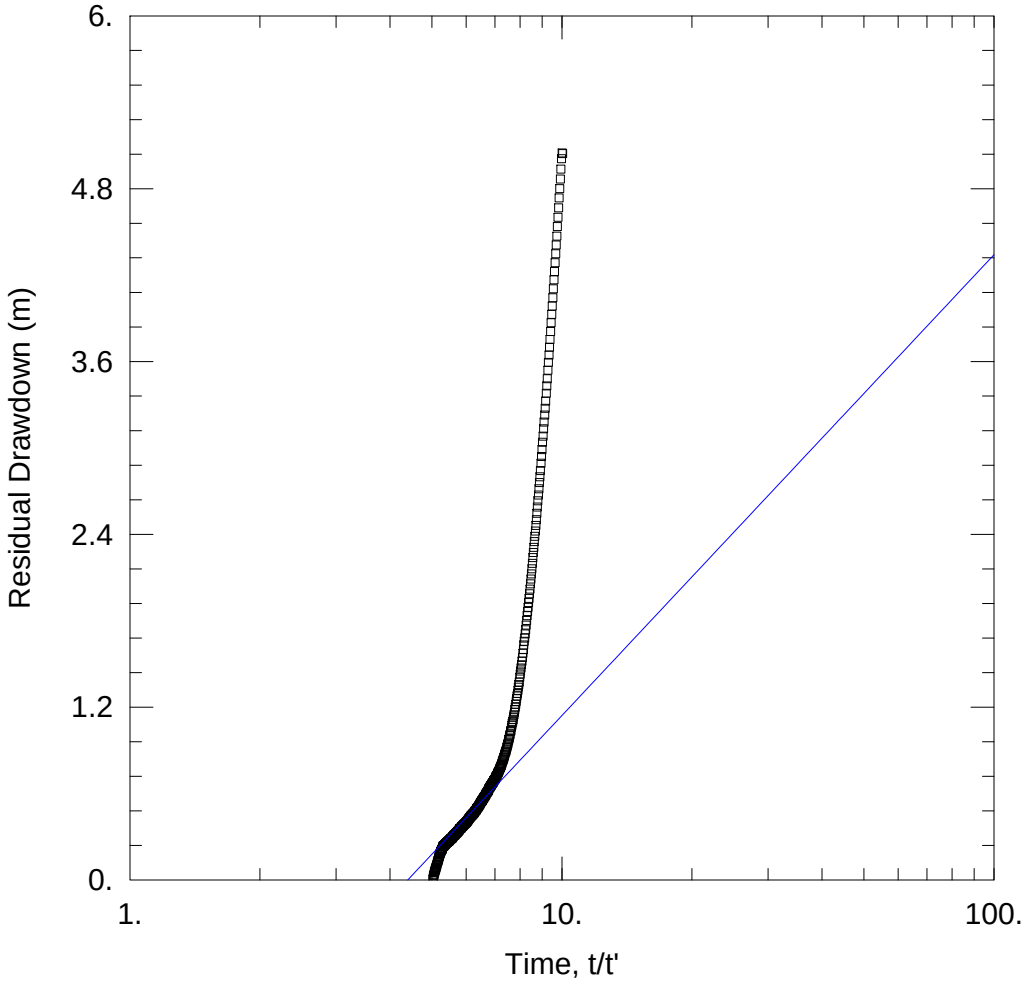
Observation Wells

Well Name	X (m)	Y (m)
HCM-19	776138	8504412

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 43.23 m^2/day S/S' = 1.461



WELL TEST ANALYSIS

Data Set: \...\HCM-20_theis_rec.aqt
Date: 01/16/18 Time: 14:32:40

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Iron Blow
Test Well: HCM-20
Test Date: 4/12/2017

AQUIFER DATA

Saturated Thickness: 52. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCM-20	776030	8504545

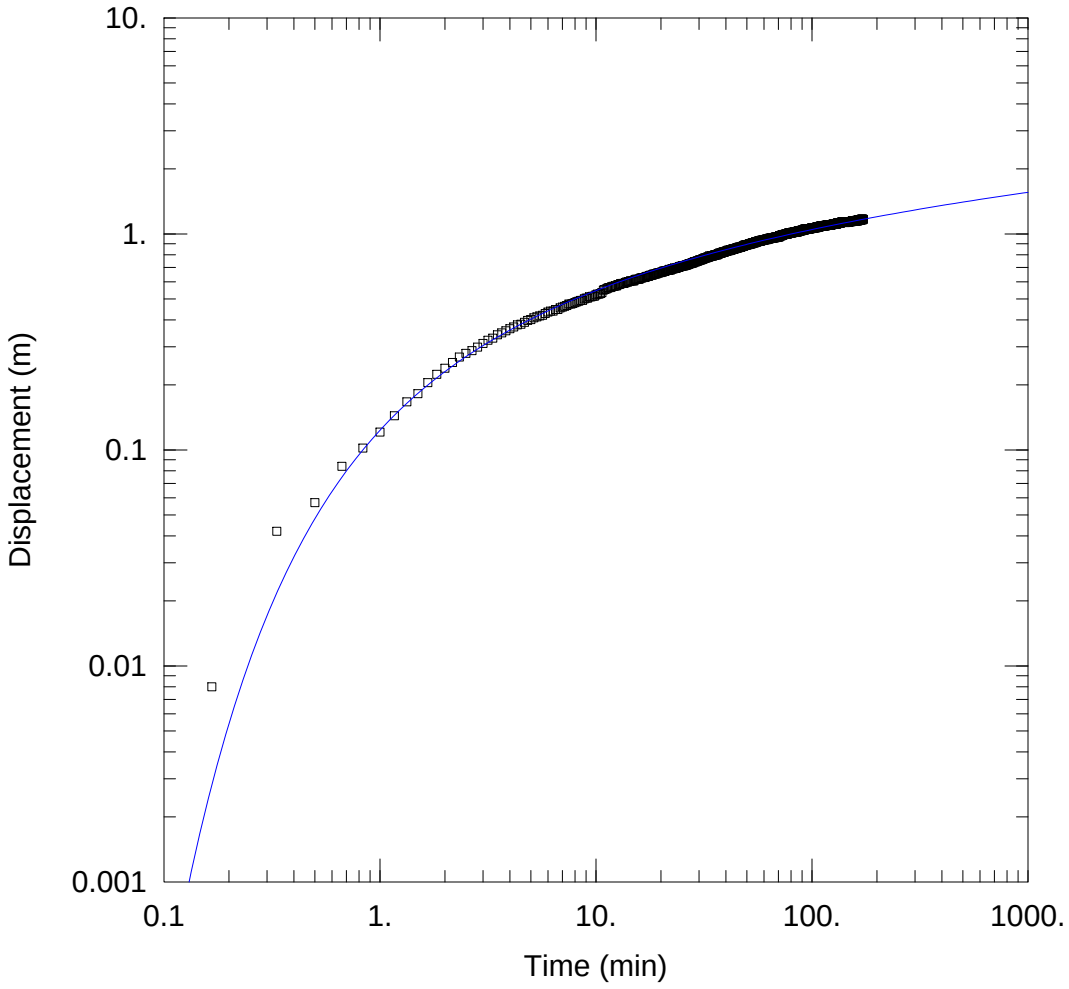
Observation Wells

Well Name	X (m)	Y (m)
HCM-20	776030	8504545

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 10.89 m^2/day S/S' = 4.399



WELL TEST ANALYSIS

Data Set: \...\HCT-1_Theis.aqt
Date: 01/16/18 Time: 14:38:24

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCT-1
Test Date: 31/10/2017

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCT-1	776066	8501784

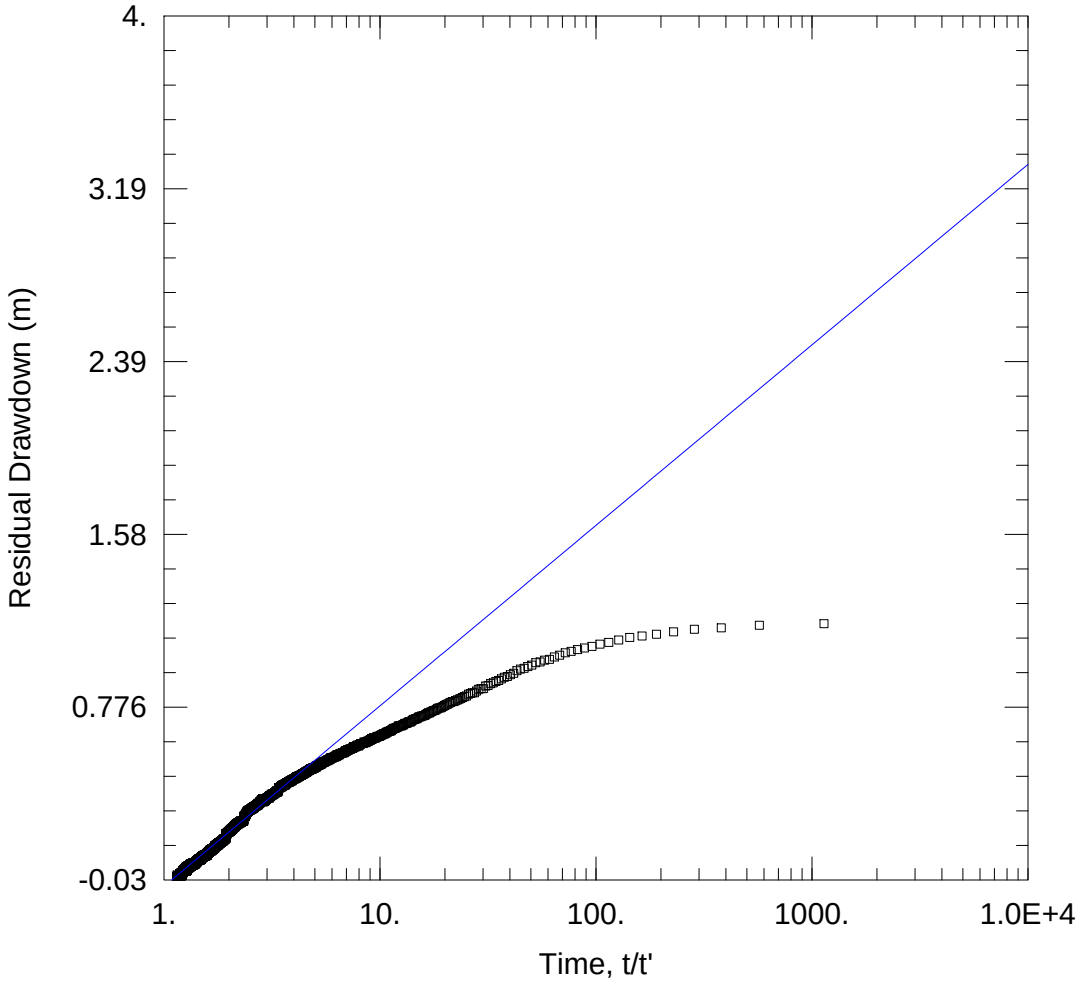
Observation Wells

Well Name	X (m)	Y (m)
▫ HCM-12	776010	8501795

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 52.64 m^2/day
S = 2.262E-5
Kz/Kr = 0.1
b = 11. m



WELL TEST ANALYSIS

Data Set: \...\HCM-12_Theis_rec_late-time.aqt
Date: 01/16/18 Time: 14:37:57

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCT-1
Test Date: 31/10/2017

AQUIFER DATA

Saturated Thickness: 11. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCT-1	776066	8501784

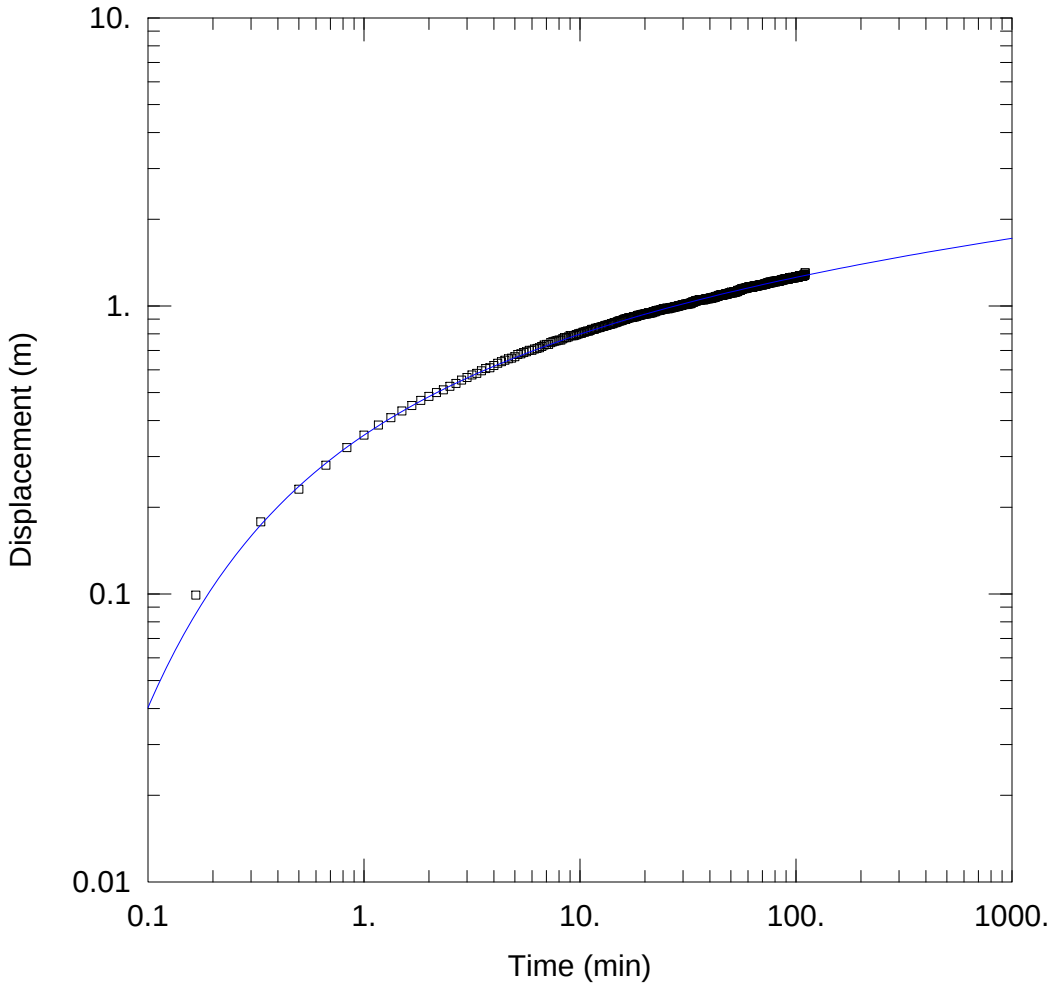
Observation Wells

Well Name	X (m)	Y (m)
HCM-12	776010	8501795

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 28.4 m^2/day S/S' = 1.179



WELL TEST ANALYSIS

Data Set: \...\HCT-2_Theis.aqt
Date: 01/16/18 Time: 14:39:09

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCT-2
Test Date: 29/10/2017

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCT-2	776052	8501221

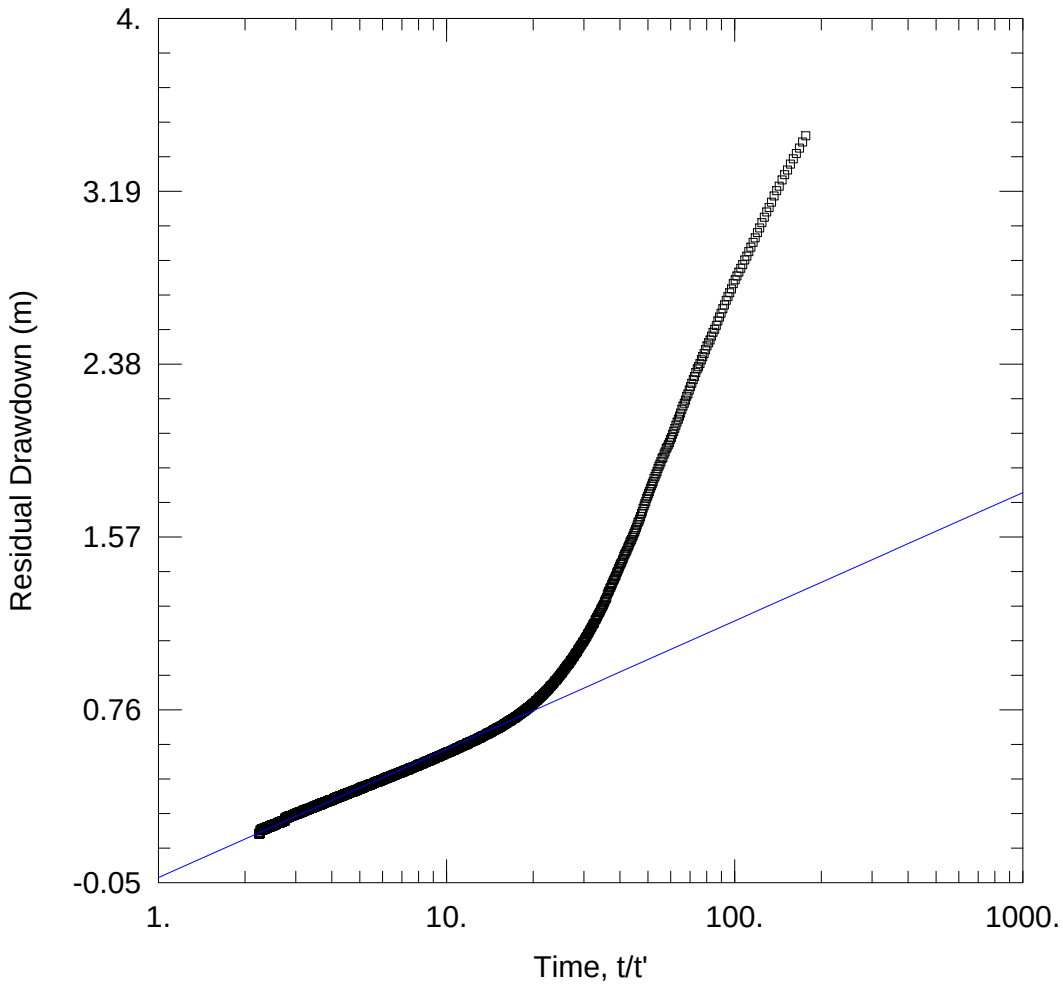
Observation Wells

Well Name	X (m)	Y (m)
▫ HCM-13	776040	8501215

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 42.63 m^2/day
S = 6.917E-5
Kz/Kr = 0.1
b = 18. m



WELL TEST ANALYSIS

Data Set: \...\HCT-2_theis_rec_mid-time_KH.aqt
Date: 01/22/18 Time: 12:24:56

PROJECT INFORMATION

Company: CDM Smith
Client: ERIAS Group
Project: AWS170073
Location: Mt Bonnie
Test Well: HCT-2
Test Date: 29/10/2017

AQUIFER DATA

Saturated Thickness: 18. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
HCT-2	776052	8501221

Observation Wells

Well Name	X (m)	Y (m)
▫ HCT-2	776052	8501221

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 32.65 m^2/day S/S' = 1.107

Appendix D Laboratory reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1731329**	Page	: 1 of 4
Client	: **CDM SMITH AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR MICHAEL SHORT	Contact	: Customer Services ES
Address	: 1/48-50 Smith Street Darwin City NT 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: AWS170073.02	Date Samples Received	: 12-Dec-2017 10:30
Order number	: ----	Date Analysis Commenced	: 12-Dec-2017
C-O-C number	: ----	Issue Date	: 18-Dec-2017 16:13
Sampler	: MICHAEL SHORT		
Site	: Darwin Water Analysis		
Quote number	: SY/544/17		
No. of samples received	: 4		
No. of samples analysed	: 4		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	HCM-21	HCM-20	HCM-17	Rinsate Blank	----
			Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	----
Compound	CAS Number	LOR	Unit	ES1731329-001	ES1731329-002	ES1731329-003	ES1731329-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.11	7.60	7.91	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	186	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	165	----	1310	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	----	121	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	28	37	141	----	----
Total Alkalinity as CaCO3	----	1	mg/L	28	37	141	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	10	2	6	----	----
ED040F: Dissolved Major Anions								
Silicon	7440-21-3	0.05	mg/L	13.6	5.24	16.4	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	65	86	748	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	1	3	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	10	4	134	----	----
Magnesium	7439-95-4	1	mg/L	10	17	118	----	----
Sodium	7440-23-5	1	mg/L	4	18	48	----	----
Potassium	7440-09-7	1	mg/L	2	2	5	----	----
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	66	46	730	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.09	<0.01	<0.01	----
Antimony	7440-36-0	0.001	mg/L	0.073	0.007	0.018	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	1.68	0.005	0.960	<0.001	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	0.027	0.008	0.026	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HCM-21	HCM-20	HCM-17	Rinsate Blank	----
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	----
Compound	CAS Number	LOR	Unit		ES1731329-001	ES1731329-002	ES1731329-003	ES1731329-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.0001	mg/L		**0.0524**	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L		**0.005**	<0.001	**0.004**	<0.001	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L		**0.003**	<0.001	**0.001**	<0.001	----
Manganese	7439-96-5	0.001	mg/L		**0.792**	**0.069**	**1.58**	<0.001	----
Molybdenum	7439-98-7	0.001	mg/L		**0.004**	**0.029**	**0.035**	<0.001	----
Nickel	7440-02-0	0.001	mg/L		**0.007**	**0.003**	**0.004**	<0.001	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Strontium	7440-24-6	0.001	mg/L		**0.010**	**0.008**	**0.351**	<0.001	----
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	**0.002**	<0.001	----
Zinc	7440-66-6	0.005	mg/L		**3.36**	**0.010**	**0.034**	<0.005	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		**2.16**	<0.05	**1.38**	<0.05	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.7**	**1.2**	**0.5**	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**1.91**	**2.56**	**18.5**	----	----
Total Cations	----	0.01	meq/L		**1.67**	----	----	----	----
Total Cations	----	0.01	meq/L		----	**2.43**	**18.6**	----	----
Ionic Balance	----	0.01	%		----	----	**0.37**	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1731336**	Page	: 1 of 4
Client	: **CDM SMITH AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR MICHAEL SHORT	Contact	: Customer Services ES
Address	: 1/48-50 Smith Street Darwin City NT 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: AWS170073.02	Date Samples Received	: 12-Dec-2017 13:00
Order number	: ----	Date Analysis Commenced	: 12-Dec-2017
C-O-C number	: ----	Issue Date	: 18-Dec-2017 09:46
Sampler	: MIKE WHITTY		
Site	: Darwin Water Analysis		
Quote number	: SY/544/17		
No. of samples received	: 2		
No. of samples analysed	: 2		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	HCM-19	HCM-16	----	----	----
			Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1731336-001	ES1731336-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.86**	**7.02**	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**466**	**269**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**101**	**12**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**101**	**12**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**4**	**5**	----	----	----
ED040F: Dissolved Major Anions								
Silicon	7440-21-3	0.05	mg/L	**15.4**	**13.4**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**217**	**37**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	<1	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**36**	**3**	----	----	----
Magnesium	7439-95-4	1	mg/L	**44**	**9**	----	----	----
Sodium	7440-23-5	1	mg/L	**16**	**6**	----	----	----
Potassium	7440-09-7	1	mg/L	**3**	**3**	----	----	----
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	**271**	**44**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.07**	**0.02**	----	----	----
Antimony	7440-36-0	0.001	mg/L	**0.022**	**0.004**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.913**	**0.222**	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.016**	**0.001**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0039**	**0.0184**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.004**	**0.003**	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	**0.004**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HCM-19	HCM-16	----	----	----
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1731336-001	ES1731336-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		**0.562**	**0.383**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.019**	**0.003**	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.006**	**0.003**	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	----	----	----
Strontium	7440-24-6	0.001	mg/L		**0.055**	**0.009**	----	----	----
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	----	----	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.109**	**1.91**	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.66**	<0.05	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.8**	**0.6**	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**6.59**	**1.01**	----	----	----
Total Cations	----	0.01	meq/L		**6.19**	**1.23**	----	----	----
Ionic Balance	----	0.01	%		**3.14**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1727770**	Page	: 1 of 8
Amendment	: **1**		
Client	: **CDM SMITH AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SALLY-ANNE ORCHARD	Contact	: Customer Services ES
Address	: 1/48-50 Smith Street Darwin City NT 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: AWS170073.02	Date Samples Received	: 07-Nov-2017 08:00
Order number	: ----	Date Analysis Commenced	: 07-Nov-2017
C-O-C number	: ----	Issue Date	: 14-Nov-2017 15:19
Sampler	: ----		
Site	: Darwin Water Analysis		
Quote number	: SY/544/17		
No. of samples received	: 14		
No. of samples analysed	: 14		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Amendment (14/11/2017): This report has been amended and re-released to allow the reporting of additional filtered metals data.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	HCT-2	HCM-12	HCT-1	HCT-1 (dup)	HCM-5
			Client sampling date / time	29-Oct-2017 08:30	29-Oct-2017 15:30	31-Oct-2017 08:30	31-Oct-2017 08:30	31-Oct-2017 09:30
Compound	CAS Number	LOR	Unit	ES1727770-001	ES1727770-002	ES1727770-003	ES1727770-004	ES1727770-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.90**	**8.01**	**8.24**	**8.23**	**7.82**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**159**	**316**	**326**	**324**	**254**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**118**	**191**	**182**	**180**	**133**
Total Alkalinity as CaCO3	----	1	mg/L	**118**	**191**	**182**	**180**	**133**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	<1	<1	<1	<1
ED040F: Dissolved Major Anions								
Silicon	7440-21-3	0.05	mg/L	**12.4**	**22.7**	**24.2**	**23.5**	**21.0**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**14**	**68**	**69**	**69**	**41**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**5**	**4**	**4**	**4**	**3**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**4**	**24**	**23**	**24**	**12**
Magnesium	7439-95-4	1	mg/L	**23**	**33**	**33**	**34**	**24**
Sodium	7440-23-5	1	mg/L	**8**	**19**	**18**	**19**	**16**
Potassium	7440-09-7	1	mg/L	**3**	**4**	**3**	**3**	**2**
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	**105**	**196**	**193**	**200**	**129**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	**0.04**	**0.04**	<0.01
Antimony	7440-36-0	0.001	mg/L	**0.032**	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	**0.747**	**0.009**	**0.004**	**0.004**	<0.001
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L	**0.007**	**0.009**	**0.020**	**0.020**	**0.011**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HCT-2	HCM-12	HCT-1	HCT-1 (dup)	HCM-5
				Client sampling date / time	29-Oct-2017 08:30	29-Oct-2017 15:30	31-Oct-2017 08:30	31-Oct-2017 08:30	31-Oct-2017 09:30
Compound	CAS Number	LOR	Unit		ES1727770-001	ES1727770-002	ES1727770-003	ES1727770-004	ES1727770-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		**0.267**	**0.295**	**0.198**	**0.206**	**0.092**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.002**	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		**0.002**	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L		**0.012**	**0.080**	**0.078**	**0.076**	**0.044**
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		**0.122**	<0.005	<0.005	<0.005	<0.005
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.19**	<0.05	<0.05	<0.05	**0.14**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**2.79**	**5.34**	**5.18**	**5.14**	**3.60**
Total Cations	----	0.01	meq/L		**2.52**	**4.84**	**4.72**	**4.90**	**3.32**
Ionic Balance	----	0.01	%		**----**	**4.93**	**4.67**	**2.46**	**3.97**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HCM-7	HCM-15	HCM-13	HCM-8	HCM-6
				Client sampling date / time	31-Oct-2017 11:00	31-Oct-2017 12:30	31-Oct-2017 13:30	31-Oct-2017 14:30	01-Nov-2017 08:30
Compound	CAS Number	LOR	Unit		ES1727770-006	ES1727770-007	ES1727770-008	ES1727770-009	ES1727770-010
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		8.29	7.97	7.85	8.11	7.55
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		245	448	194	1910	356
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		196	255	125	241	30
Total Alkalinity as CaCO3	----	1	mg/L		196	255	125	241	30
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	<1	2	<1	2
ED040F: Dissolved Major Anions									
Silicon	7440-21-3	0.05	mg/L		16.4	28.1	15.2	20.2	19.1
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		13	112	21	1200	110
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		18	10	5	44	1
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		6	46	9	151	12
Magnesium	7439-95-4	1	mg/L		36	44	25	167	19
Sodium	7440-23-5	1	mg/L		26	22	8	172	13
Potassium	7440-09-7	1	mg/L		2	3	2	5	2
ED093F: SAR and Hardness Calculations									
Total Hardness as CaCO3	----	1	mg/L		163	296	125	1060	108
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.02	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L		0.002	0.006	0.049	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.314	0.069	1.21	0.002	0.002
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		0.017	0.012	0.022	0.018	0.009
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	0.0126	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		0.001	0.004	0.004	1.03	0.038
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	0.004	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HCM-7	HCM-15	HCM-13	HCM-8	HCM-6
				Client sampling date / time	31-Oct-2017 11:00	31-Oct-2017 12:30	31-Oct-2017 13:30	31-Oct-2017 14:30	01-Nov-2017 08:30
Compound	CAS Number	LOR	Unit		ES1727770-006	ES1727770-007	ES1727770-008	ES1727770-009	ES1727770-010
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		**0.004**	**0.604**	**0.815**	**0.565**	**0.079**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	**0.002**	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.001**	**0.005**	**0.002**	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L		**0.018**	**0.089**	**0.028**	**0.303**	**0.030**
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		**0.019**	<0.005	**0.640**	**0.008**	<0.005
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	**0.14**	<0.05	**0.06**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**4.69**	**7.71**	**3.08**	**31.0**	**2.92**
Total Cations	----	0.01	meq/L		**4.44**	**6.95**	**2.90**	**28.9**	**2.78**
Ionic Balance	----	0.01	%		**2.74**	**5.17**	**2.84**	**3.59**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	HCM-14	HCM-11	HCM-10	HCM-9	----
			Client sampling date / time	01-Nov-2017 09:30	01-Nov-2017 10:30	01-Nov-2017 11:30	01-Nov-2017 12:30	----
Compound	CAS Number	LOR	Unit	ES1727770-011	ES1727770-012	ES1727770-013	ES1727770-014	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.22	8.02	8.01	8.10	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	372	569	250	1990	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	10	237	212	150	----
Total Alkalinity as CaCO3	----	1	mg/L	10	237	212	150	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	47	<1	<1	1	----
ED040F: Dissolved Major Anions								
Silicon	7440-21-3	0.05	mg/L	12.4	26.8	19.6	27.1	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	231	258	28	1150	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	10	12	2	50	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	22	74	22	209	----
Magnesium	7439-95-4	1	mg/L	28	53	26	174	----
Sodium	7440-23-5	1	mg/L	17	21	31	80	----
Potassium	7440-09-7	1	mg/L	4	3	2	8	----
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	170	403	162	1240	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.03	<0.01	----
Antimony	7440-36-0	0.001	mg/L	<0.001	0.001	0.002	0.004	----
Arsenic	7440-38-2	0.001	mg/L	0.002	0.008	0.003	0.004	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	0.104	0.020	0.017	0.008	----
Cadmium	7440-43-9	0.0001	mg/L	0.0065	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L	0.015	0.010	0.002	0.026	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HCM-14	HCM-11	HCM-10	HCM-9	----
				Client sampling date / time	01-Nov-2017 09:30	01-Nov-2017 10:30	01-Nov-2017 11:30	01-Nov-2017 12:30	----
Compound	CAS Number	LOR	Unit		ES1727770-011	ES1727770-012	ES1727770-013	ES1727770-014	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		**5.36**	**1.24**	**0.320**	**0.140**	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	**0.001**	**0.005**	----
Nickel	7440-02-0	0.001	mg/L		**0.014**	<0.001	<0.001	**0.003**	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Strontium	7440-24-6	0.001	mg/L		**0.076**	**0.122**	**0.067**	**0.399**	----
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	**0.004**	----
Zinc	7440-66-6	0.005	mg/L		**12.8**	**0.012**	<0.005	**0.005**	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		**12.4**	<0.05	<0.05	<0.05	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**5.29**	**10.4**	**4.88**	**28.4**	----
Total Cations	----	0.01	meq/L		**4.91**	----	----	----	----
Total Cations	----	0.01	meq/L		----	**9.04**	**4.64**	**28.4**	----
Ionic Balance	----	0.01	%		**3.74**	----	----	----	----
Ionic Balance	----	0.01	%		----	**7.18**	**2.50**	**0.15**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1725770**	Page	: 1 of 4
Client	: **CDM SMITH AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SALLY-ANNE ORCHARD	Contact	: Customer Services ES
Address	: 1/48-50 Smith Street Darwin City NT 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: AWS170073.02	Date Samples Received	: 17-Oct-2017 08:00
Order number	: ----	Date Analysis Commenced	: 17-Oct-2017
C-O-C number	: ----	Issue Date	: 23-Oct-2017 15:35
Sampler	: ----		
Site	: Darwin Water Analysis		
Quote number	: SY/544/17		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035: Positive Hg result for ES1725770 #2 has been confirmed by reanalysis
- ED041G: LOR raised for Sulfate on sample no:4 due to sample matrix.
- Ionic Balance out of acceptable limits due to analytes not quantified in this report.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	DAM1	DAM3	DAM4	HCM5 Area	M River
			Client sampling date / time	11-Oct-2017 00:00	11-Oct-2017 00:00	11-Oct-2017 00:00	11-Oct-2017 00:00	11-Oct-2017 00:00
Compound	CAS Number	LOR	Unit	ES1725770-001	ES1725770-002	ES1725770-003	ES1725770-004	ES1725770-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.00	5.96	3.59	6.82	7.26
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	104	222	181	129	127
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	18	4	<1	68	86
Total Alkalinity as CaCO3	----	1	mg/L	18	4	<1	68	86
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	3	8	34	14	6
ED040F: Dissolved Major Anions								
Silicon	7440-21-3	0.05	mg/L	4.75	3.26	2.95	6.17	11.6
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	41	91	116	<10	6
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	2	3	<1	3	8
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	4	6	6	5	8
Magnesium	7439-95-4	1	mg/L	8	10	12	9	10
Sodium	7440-23-5	1	mg/L	10	4	3	2	7
Potassium	7440-09-7	1	mg/L	2	9	3	13	4
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	43	56	64	50	61
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.01	0.11	2.44	0.04	0.03
Antimony	7440-36-0	0.001	mg/L	<0.001	0.002	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	0.030	0.135	0.018	0.006	0.009
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L	0.011	0.066	0.035	0.062	0.074
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0262	0.0083	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	0.001	0.023	0.038	0.003	0.004
Copper	7440-50-8	0.001	mg/L	0.002	0.257	0.254	0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	0.032	0.022	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DAM1	DAM3	DAM4	HCM5 Area	M River
				Client sampling date / time	11-Oct-2017 00:00	11-Oct-2017 00:00	11-Oct-2017 00:00	11-Oct-2017 00:00	11-Oct-2017 00:00
Compound	CAS Number	LOR	Unit		ES1725770-001	ES1725770-002	ES1725770-003	ES1725770-004	ES1725770-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		**0.016**	**7.40**	**5.99**	**1.33**	**2.03**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.009**	**0.045**	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L		<0.001	**0.001**	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L		**0.016**	**0.028**	**0.007**	**0.035**	**0.038**
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	**2.36**	**0.648**	**0.007**	<0.005
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	**1.36**	**0.38**	**1.51**	**2.17**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	**0.0013**	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.1**	**0.2**	**0.1**	**0.2**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**1.27**	**2.06**	**2.42**	**1.44**	**2.07**
Total Cations	----	0.01	meq/L		**1.34**	**1.53**	**1.49**	**1.41**	**1.63**