



# Bore Completion Report



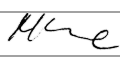

O'Neil

Alcoa of Australia

13 March 2024

→ The Power of Commitment



<b>Project name</b>		Alcoa Holyoake Environmental Assessments					
<b>Document title</b>		Bore Completion Report   O'Neil					
<b>Project number</b>		12565572					
<b>File name</b>		12565572-00000-HY-RPT-016_Rev1					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	A	Jamphel Jamphel Kristyn Blomme	S.Bright		M. Brook		23/02/24
S3	B	Kristyn Blomme	M.Rosic		M. Brook		05/03/24
S4	1	Kristyn Blomme	M.Rosic		M. Brook		13/03/24
[Status code]							

**GHD Pty Ltd ABN 39 008 488 373**

999 Hay Street, Level 10

Perth, WA 6000, Australia

**T** +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** [permail@ghd.com](mailto:permail@ghd.com) | **ghd.com**

© GHD 2024

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

# Contents

<b>1. Introduction</b>	<b>1</b>
1.1 Purpose of this report	1
1.2 Scope and limitations	1
1.3 Limitations	1
<b>2. Methodology</b>	<b>1</b>
2.1 Bore location selection	1
2.2 Drilling methodology	2
2.3 Field testing methodology	2
<b>3. Results</b>	<b>2</b>
3.1 Drilling summary	2
3.2 Geological observations	3
3.3 Permeability results	5

## Table index

Table 1	Installed monitoring bore details	4
Table 2	Permeability test results	5

## Figure index

Figure 1	Hydraulic conductivity results from field testing	6
----------	---	---

## Appendices

Appendix A	Bore locations
Appendix B	Bore logs
Appendix C	Chip trays and sample piles
Appendix D	Permeability data – field data, summary table and AQTESOLV analysis

# 1. Introduction

A comprehensive groundwater monitoring network is required in the O'Neil region to understand the project wide hydrogeological conditions and develop a robust baseline groundwater level and groundwater quality data set. The monitoring network includes newly installed monitoring bores in areas lacking groundwater data.

GHD Pty Ltd (GHD) was engaged by Alcoa of Australia (Alcoa) to complete drilling and installation of required monitoring bores in the weathered geological profile in the O'Neil project area.

## 1.1 Purpose of this report

The purpose of this report is to provide a factual summary of the scope of works, applied methodology, and results of drilling and hydraulic testing works completed by GHD between 31<sup>st</sup> July 2023 and 19<sup>th</sup> January 2024.

## 1.2 Scope and limitations

The scope of works completed as part of this engagement is summarised as follows:

- Drilling, installation, and development of 15 bores screened in water bearing units, installed over 14 locations. At ONMB02, two monitoring bores were installed approximately one meter apart, a shallow monitoring bore targeting the lower regolith and deeper monitoring bore targeting upper weathered basement aquifer.
- Completion of in-situ falling/rising head tests at all installed monitoring bores with sufficient water levels.
- Preparation of bore the completion report.

## 1.3 Limitations

This report: has been prepared by GHD for Alcoa of Australia and may only be used and relied on by Alcoa of Australia for the purpose agreed between GHD and Alcoa of Australia as set out in section 1.2 of this report.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the report was prepared.

# 2. Methodology

Drilling of the boreholes was undertaken by Proline Drilling using a Geo 305 Comacchio track-mounted air-core drilling rig, capable of doing small scale diamond holes using an interchangeable drill bit. A GHD hydrogeologist was present during the drilling and installation of the monitoring bores throughout the field program.

## 2.1 Bore location selection

Bore site selection was completed by GHD in consultation with Alcoa. Bore locations were selected to provide a broad spatial distribution of locations across the O'Neil region and with reasonable prospects of access. Ground truthing of each location was completed and some original sites were found to be restricted by limited accessibility, subsequently these locations were relocated to nearby areas prior to being submitted for approval.

Screen intervals for the bores targeted the vertical profile associated with the inferred dominant seepage pathways within the saprolite clays and weathered bedrock horizon. Refer to Table 1 for borehole Easting and Northing coordinates.

ONMB03 was located on the granite surface therefore, diamond drilling was carried out up to 1.2 m as air-core was ineffective, but no progress was made due to the significant thickness of fresh impermeable rock. The primary drilling method used was air-core for the rest of the bores. However, the rig was capable of performing small-scale

shallow diamond holes using interchangeable drilling bits. The diamond drill was intended to determine whether the granite was fresh or became weathered with depth, which could host groundwater flow and thus warrant the installation of a monitoring bore. The borehole was refilled and grouted to the surface with cement.

## 2.2 Drilling methodology

At each location a monitoring bore was installed targeting the lower regolith and upper weathered basement rock stratigraphy, as this is the water bearing unit for unconfined aquifers in this region. At ONMB02, there was evidence for a potential perched aquifer higher up the regolith profile therefore, a second shallower monitoring bore was installed approximately one meter away targeting this interval.

The drilling was completed using an air-core drilling method. This method allowed for the collection and sampling of rock chips by the drilling crew, which were presented to the hydrogeologist in 0.5 m intervals, see Appendix C, for photographs of the sample piles. The onsite hydrogeologist logged the samples and collected representative chips for each metre to display in sample trays. The sample trays were then photographed and are included in Appendix C. Where the shallow bore was drilled, detailed logging was not undertaken given the proximity to the deeper bore, whose logs were considered valid.

All weathered basement bores were installed using 3-6 m of PVC Class 12 slotted screens with an aperture of 0.5 mm followed by blank casing to surface. Graded gravel pack (0.85-2 mm) was used around the screens and at least one metre above the screens. A bentonite seal of at least one metre was installed above the gravel pack, followed by a 5% bentonite cement grout to surface. Stainless steel monuments were installed above ground level to approximately 0.6 m.

Shallow bore OEMB02 was installed using 2-4 metres of PVC Class 12 slotted screens with an aperture of 0.5 mm followed by blank casing to surface. Graded gravel pack (0.85-2mm) was installed at least 1 metre above the screen, a bentonite seal of 0.7 m was installed above the gravel pack, followed by a 5% bentonite cement grout to surface.

Once bore installation was completed, each bore was developed using air-lifting techniques to remove fines. Where the bore was dry or produced insufficient water for airlifting, bore development was not completed.

## 2.3 Field testing methodology

Field permeability testing was completed by GHD hydrogeologists via falling and rising head tests.

For each test, a transducer water level logger (logger) was typically either placed 5 m below the water level, or 0.1 m from the bottom of the bore. The interval data for each logger was set to record every 1 second. The logger was left for several minutes to record a static water level and then a slug with a known volume was added to the bore. The change in water for the falling head test was then recorded by the logger. Once the standing water level had recovered to within 95% of static, the slug was then removed and the change in water for the rising head test was recorded. At monitoring bores that were dry or had insufficient water, no permeability testing was completed.

Logger results were processed in Microsoft Excel to determine head displacement from the static water level. The aquifer test software AQTESOLV was then used to estimate hydraulic conductivity based on the head displacement data and bore construction details.

# 3. Results

## 3.1 Drilling summary

Drilling was completed between 31<sup>st</sup> July 2023 and 25<sup>th</sup> August 2023, with 15 monitoring bores drilled in 14 locations. Bore locations are presented in Appendix A.

Tabulated bore details with coordinates, drilled depth and construction details are supplied in Table 1.

Drill cuttings were collected whilst drilling and logged by the onsite hydrogeologist. Bore logs are attached as Appendix B and include lithology and construction details. Where two clustered bores were drilled, only the deepest bore was logged in the field and the geology of the deepest bore is used in the bore log with the construction of the shallower monitoring bore.

## 3.2 Geological observations

Chip and sample photos corresponding to each bore are included in Appendix C and geological logs are presented in Appendix B.

The geological profile encountered was typically characterised by the following:

- Surface materials consisting of loose pisolite or soil (~0.5 – 2 m thick)
- Underlain by superficial cemented iron laterite (~0.5 – 2 m thick).
- Some holes contained a transported sandy stiff clay (~0.5 – 2 m thick) below the laterite.
- Followed by in-situ saprolite clays including pallid and mottling zones depending on the basement profile (~4 – 30 m thick).
- Saprolite transitions to saprock through development of chips of weathered basement (~ 0.1 – 12 m thick).
- Weathered basement was encountered before rod refusal (0.5 - 4 m thick).

Otherwise the geological profile exhibited the following observations:

- No laterite was observed in ONMB02.
- Quartz veins of between 0.5 to 2.5 m thickness were intercepted in OEMB02, OEMB04, OEMB06, OEMB08, OEMB09, OEMB10, ONMB04.
- Saprock grading to weathered bedrock was not observed in OEMB02, OEMB05, OEMB07, OEMB09, OEMB10, ONMB02D, ONMB02S, ONMB05.

Table 1 Installed monitoring bore details

Bore ID	Easting*	Northing*	Drill start date	Drilled end date	Drilled depth (m)	Screen from (m)	Screen to (m)	Gravel from (m)	Gravel to (m)	Bentonite from (m)	Bentonite to (m)	TOC (mAHD)*	Stick up (m)	SWL Date	Depth to water (m bgl)	Static water level* (m AHD)
OEMB01	428579	6396203	8/08/2023	9/08/2023	31.7	25.7	31.7	21.5	31.7	19.4	21.5	263	0.56	28/08/2023	23.91	239.09
OEMB02	430620	6397666	24/08/2023	24/08/2023	4	2	4	1	4	0.3	1	274	0.56	28/08/2023	0.92	273.08
OEMB03	431449	6396554	9/08/2023	10/08/2023	34.8	28.8	34.8	25	34.8	23	25	335	0.63	28/08/2023	Dry	Dry
OEMB04	431561	6394319	23/08/2023	24/08/2023	25	19	25	11.5	25	9.4	11.5	316	0.56	28/08/2023	14.82	301.18
OEMB05	433936	6394923	22/08/2023	23/08/2023	25	19	25	12.1	25	10	12.1	289	0.44	28/08/2023	16.27	272.73
OEMB06	436433	6396551	11/08/2023	14/08/2023	19	13.5	19.5	10.5	19.5	8.5	10.5	289	0.6	28/08/2023	Dry	Dry
OEMB07	434773	6397372	17/08/2023	18/08/2023	16.2	13.2	16.2	9.5	16.2	7.5	9.5	282	0.58	28/08/2023	Dry	Dry
OEMB08	433004	6397329	18/08/2023	22/08/2023	31	25	31	13	31	11	13	274	0.53	28/08/2023	16.08	257.92
OEMB09	432819	6398941	10/08/2023	11/08/2023	26.5	20.5	26.5	14.1	26.5	12	14.1	294	0.63	28/08/2023	17.31	276.69
OEMB10	437526	6399563	14/08/2023	15/08/2023	30.1	24.1	30.1	12.3	30.1	10.2	12.3	284	0.59	28/08/2023	14.2	269.8
ONMB01	423897	6399852	7/08/2023	7/08/2023	10	4	10	1.5	10	0.3	1.5	234	0.59	28/08/2023	3.65	230.35
ONMB02_D	431869	6406346	31/07/2023	1/08/2023	23.7	17.8	23.7	12.7	23.7	10.9	12.7	239	0.625	28/08/2023	13.885	225.115
ONMB02_S	431868	6406343	1/08/2023	1/08/2023	7	4	7	2	7	1	2	255	0.51	28/08/2023	Dry	Dry
ONMB04	432558	6404407	1/08/2023	2/08/2023	27.1	21	27	18.1	27	16	18.1	265	0.58	28/08/2023	22.63	242.37
ONMB05	433068	6401695	25/08/2023	25/08/2023	14	8	14	5	14	3	5	254	0.59	28/08/2023	Dry	Dry

\* Bore locations (easting, northing and elevation) are based on handheld GPS with  $\pm 5m$ . \* Coordinates system: GDA94/MGA zone 50

### 3.3 Permeability results

The field permeability tests were analysed in AQTESOLV, an industry-standard aquifer testing software, using either the Bouwer-Rice, Cooper-Bredehoft-Papaopulos, KGS, or KGS with skin effect solution to determine hydraulic conductivity. Appendix D presents assumptions made during the analysis methodology and a detailed tabulated summary of the analytical results, in addition to plots of the fitted drawdown curves exported from AQTESOLV.

Assumptions made regarding the aquifer thickness parameter (b) in AQTESOLV were based on the following rationale at each bore location:

- Interpreted water bearing unit based on logged geology including consideration of the following;
  - o thickness of saprock/basement rock,
  - o thickness of clay/saprolite.
- Saturated thickness of aquifer where water level was within the identified water bearing unit.

The calculated hydraulic conductivity values are reasonably sensitive to changes in aquifer thickness and given the aquifer thickness is controlled largely by the vertical hydraulic conductivity (which is not known), this inherent uncertainty should be reflected in the understanding of the hydraulic conductivity results.

A summary of the hydraulic conductivity results is presented in Table 2. Hydraulic conductivity results are also illustrated in Figure 1

The estimated hydraulic conductivity at the monitoring bores is within an expected range of the geology and ranged from between  $4.1 \times 10^{-3}$  m/day (OEMB04) to  $4.2 \times 10^{-1}$  m/day (OEMB09), with an average hydraulic conductivity of  $1.2 \times 10^{-1}$  m/day.

Table 2 Permeability test results

Tests	No. tests conducted	Bore depth range (mbgl)	Estimated conductivity (K)	
			(m/day)	(m/sec)
O'Neil	9	10 - 34.8	Range from $4.1 \times 10^{-3}$ to $4.2 \times 10^{-1}$ Average $1.2 \times 10^{-1}$	Range from $4.7 \times 10^{-8}$ to $4.9 \times 10^{-6}$ Average $1.4 \times 10^{-6}$

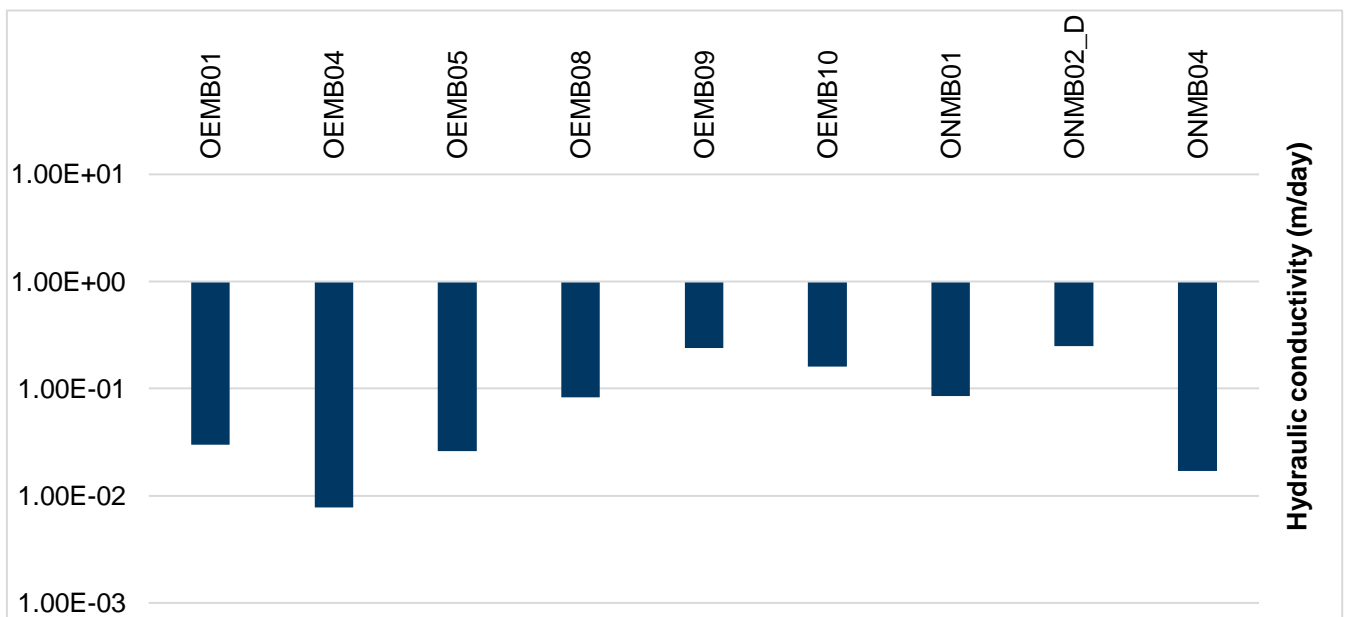
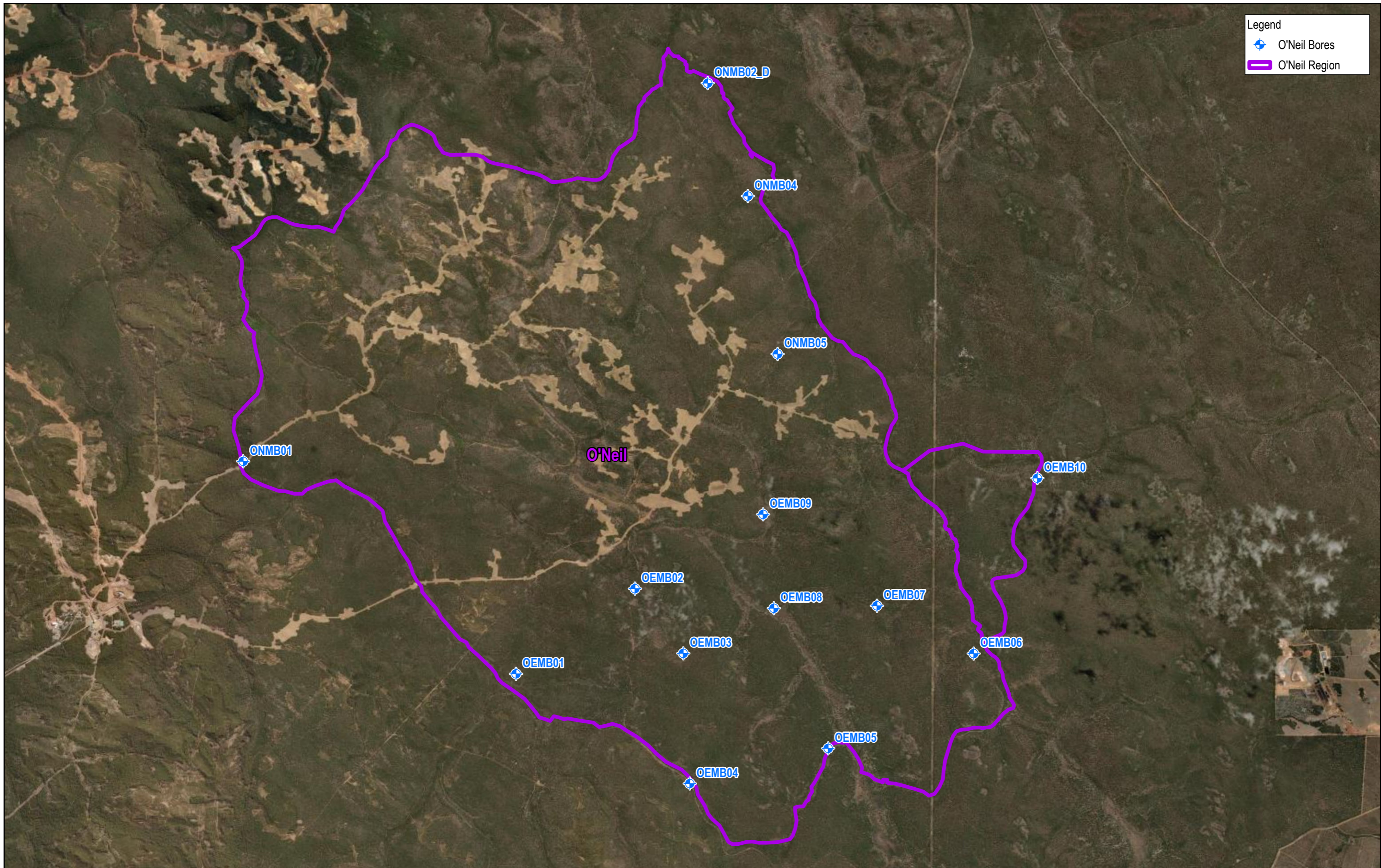


Figure 1. Hydraulic conductivity results from field testing.

# Appendix A

## Bore locations



Legend

- ◆ O'Neil Bores
- O'Neil Region

<p>Paper Size ISO A3</p> <p>0 0.4 0.8 1.2 1.6</p> <p>Kilometers</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>			<p>Alcoa of Australia Alcoa Environmental Assessment 2024</p>	<p>Project No. 12565572 Revision No. 1 Date 23/02/2024</p>
<p><b>O'NEIL EAST BORE LOCATIONS</b></p>			<p><b>FIGURE 1</b></p>	

\\ghdnet\ghd\AU\Perth\Projects\6112565572\GIS\Maps\Working\ww\_working\ww.aprx  
Print date: 23 Feb 2024 - 14:34

Data source: World Imagery: Earthstar Geographics. Created by: wwan3

# Appendix B

## Bore logs



# BOREHOLE LOG

MONITORING WELL OEMB01

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 08/08/2023 - 09/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 31.70 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 428579, 6396203 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphel Jamphel <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Gravel, brown, fine to coarse nodules, moderately sorted, subangular to rounded with minor pisolitic sand and rare clay		262
4					Clay, yellow-brown, dry, gritty, non-plastic with slightly weathered fine to coarse lateric and gravel nodules		260
6					Clay, white-pink to red-brown mottled yellow, non-plastic, gritty, dry, cemented texture at 5-6m with weathered lateritic fragments and quartz		258
8					- Clay, pink-white to pinkish brown up to 16m, brown to yellow-brown thereafter, dry (slightly moist after 22m), non-plastic, soft with rare coarse quartz fragments and other feldspar minerals. - 11-12m: red-brown and gritty with medium to coarse lateritic gravels and weathered fined feldspar minerals. The rest of the characteristics are the same as above		256
10						254	
12						252	
14						250	
16							248
18							246
20							244
22							242
24							240
26							238
28							236
30							234
32							232
34							230

Cement grout  
Depth: 0.00 - 19.4

Bentonite  
Depth: 19.4 - 21.5

Gravel pack  
(0.85-2mm)  
Depth: 21.5 - 31.7

Q: 0.01L/s, pH: 6.92, EC: 4200 uS/cm, TDS: 1232 ppm, Temp: 16.1 C

- Weathered saprock, brown, slightly moist, fine to medium mineral grain with mica and mafic minerals (brown and yellow)  
- 5% Clay

Dolerite, fresh caprock, slightly moist, greenish grey mottled black and white mineral (shiny likely mica), fine grain

Termination Depth at: 31.70 m

**Notes** Saprolite Clay

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB02

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 24/08/2023 - 24/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 4.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 430620, 6397666 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> JampheJ JampheJ <b>Checked By</b> S. Bright
--	--	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monoment
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
0.5	Aircore		Cement grout Depth: 0.00 - 0.30		Clay, white-brown mottled yellow/orange, gritty, plastic, wet with pisolitic sand and fine to medium laterite fragments along with rare fine quartz and feldspar minerals		273.0
1.0			Bentonite Depth: 0.30 - 1.00		Clay, yellow-white mottled red, highly plastic with cemented texture, wet, gritty with fine to medium laterite fragments along with fine quartz and feldspars.		273.0
1.5					Clay, reddish yellow-brown, slightly plastic, gritty, moist with fine to coarse laterite fragments, fine quartz and feldspar minerals		272.0
2.0					Clay, yellow-grey, gritty, slightly moist, slightly plastic, slightly cemented with sand, fine quartz and feldspar minerals		272.0
2.5			Gravel pack (0.85-2mm) Depth: 1.00 - 4.00		Granitic saprock, brown-black mottled yellow, dry, fine to coarse mineral grain, medium to high strength		271.0
3.0							271.0
3.5							270.0
4.0					Termination Depth at: 4.00 m	Dry at the time of drilling	270.0
4.5							269.0
5.0							269.0
5.5							268.0
6.0							268.0
6.5							267.0
7.0							267.0
7.5							266.0
8.0							266.0
8.5							265.0
9.0							265.0
9.5							264.0

**Notes** Granitic Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB03

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 09/08/2023 - 10/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 34.80 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 431449, 6396554 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphel Jamphel <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Gravel, yellow-brown, moderately sorted, dry, sub-rounded to rounded, medium to coarse nodules		334
4					Laterite, red-brown, medium to coarse fragments, poorly sorted, dry with iron stain		332
6					Clay, yellow-brown, gritty, non-plastic, dry with lateritic fragments ranging from medium to coarse grain (20%)		330
8					Saprolite clay, highly weathered, red-brown to yellow-brown mottled white, soft, non-plastic, dry with trace mica		328
10							326
12			Cement grout Depth: 0.00 - 23.0				324
14					Weathered saprock, pink-white mottled black, low strength, dry, fine to medium mineral grain containing fine quartz and mica with medium to coarse felsic minerals		322
16					Clay, pinkish yellow-brown mottled white, gritty, dry, non-plastic with fine quartz, mica and feldspar minerals		320
18							318
20					Slightly weathered saprock, low to medium strength, contain iron stain, rest same as 14-15m		316
22					Clay, pinkish brown to reddish brown mottled white/yellow, soft, non-plastic, dry but slightly moist from 33m with feldspar minerals and iron stain		314
24			Bentonite Depth: 23.0 - 25.0				312
26							310
28							308
30			Gravel pack (0.85-2mm) Depth: 25.0 - 34.8				306
32							304
34					Doleritic saprock, grey mottled white, low to high strength, slightly weathered on the top, consisting of fine quartz, mica and magnesium with iron stain	Dry	302
36					Termination Depth at: 34.80 m		300
							298

**Notes** Dolerite Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB04

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 23/08/2023 - 24/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 25.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 431561, 6394319 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphele Jamphele <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Gravel, yellow-brown, wet, fine to coarse nodule, sub-angular to rounded with approximately 10% laterite and 15% clay		314
4					Laterite, reddish yellow-brown, fine to coarse fragments, dry with approximately 2% clay and 5% Gravel		312
6			Cement grout Depth: 0.00 - 9.40		Clay, pink-brown to yellow-brown mottled white, cemented and highly plastic, hard, wet until 4m and slightly moist afterwards, slightly gritty with minor mica and medium, to coarse laterite fragments		310
8					Clay, yellow-brown mottled white, cemented clay at 5.5m, gritty, dry, non-plastic with medium to coarse lateritic fragments and sand		308
10			Bentonite Depth: 9.40 - 11.5		Clay, dirty white to yellowish pink, cemented texture until 22m, slightly plastic and slightly moist until 16m, plastic and slightly wet between 16-22m, slightly plastic and moist after 22m with trace fine mica, quartz and feldspar minerals		306
12							304
14							302
16							300
18			Gravel pack (0.85-2mm) Depth: 11.5 - 25.0				298
20							296
22							294
24					Saprock, slightly weathered, medium strength to high strength, felsic with mica, feldspars and iron stain	Q: 0.003L/s, pH: 7.17, EC: 813 uS/cm, TDS: 445 ppm, Temp: 16.8 C	292
26					Termination Depth at: 25.00 m		290
28							288

**Notes** Granitic Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB05

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 22/08/2023 - 23/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 25.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 433936, 6394923 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphelel Jamphelel <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Sandy topsoil, gritty, brown-grey, dry, non-plastic with humus and sand		288
4					Clay, reddish yellow-brown mottled white up to 3m, dirty white after 3m, cemented, highly plastic, moist from 0.5-3m, slightly moist afterwards, gritty with fine to medium quartz and feldspar minerals		286
6			Cement grout Depth: 0.00 - 10.0		Clay, creamy white, dry, non-plastic, soft, highly weathered and slightly cemented		284
8					Clay, yellowish brown-white, soft, slightly moist and slightly plastic up to 13.5m, and plastic and moist afterwards with weathered mafic claystone		282
10							280
12			Bentonite Depth: 10.0 - 12.1				278
14							276
16							274
18							272
20			Gravel pack (0.85-2mm) Depth: 12.1 - 25.0				270
22					Sandstone, slightly weathered, greenish grey-black, weak to medium strength, dry with fine quartz, mica and rare mafic minerals		268
24					Doleritic saprock, grey-black, fine to medium-grained mafic intrusive rocks, dry, medium to high strength with magnesium and plagioclase feldspar	Q: 0.003L/s, pH: 7.17, EC: 1066 uS/cm, TDS: 584 ppm, Temp: 16.3 C	266
26					Termination Depth at: 25.00 m		264
28							262
							260

**Notes** Dolerite Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB06

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 11/08/2023 - 14/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 19.50 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 436433, 6396551 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphele Jamphele <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monomet
----------------------------------	---	---

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
1	Aircore				Gravel, brown to yellow-brown, medium to coarse nodules, moderately sorted, sub-rounded to rounded with minor pisolitic sand and roots		288
2							287
3					Laterite, red-brown, medium to coarse fragments, angular, poorly sorted with iron oxide		286
4			Cement grout Depth: 0.00 - 8.50		Sandy clay, yellow-brown to pink-brown mottled white, gritty, non-plastic, dry with 2% of fine to coarse lateric gravels except at 3-4m and 7.5-8.5m (30%)		285
5							284
6							283
7							282
8							281
9			Bentonite Depth: 8.50 - 10.5		Saprolite clay, pink white up to 10m, creamy white from 10-11.5m and pink brown to yellow brown after 11.5m, soft, dry, non-plastic, highly weathered with minor lateritic gravel ranging from medium to coarse along with slightly weathered mafic coarse fragments		280
10							279
11							278
12							277
13							276
14							275
15			Gravel pack (0.85-2mm) Depth: 10.5 - 19.5				274
16							273
17							272
18					Saprock, yellow-brown, slightly moist, mafic, slightly weathered consisting fine feldspar minerals and iron oxide		271
19					Dolerite, grey-black, dry, slightly mafic, fresh saprock, medium to coarse fragment with fine feldspar minerals and mica	Dry	270
20					Termination Depth at: 19.50 m		269
21							268
22							267
23							266
24							265

**Notes** Dolerite Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB07

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 17/08/2023 - 18/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 16.20 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 434773, 6397372 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphelel Jamphelel <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
1	Aircore				Gravel, yellow-brown, fine to coarse nodule, moderately sorted, dry, sub-angular to rounded with sandy clay at 2-2.5m (approximately 5%)		281
2							280
3					Sandy clay, pink-brown to dirty white with depth, dry, non-plastic, gritty with coarse laterite fragments. The composition ratio for clay and laterite fragments is 25:75 at 2.5-3m, 85:15 at 3-4m and 95:5 after 4m		279
4			Cement grout Depth: 0.00 - 7.50				278
5					Saprolite clay, creamy white mottled yellow, highly weathered, dry, soft, non-plastic with minor coarse laterite fragments		277
6							276
7					Sandy clay, pink-brown to red-brown mottled white/yellow, dry, gritty, non-plastic with fine to coarse laterite fragments		275
8							274
9			Bentonite Depth: 7.50 - 9.50				273
10					Saprolite clay, red-brown to yellow-brown, slightly moist and slightly plastic until 14m and moist, slightly cemented and plastic after 14m with trace mica and rare feldspar		272
11							271
12							270
13			Gravel pack (0.85-2mm) Depth: 9.50 - 16.2				269
14							268
15							267
16					Dolerite, grey/green-black, fresh rock, high strength, dry, consist feldspar minerals with iron stain	Dry	266
17					Termination Depth at: 16.20 m		265
18							264
19							263

**Notes** Dolerite Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB08

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 18/08/2023 - 22/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 31.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 433004, 6397329 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphele Jamphele <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Gravel, yellow-brown, fine to coarse nodule, moderately sorted, dry, subrounded to rounded with roots and pisolitic sand		272
4					Laterite fragments, red-brown, dry, medium to coarse, angular, poorly sorted with mottled black and iron oxide, and minor sandy clay		270
6			Cement grout Depth: 0.00 - 11.0		Clay, yellow-brown, slightly cemented and plastic, gritty, slightly moist with fine to medium laterite fragments		268
8					Saprolite clay, creamy white mottled yellow/pink, dry until 3.5m and slightly moist afterwards, slightly gritty, slightly cemented after 3.5m with fine to medium quartz vein		266
10					Saprolite clay, pink-red to red-brown mottled white and yellow, soft until 7m and slightly gritty thereafter, dry until 9.5m and slightly moist and slightly plastic afterwards, white cemented clay at 13-13.5m, fine to medium quartz throughout with minor mica		264
12			Bentonite Depth: 11.0 - 13.0				262
14							260
16					Saprolite clay, yellow-brown to yellow-grey, moist, slightly plastic, slightly gritty with fine to coarse quartz and mica		258
18							256
20							254
22			Gravel pack (0.85-2mm) Depth: 13.0 - 31.0				252
24							250
26							248
28					Quartz fragments, fine to coarse but not significantly coarse, wet (first water strike), low to high strength with minor black and white minerals and iron oxide. Contain small clay (approximately 5%) with water		246
30					Granitic saprock, white-black mottled brown, wet, slightly weathered (low to medium strength), fine to medium, quartz with fine mica, iron stain mottled black and white mineral textures	Q: 0.036L/s, pH: 7.13, EC: 1001uS/cm, TDS: 547 ppm, Temp: 16.4 C	244
32					Termination Depth at: 31.00 m		242
34							240

**Notes** - Dolerite Saprock- Redrilled

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB09

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 10/08/2023 - 11/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 26.50 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 432819, 6398941 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphele Jamphele <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Gravel, yellow-brown, subrounded to rounded nodule, dry, moderately sorted with laterite sand		292
					Laterite, red-brown, dry, coarse fragment, angular with rare Gravel		
					Clay, pinkish brown, gritty, non-plastic, dry with medium to coarse laterite fragments and sand		
4					Clay, dirty white mottled yellow/pink, non-plastic except at 2.5-3m and 4-4.5m, dry, gritty up to 5m and soft afterwards with fine to medium quartz until 5m		290
6			Cement grout Depth: 0.00 - 12.0				288
8					Clay, pinkish black-white to red-brown, soft, dry and non-plastic at 7-9m, slightly moist and plastic after 7m with fine feldspar minerals		286
10							284
12							282
14			Bentonite Depth: 12.0 - 14.1				280
16							278
18							276
20			Gravel pack (0.85-2mm) Depth: 14.1 - 26.5				274
22							272
24							270
26					Doleritic saprock, grey-black, fine to medium-grained mafic intrusive rocks, dry, medium to high strength with magnesium and plagioclase feldspar	Q: 0.04L/s, pH: 6.78, EC: 1474 uS/cm, TDS: 807 ppm, Temp: 16.8 C	268
28					Termination Depth at: 26.50 m		266

**Notes** Dolerite Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL OEMB10

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 14/08/2023 - 15/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 30.10 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 437526, 6399563 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphele Jamphele <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Sandy topsoil, black mottled yellow, dry, non-plastic with tree barks/roots and other humus		282
4					Pisolitic sand, yellow-brown, dry, high sand content (99%) with fine to medium gravel nodules from 1-1.5m and 20% gravel nodules from 1.5-2m and trace clay		280
6			Cement grout Depth: 0.00 - 10.2		Laterite, yellow-brown mottled red, coarse fragments, moderately sorted, dry consisting feldspar minerals with minor coarse consolidated quartz		278
8					Gravelly clay, pink-white, non-plastic, dry, soft with coarse laterite fragments		276
10					Clay, creamy white, highly weathered, soft, dry, non-plastic with rare fine quartz		274
12			Bentonite Depth: 10.2 - 12.3				272
14					Clay, pink-brown to yellow-brown mottled red, highly weathered, slightly moist from 12-24.5m, moist from 24.5-26.5m and slightly gritty (quartz-rich) and wet thereafter, soft and slightly plastic until 26.5m, plastic from 26.5-28m and highly plastic afterwards with fine to coarse weathered biotite fragments and feldspar		270
16							268
18							266
20							264
22			Gravel pack (0.85-2mm) Depth: 12.3 - 30.1				262
24							260
26							258
28							256
30					Granite bedrock, slightly weathered, fine to coarse mineral grain, high strength, wet with quartz and feldspar		254
32					Termination Depth at: 30.10 m		252
34							250

**Notes** Granitic Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL ONMB01

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> <b>Date Drilled</b> 07/08/2023 - 07/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 10.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 423897, 6399852 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphelel Jamphelel <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
1	Aircore		Cement grout Depth: 0.00 - 0.30 Bentonite Depth: 0.30 - 1.50		Clay, reddish brown to yellowish brown, slightly moist up to 1m, non-plastic, gritty with fine to coarse pisolitic gravels and rare laterite fragments		233
2							232
3					Clay, yellow-brown to creamy white mottled red/yellow, cemented, highly plastic, slightly moist until 4.5m and moist thereafter, slightly gritty with fine to coarse lateritic gravels and minor quartz fragments		231
4							230
5							229
6			Gravel pack (0.85-2mm) Depth: 1.50 - 10.0				228
7					Clay, reddish brown to tan mottled yellow, wet, plastic, gritty with fine to coarse quartz and fine weathered feldspar minerals		227
8							226
9							225
10						Q: 0.03 L/s, pH: 6.69, EC: 223 uS/cm, TDS: 177 ppm, Temp: 16.3 C	224
10					Termination Depth at: 10.00 m		224
11							223
12							222
13							221
14							220

**Notes** Saprolite Clay

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL ONMB02D

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> <b>Date Drilled</b> 31/07/2023 - 01/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 23.70 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 431869, 6406346 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Morgan Harding <b>Checked By</b> S. Bright
--	---	---

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
1	Aircore				Gravel, reddish brown-yellow, fine to coarse nodules, subrounded, moderately sorted, moist		238
2							237
3					Clay, white, cemented, high plasticity, gritty feel, alluvial, moist with coarser quartz-rich material		236
4							235
5			Cement grout Depth: 0.00 - 10.9				234
6					Clay, reddish yellow-white, low plasticity, soft, slightly moist		233
7							232
8							231
9							230
10							229
11							228
12			Bentonite Depth: 10.9 - 12.7				227
13					Clay, red-brown, slightly plastic, gritty, moist with remnant bedrock		226
14							225
15							224
16							223
17							222
18			Gravel pack (0.85-2mm) Depth: 12.7 - 23.7				221
19							220
20							219
21							218
22							217
23					Granite bedrock, slightly weathered, fine to coarse mineral grain, iron staining, high strength, wet	Q: 0.07 L/s, pH: 6.91, EC: 3310 uS/cm, TDS: 1820 ppm, Temp: 17.2 C	216
24					Termination Depth at: 23.70 m		215
25							214

**Notes** Granitic Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL ONMB02S

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> <b>Date Drilled</b> 01/08/2023 - 01/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 7.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 431868, 6406343 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Morgan Harding <b>Checked By</b> S. Bright
--	--	---

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monoment
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
0.5	Aircore		Cement grout Depth: 0.00 - 1.00		Gravel, reddish brown-yellow, fine to coarse nodule, subrounded, moderately sorted, moist		254.8
1.0			Bentonite Depth: 1.00 - 2.00				254.0
1.5							253.2
2.0							253.0
2.5							252.8
3.0					Clay, white, cemented, high plasticity, gritty feel, alluvial, moist with coarser quartz-rich material		252.2
3.5					Clay, white, cemented, high plasticity, gritty feel, alluvial, moist with coarser quartz-rich material		252.0
4.0							251.8
4.5			Gravel pack (0.85-2mm) Depth: 2.00 - 7.00				250.8
5.0							250.0
5.5							249.8
6.0					Clay, reddish yellow-white, low plasticity, soft, slightly moist		249.0
6.5							248.8
7.0					Termination Depth at: 7.00 m	Dry	248.0
7.5							247.8
8.0							247.0
8.5							246.8
9.0							246.0
9.5							245.8

**Notes** Clay

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL ONMB04

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> <b>Date Drilled</b> 01/08/2023 - 02/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 27.10 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 432558, 6404407 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Kristyn Blomme <b>Checked By</b> S. Bright
--	---	---

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monument
----------------------------------	---	--

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
2	Aircore				Laterite, brown, sub-angular, moderately sorted, fine to coarse gravels, moist with sandy clay matrix		264
4					Clay, brown to white, cemented, highly plastic, stiff, dry with quartz veins		262
6					Sandy clay, white (pink at 18m), soft, dry, low plasticity with rare quartz		260
8			Cement grout Depth: 0.00 - 16.0				258
10					Sandy clay, white, moist, with rich coarse quartz		256
12					Sandy clay, yellow, low plasticity, cemented, moist with rare quartz		254
14							252
16							250
18			Bentonite Depth: 16.0 - 18.1				248
20							246
22			Gravel pack (0.85-2mm) Depth: 18.1 - 27.0				244
24							242
26						Q: 0.01 L/s, pH: 6.98, EC: 5570 uS/cm, TDS: 3120 ppm, Temp: 17.0 C	240
28					Granite bedrock, weathered, iron staining, high strength, wet, rich in quartz		238
					Termination Depth at: 27.10 m		236

**Notes** Granitic Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# BOREHOLE LOG

MONITORING WELL ONMB05

HYDROGEOLOGICAL-GROUNDWATER

<b>Client</b> Alcoa of Australia <b>Project</b> Alcoa Holyoake Environmental Assessments <b>Project No.</b> 12565572 <b>Site</b> O'Neil <b>Location</b> Western Australia <b>Date Drilled</b> 25/08/2023 - 25/08/2023	<b>Drill Co.</b> Proline <b>Rig Type</b> PL001 <b>Drill Method</b> Aircore <b>Total Depth (m)</b> 14.00 <b>Casing Diameter (mm)</b> 50 <b>Drilling Diameter (mm)</b> 125	<b>Easting, Northing</b> 433068, 6401695 <b>Grid Ref</b> GDA2020_MGA_zone_50 <b>Stickup (m)</b> 0.6 <b>TOC Elevation (m AHD)</b> - <b>Logged By</b> Jamphele Jamphele <b>Checked By</b> S. Bright
--	---	--

<b>Casing</b> 50 mm Class 12 PVC	<b>Screen</b> 0.5mm aperture slotted CL12 PVC	<b>Surface Completion</b> Steel Monomet
----------------------------------	---	---

Depth (m)	Drilling Method	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	DRILLING OBSERVATIONS	Elevation (m)
1	Aircore		Cement grout Depth: 0.00 - 3.00		Sandy Topsoil, yellow-black, dry, gritty, non-plastic with roots and sand		253
2					Sandy soil, yellow-white, gritty, dry, slightly cemented, sandy texture, with fine to medium quartz throughout		252
3			Bentonite Depth: 3.00 - 5.00		Clay, dirty white mottled yellow/brown, gritty, hard, slightly moist, slightly cemented, non-plastic with fine to medium quartz, feldspar minerals and iron stain		251
4							250
5							249
6					Clay, creamy white mottled yellow, dry, highly weathered, non-plastic, soft until 9m, slightly gritty afterwards with fine to medium quartz throughout		248
7							247
8							246
9			Gravel pack (0.85-2mm) Depth: 5.00 - 14.0				245
10							244
11					Clay, creamy white, non-plastic, dry, gritty with fine to coarse quartz vein (approximately 40%)		243
12					Sandy clay, yellow-brown, non-plastic, dry, gritty with fine to medium quartz and feldspar minerals		242
13							241
14					Granitic saprock, fresh, dry, medium to high strength, consists of quartz and feldspar minerals	Dry	240
15					Termination Depth at: 14.00 m		239
16							238
17							237
18							236
19							235

**Notes** Granitic Saprock

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, MR-Mud Rotary, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	<b>Granular Soils</b> VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense	<b>Cohesive Soils</b> VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



# Appendix C

## Chip trays and sample piles

### Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB01	0 - 20	
		20 - 31.7	

Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB02	0 - 4	
O'Neil	OEMB03	0 - 20	



Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB03	20 – 35	
O'Neil	OEMB04	0 – 20	

Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB04	20 – 25	
O'Neil	OEMB05	0 – 20	



Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB05	20 – 25	
O'Neil	OEMB06	0 – 19	

Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB07	0 - 16.2	
O'Neil	OEMB08	0 - 20	

Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB08	20 – 31	
O'Neil	OEMB09	0 – 20	


Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB09	20 – 26.5	 <p>A white plastic chip tray with seven compartments. The lid is marked with blue handwritten labels: 20-21, 21-22, 22-23, 23-24, 24-25, 25-26, and 26-26.5. The compartments contain soil samples of varying colors and textures, ranging from light brown to dark greenish-grey.</p>
O'Neil	OEMB10	0 – 20	 <p>A white plastic chip tray with 20 compartments. The lid is marked with blue handwritten labels from 0-1 to 19-20. The compartments contain soil samples showing a color gradient from light tan to dark reddish-brown.</p>


Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	OEMB10	20 – 30.2	
O'Neil	ONMB01	0 – 10	

Chip Tray Sample

Location	Bore ID	Depth (m)	Chip Tray
O'Neil	ONMB02	0 - 23.8	

Chip Tray Sample



Location	Bore ID	Depth (m)	Chip Tray
O'Neil	ONMB04	0 – 27.1	
O'Neil	ONMB05	0 – 14	

### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	ONMB01	0 – 5	
O'Neil	ONMB01	5 – 10	

<sup>1</sup> Depth to be interpreted from left to right.

### Sample Photos



Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	ONMB_02D & ONMB_02S <sup>2</sup>	0 – 10	
		10 – 20	
		20 – 23.7	
O'Neil	ONMB04	0 – 10	
		10 – 20	
		20 – 27.1	

<sup>2</sup> ONMB\_02S is a shallow bore located next to ONMB\_02D (deep bore) and consists of similar lithology to the deep bore.


### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB01	0 - 5	
		10 - 15	
		20 - 25	
		30 - 31.7	




### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB01	5 – 10  15 – 20  25 – 30	
O'Neil	OEMB02	0 - 4	



### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB03	0 - 5	
		10 - 15	
		20 - 25	
		30 - 34.8	

### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB03	5 – 10	
		15 – 20	
		25 – 30	




### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB04	0 - 5	
		10 - 15	
20 - 25			
		5 - 10	
		15 - 20	



### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB05	0 - 5	
		10 - 15	
		20 - 25	
		5 - 10	
		15 - 20	


### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB06	0 – 5	
		10 – 15	
		15 – 19	

### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB07	0 – 5	
		10 – 15	
		5 – 10	
15 – 16.2			

### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB08	0 – 5	
		10 – 15	
		20 – 25	
		30-31	



### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB08	5 – 10	
		15 – 20	
		25 – 30	


### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB09	0 – 5  10 – 15  20 – 25	




### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB09	5 – 10	
		5 – 20	
		25 – 26.5	
O'Neil	OEMB10	0 – 5	
		10 – 15	
		20 – 25	

### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	OEMB10	5 – 10	
		15 – 20	
		25 – 30.1	

### Sample Photos

Location	Bore ID	Depth (m)	Sample <sup>1</sup>
O'Neil	ONMB05	0 – 5	
		10 – 14	
		5 – 10	

# Appendix D

**Permeability data – field data, summary table and AQTESOLV analysis**

## Appendix D – Permeability test analysis

Permeability data was collected as rising and falling head tests and analysed using AQTESOLV to determine an estimated hydraulic conductivity. To complete the analysis several assumptions were required, a discussion of which is provided below.

### Confined vs unconfined

It was assumed all bores were unconfined. This assumption was based on the interpreted geology and depth of the standing water level. If a confining layer were to exist it would likely be around 2 – 7m, where thick transported clays could form, however the standing water level in most bores is below this point. The data analysis has been done using the Bouwer-Rice, Cooper-Bredehoft-Papaopulos, KGS, and KGS with skin effect. All these solutions have negligible difference between the analysis of data as confined or unconfined.

### Saturated thickness of the aquifer (AQTESOLV Parameter b)

AQTESOLV requires an input parameter (b) relating to the saturated thickness of the aquifer, including the vertical extent of the aquifer below the bore depth. This was difficult to determine due to a variety of factors including: not knowing the geology of the hole below the drilled depth, logging of sample chips which are not in-situ and in which harder minerals are over represented in the sample return, and the impact of having multiple small sand/gravel/ferricrete bands within larger horizons of clay.

Due to these issues the aquifer thickness was approximated for each bore based on the vertical thickness of the strata (above the bore termination depth) through which groundwater flow is expected to dominate. For example, where the bore was screened in saprolite clay and clayey saprock, the aquifer thickness was assumed to be from the top clayey saprock unit to the bottom of the hole, as this is where the dominant water flow is expected.

### Solution types

Numerous solution types are available within the ATEOLV software for analysis of slug test results. The solution types chosen for this analysis are for an overdamped response.

Wells screened below the water table were first analysed with Cooper-Bredehoft-Papaopulos solution to get an idea of the anisotropy. The Cooper-Bredehoft-Papaopulos is a type curve solution in confined aquifers for fully penetrating wells. Although the bores are unconfined, a confining affect can be seen in some bores due to localised confining layers of clay. The Cooper-Bredehoft-Papaopulos solution is used to estimate the following parameters:

- T (transmissivity)
- S (storativity)

The KGS model is a type curve solution in unconfined aquifers for fully or partially penetrating wells. If a skin effect was observed in the data, then the KGS skin effect solution was used instead.

It estimates results for the following parameters:

- $K_r$  (radial hydraulic conductivity in aquifer)
- $S_s$  (Specific storage in aquifer).
- $K_z/K_r$  (anisotropy ratio in aquifer) – Note this was assumed to be one in all results.

The Bouwer & Rice solution is a straight-line solution in fully or partially penetrating wells in unconfined aquifers. It allows for a correction for the effective porosity of the filter pack, allowing for its application where the well is screen across the water table. Estimation using the straight-line method has been completed using the recommended head ranges developed by Butler (1998) and which are incorporated into the AQTEOLV software. The Bouwer & Rice solution is used to estimate the following parameters:

- K (hydraulic conductivity)
- $y_0$  (intercept of line on y axis)

### Solution Assumptions

All groundwater parameter estimation solutions make several assumptions in order to estimate parameters. The assumptions made in the Cooper-Bredehoff-Papaopulos, KGS, KGS model with skin and Bouwer and Rice solutions are:

- aquifer has infinite areal extent
- aquifer is homogeneous and of uniform thickness
- aquifer is isotropic (Cooper assumption only)
- test and observation wells are fully or partially penetrating
- aquifer is unconfined (Bouwer-Rice and KGS assumption only)
- aquifer is nonleaky confined (Cooper assumption only)
- a volume of water,  $V$ , is injected into or discharged from the well instantaneously
- flow to control well is horizontal (Cooper assumption only)
- aquifer potentiometric surface is initially horizontal (KGS model and Cooper assumption only)
- flow is unsteady (KGS model and Cooper assumption only)
- water is released instantaneously from storage with decline of hydraulic head (KGS model and Cooper assumption only)
- flow to well is quasi-steady-state (storage is negligible) (Bouwer-Rice assumption only)

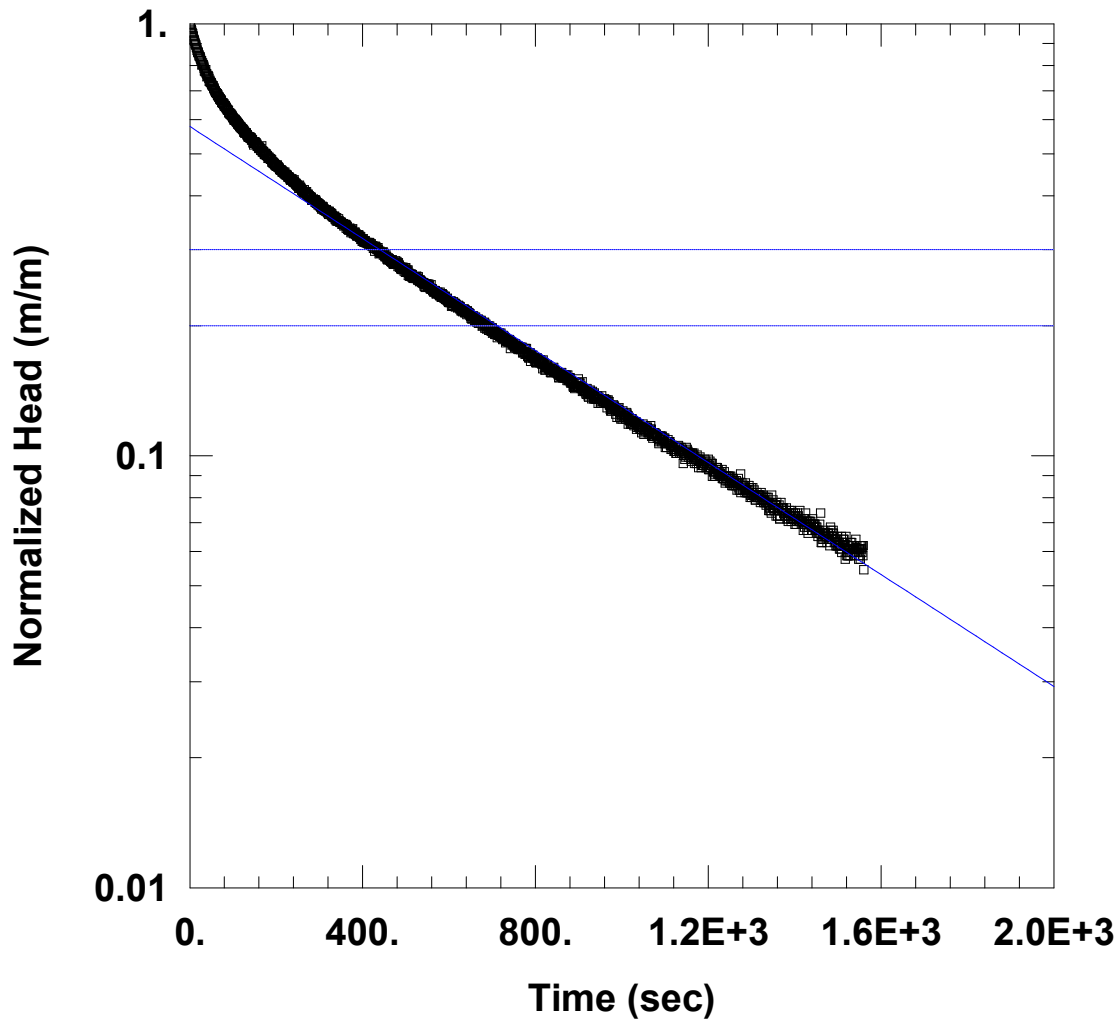
A summary of the permeability test results is provided in Table 3 on the following pages.

## **References**

Duffield, G.M., 2007. AQTESOLV for Windows Version 4.5 User's Guide, HydroSOLVE, Inc., Reston, VA.

Table 3 Summary of permeability test results

Bore ID	Method	Assessed Reliability	Estimated K (m/d)	Screened Geology
OEMB01	Bouwer and Rice	Higher	3.0E-02	Clay with minor saprolite
	Cooper-Bredehoft-Papaopulos	Moderate	1.8E-02	
	KGS with Skin	Higher	1.7E-02	
OEMB02	Dry			
OEMB03	Dry			
OEMB04	Bouwer and Rice	Higher	7.8E-03	Clay
	Cooper-Bredehoft-Papaopulos	Moderate	4.1E-03	
	KGS	Moderate	4.9E-03	
OEMB05	Bouwer and Rice	Moderate	2.6E-02	Clay and sandstone
	Cooper-Bredehoft-Papaopulos	Moderate	4.1E-03	
	KGS	Moderate	4.3E-02	
OEMB06	Dry			
OEMB07	Dry			
OEMB08	Bouwer and Rice	Higher	8.3E-02	Saprolite clay and saprock
	Cooper-Bredehoft-Papaopulos	Higher	8.9E-02	
	KGS	Higher	9.0E-02	
	KGS with skin	Higher	4.6E-02	
OEMB09	Bouwer and Rice	Lower	2.4E-01	Clay
	Cooper-Bredehoft-Papaopulos	Lower	4.2E-01	
	KGS with skin	Lower	3.7E-01	
OEMB10	Bouwer and Rice	Higher	1.6E-01	Clay with minor saprolite
	Cooper-Bredehoft-Papaopulos	Higher	3.4E-01	
	KSG with Skin Effects	Higher	4.6E-02	
ONMB01	Bouwer and Rice	Higher	8.5E-02	Clay
ONMB02_D	Bouwer and Rice	Higher	2.5E-01	Clay and granite bedrock
	Cooper-Bredehoft-Papaopulos	Moderate	1.7E-01	
	KGS with skin	Higher	2.1E-01	
ONMB04	Bouwer and Rice	Higher	1.7E-02	Sandy clay
ONMB05	Dry			



WELL TEST ANALYSIS

Data Set: \...\OEMB01-rising head test\_BR.aqt

Date: 01/31/24

Time: 12:34:14

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB01

Test Date: 19/01/2024

AQUIFER DATA

Saturated Thickness: 7.75 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB01)

Initial Displacement: 0.937 m

Static Water Column Height: 7.75 m

Total Well Penetration Depth: 7.75 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

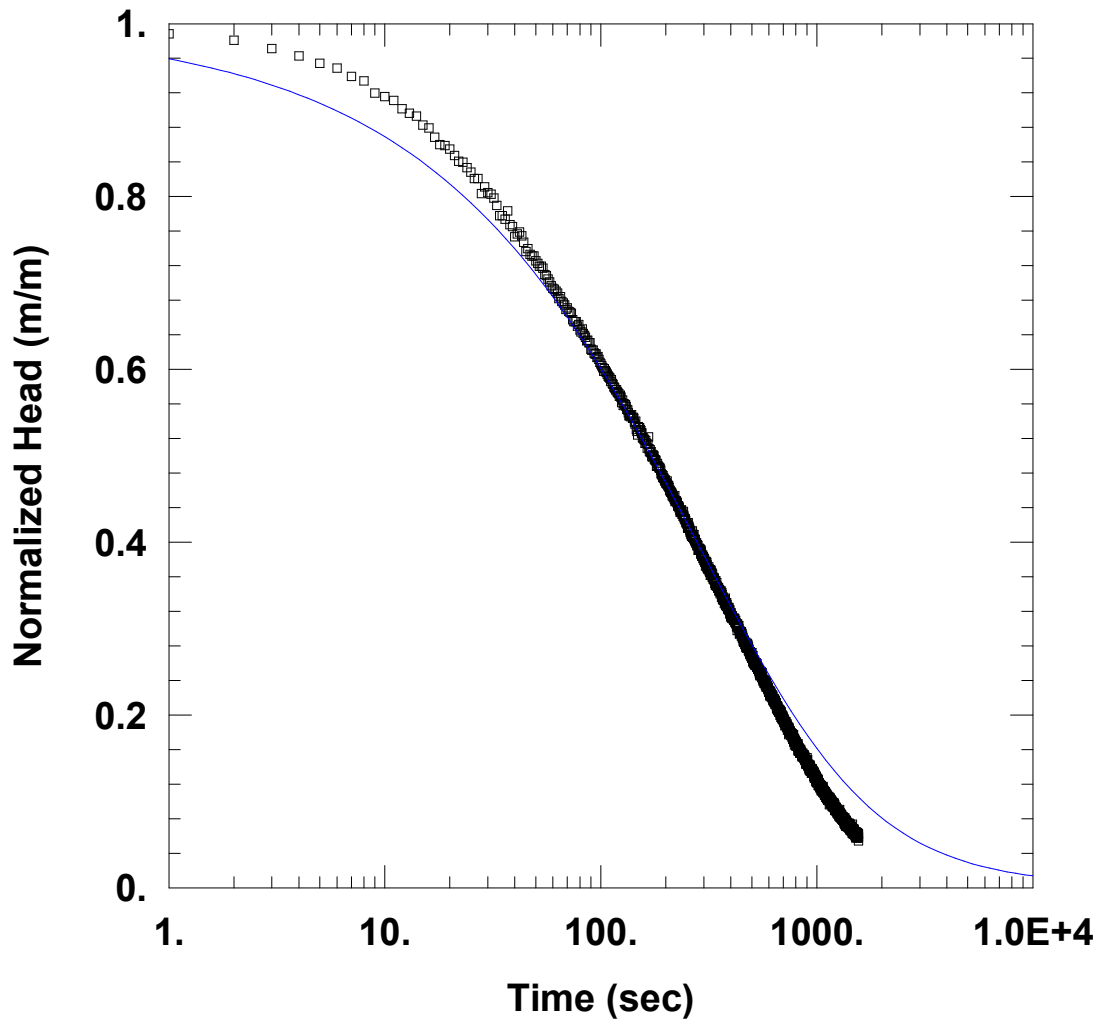
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.03002 m/day

y0 = 0.542 m



WELL TEST ANALYSIS

Data Set: \...\OEMB01-rising head test\_cooper.aqt

Date: 01/31/24

Time: 12:35:00

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB01

Test Date: 19/01/2024

AQUIFER DATA

Saturated Thickness: 7.75 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB01)

Initial Displacement: 0.937 m

Static Water Column Height: 7.75 m

Total Well Penetration Depth: 7.75 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

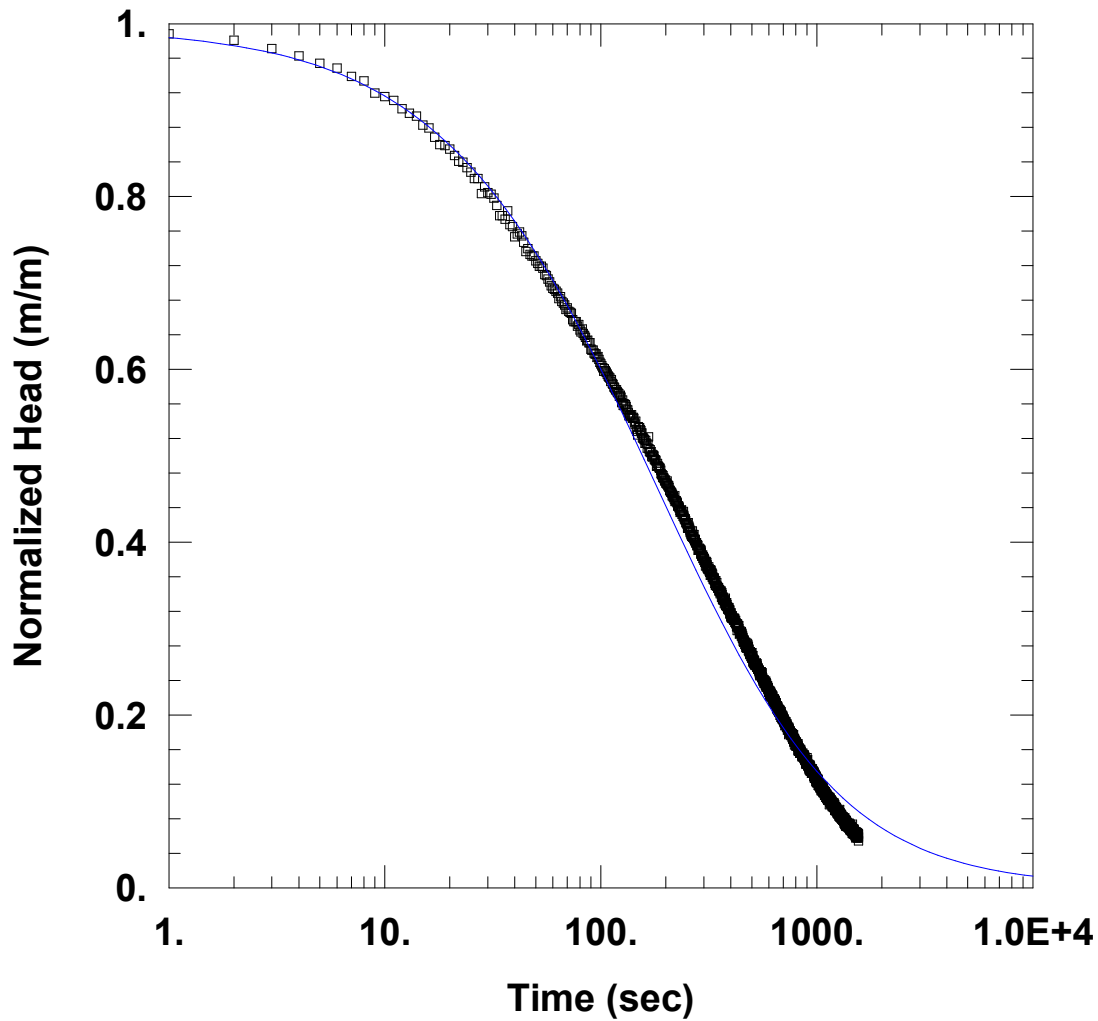
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopoulos

T = 0.108 m<sup>2</sup>/day

S = 0.1568



WELL TEST ANALYSIS

Data Set: \...\OEMB01-rising head test\_KGS with skin.aqt  
 Date: 01/31/24 Time: 12:35:32

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: OEMB01  
 Test Date: 19/01/2024

AQUIFER DATA

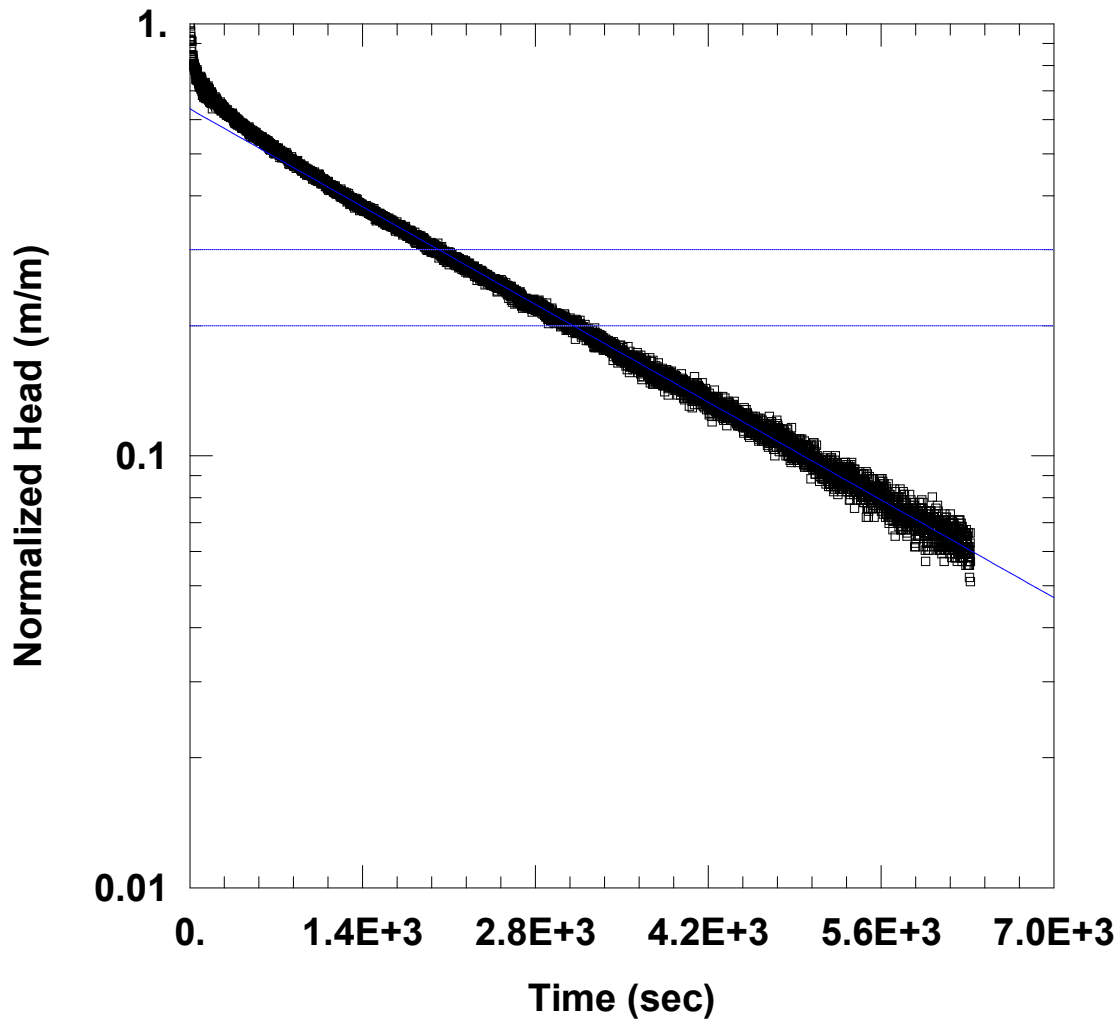
Saturated Thickness: 7.75 m

WELL DATA (OEMB01)

Initial Displacement: <u>0.937 m</u>	Static Water Column Height: <u>7.75 m</u>
Total Well Penetration Depth: <u>7.75 m</u>	Screen Length: <u>6. m</u>
Casing Radius: <u>0.025 m</u>	Well Radius: <u>0.025 m</u>
Well Skin Radius: <u>0.0625 m</u>	

SOLUTION

Aquifer Model: <u>Unconfined</u>	Solution Method: <u>KGS Model w/skin</u>
Kr = <u>0.01667 m/day</u>	Ss = <u>0.02024 m<sup>-1</sup></u>
Kz/Kr = <u>1.</u>	Kr' = <u>0.04195 m/day</u>
Ss' = <u>0.001 m<sup>-1</sup></u>	Kz/Kr' = <u>1.</u>



### WELL TEST ANALYSIS

Data Set: \\...\OEMB04-falling head test\_BR.aqt

Date: 01/31/24

Time: 12:36:01

### PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB04

Test Date: 19/01/2024

### AQUIFER DATA

Saturated Thickness: 10.54 m

Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (OEMB04)

Initial Displacement: 0.86 m

Static Water Column Height: 10.54 m

Total Well Penetration Depth: 10.54 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

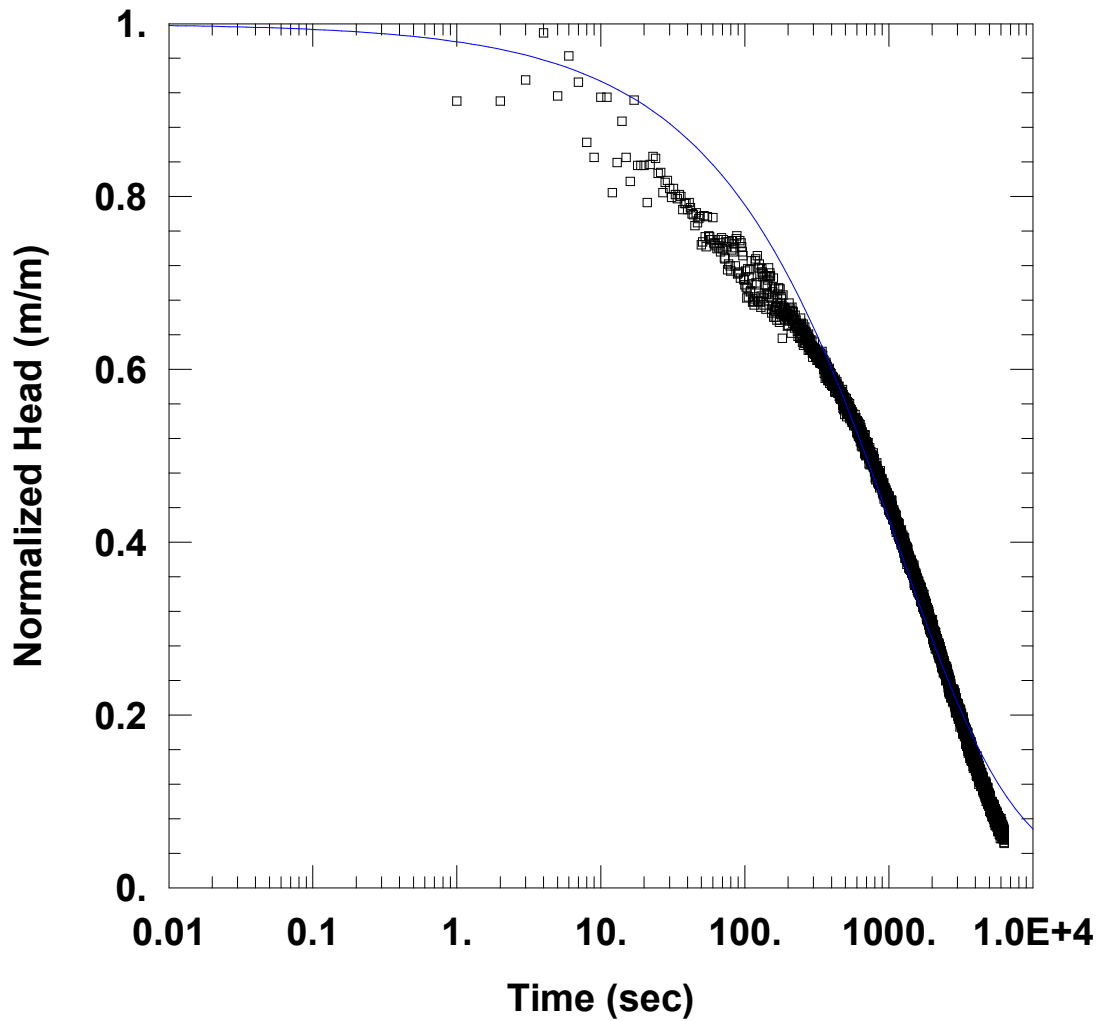
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.00783 m/day

y0 = 0.5465 m



WELL TEST ANALYSIS

Data Set: \...\OEMB04-falling head test\_Cooper.aqt  
 Date: 01/31/24 Time: 12:41:24

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: OEMB04  
 Test Date: 19/01/2024

AQUIFER DATA

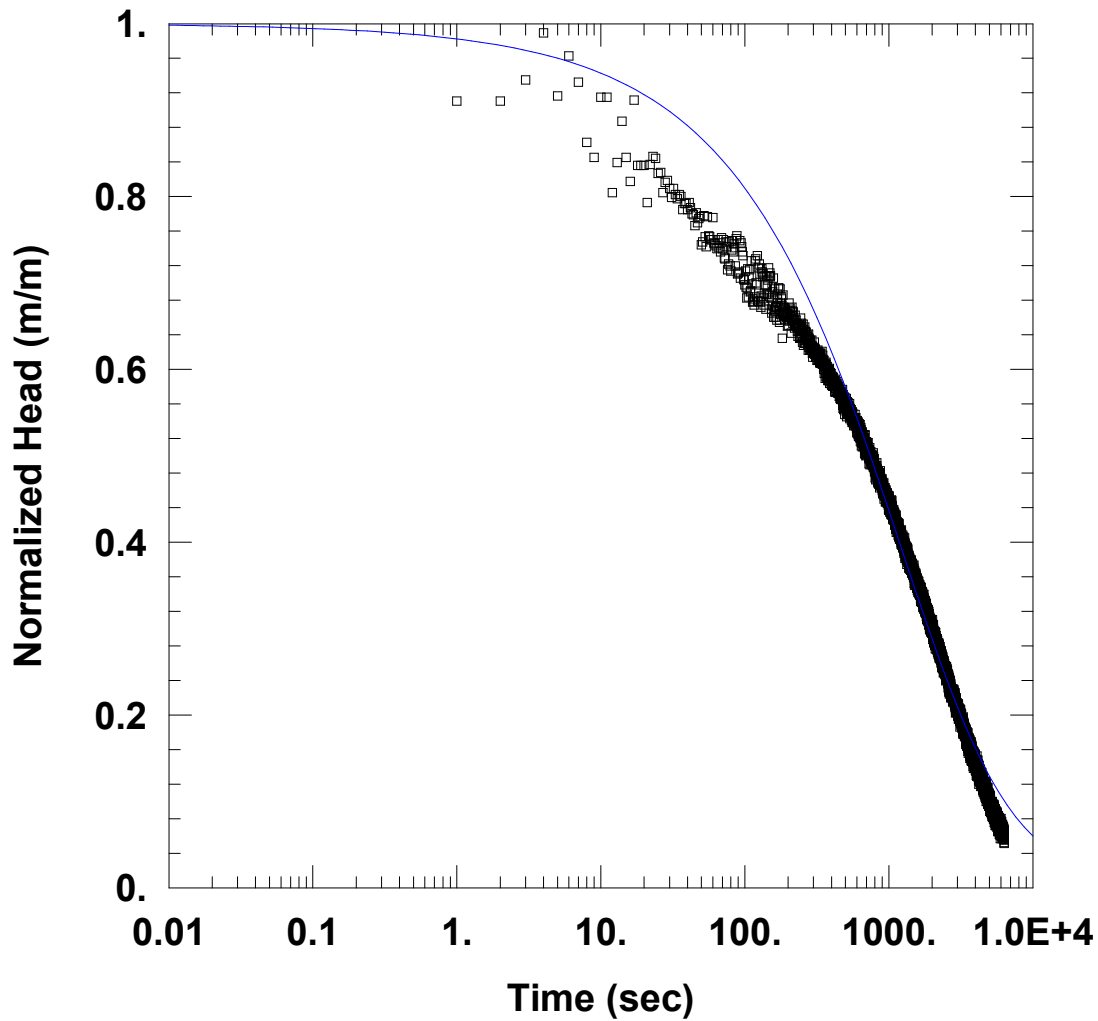
Saturated Thickness: 10.54 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB04)

Initial Displacement: 0.86 m Static Water Column Height: 10.54 m  
 Total Well Penetration Depth: 10.54 m Screen Length: 6. m  
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Bredehoeft-Papadopoulos  
 T = 0.02464 m<sup>2</sup>/day S = 0.1854



WELL TEST ANALYSIS

Data Set: \...\OEMB04-falling head test\_KGS.aqt

Date: 01/31/24

Time: 12:42:00

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB04

Test Date: 19/01/2024

AQUIFER DATA

Saturated Thickness: 10.54 m

WELL DATA (OEMB04)

Initial Displacement: 0.86 m

Total Well Penetration Depth: 10.54 m

Casing Radius: 0.025 m

Static Water Column Height: 10.54 m

Screen Length: 6. m

Well Radius: 0.025 m

SOLUTION

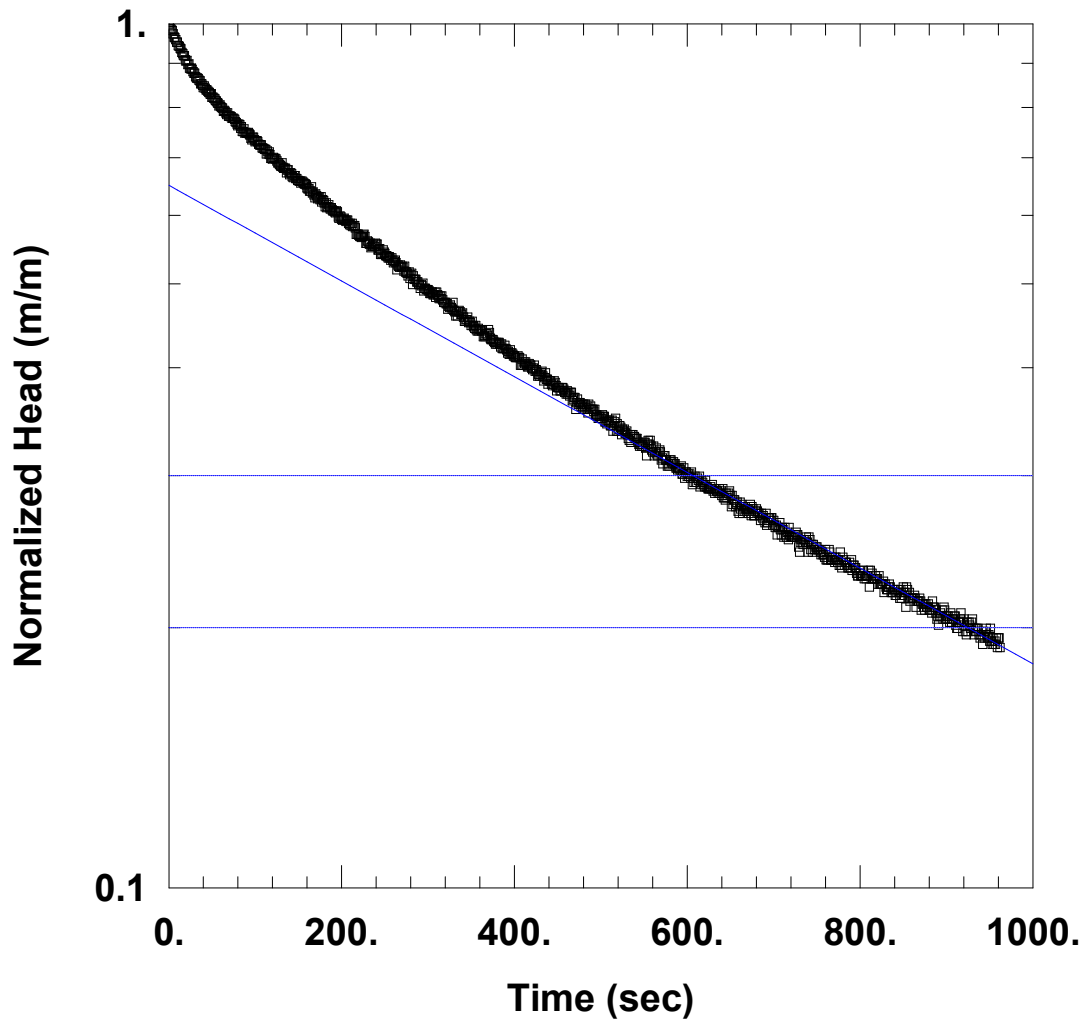
Aquifer Model: Unconfined

Kr = 0.00494 m/day

Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.01759 m<sup>-1</sup>



### WELL TEST ANALYSIS

Data Set: \...\OEMB05 falling head test\_BR.aqt

Date: 01/31/24

Time: 12:42:59

### PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB05

Test Date: 18/01/2024

### AQUIFER DATA

Saturated Thickness: 8.78 m

Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (OEMB05)

Initial Displacement: 0.601 m

Static Water Column Height: 8.78 m

Total Well Penetration Depth: 8.78 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

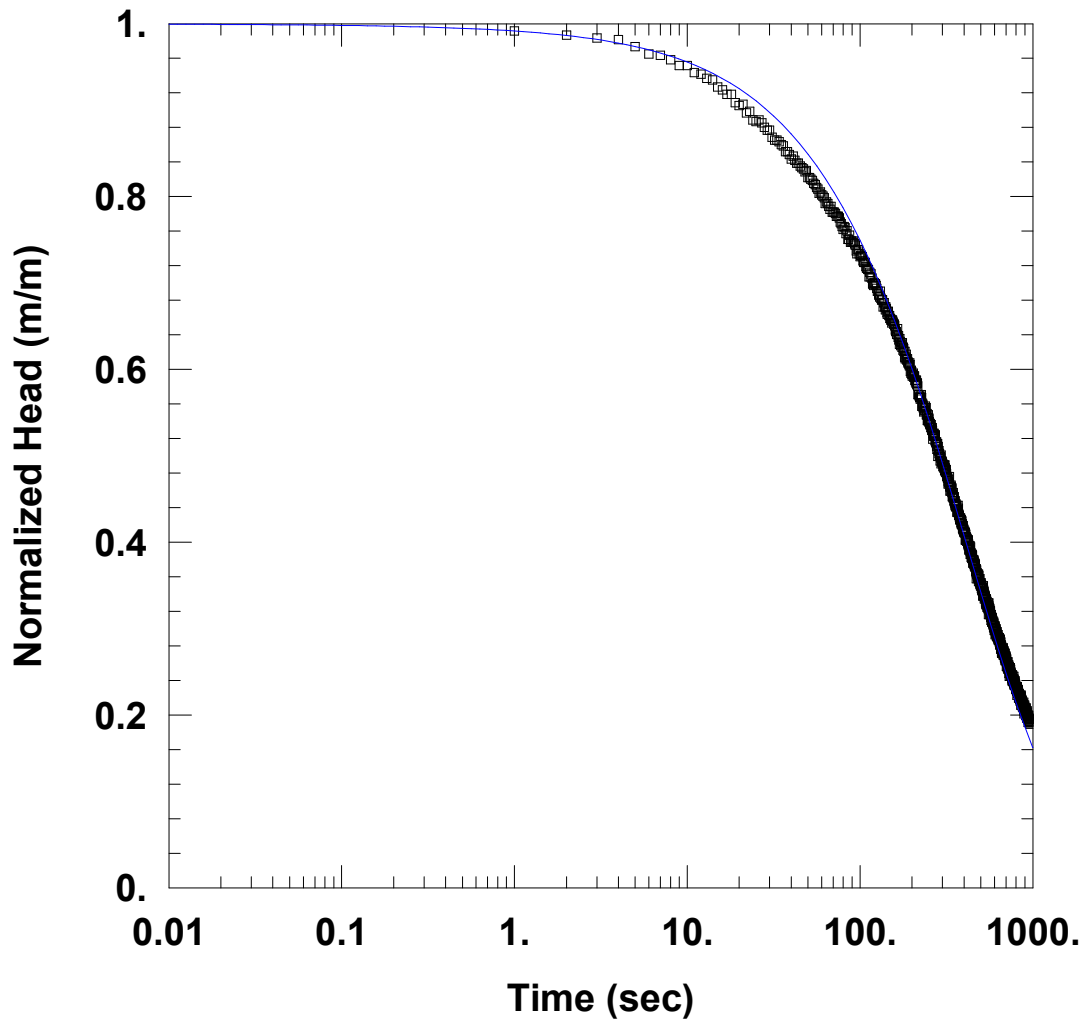
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.02613 m/day

y0 = 0.3908 m



WELL TEST ANALYSIS

Data Set: \\...\OEMB05 falling head test \_cooper.aqt  
 Date: 01/31/24 Time: 12:42:26

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: OEMB05  
 Test Date: 18/01/2024

AQUIFER DATA

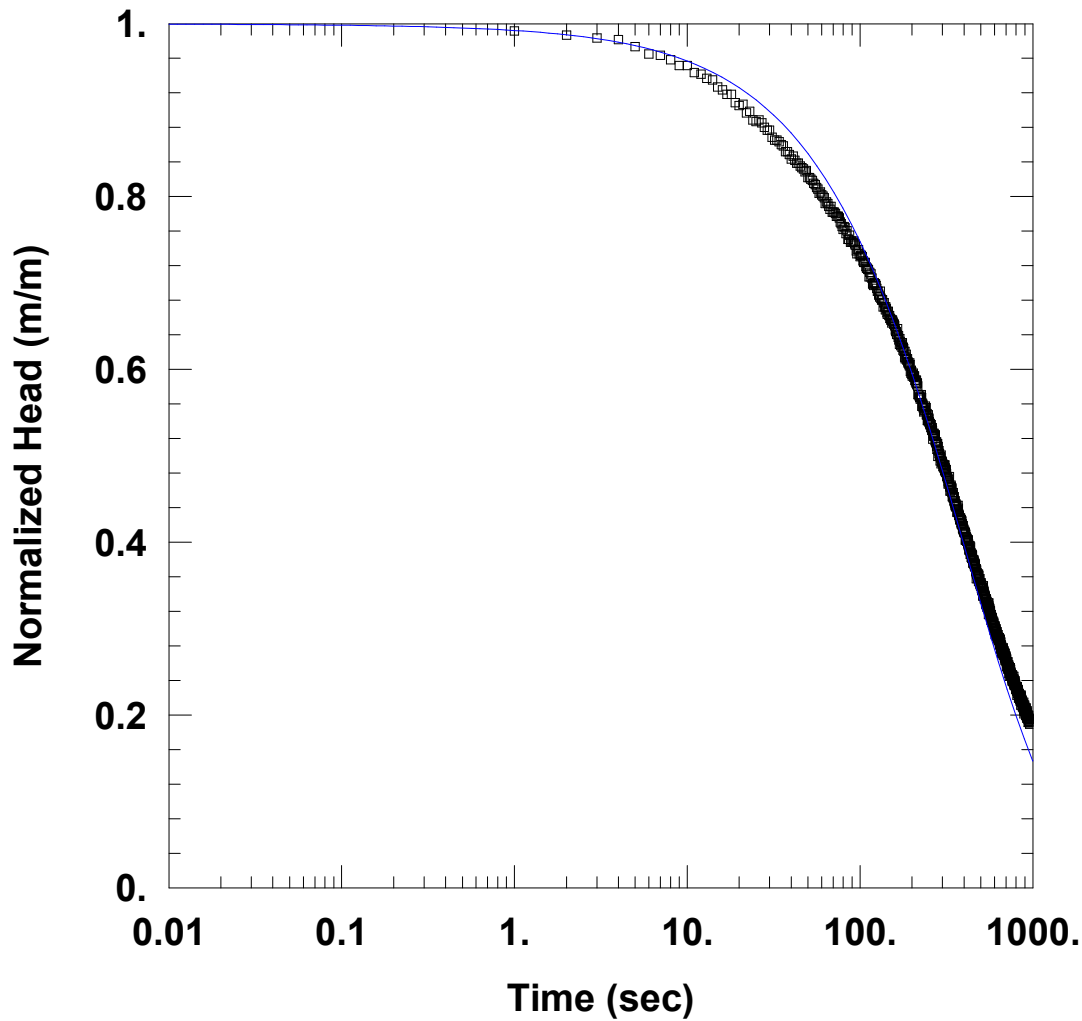
Saturated Thickness: 8.78 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB05)

Initial Displacement: 0.601 m Static Water Column Height: 8.78 m  
 Total Well Penetration Depth: 8.78 m Screen Length: 6. m  
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Bredehoeft-Papadopoulos  
 T = 0.2428 m<sup>2</sup>/day S = 0.001



WELL TEST ANALYSIS

Data Set: \...\OEMB05 falling head test\_KGS.aqt

Date: 01/31/24

Time: 12:43:28

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB05

Test Date: 18/01/2024

AQUIFER DATA

Saturated Thickness: 8.78 m

WELL DATA (OEMB05)

Initial Displacement: 0.601 m

Total Well Penetration Depth: 8.78 m

Casing Radius: 0.025 m

Static Water Column Height: 8.78 m

Screen Length: 6. m

Well Radius: 0.025 m

SOLUTION

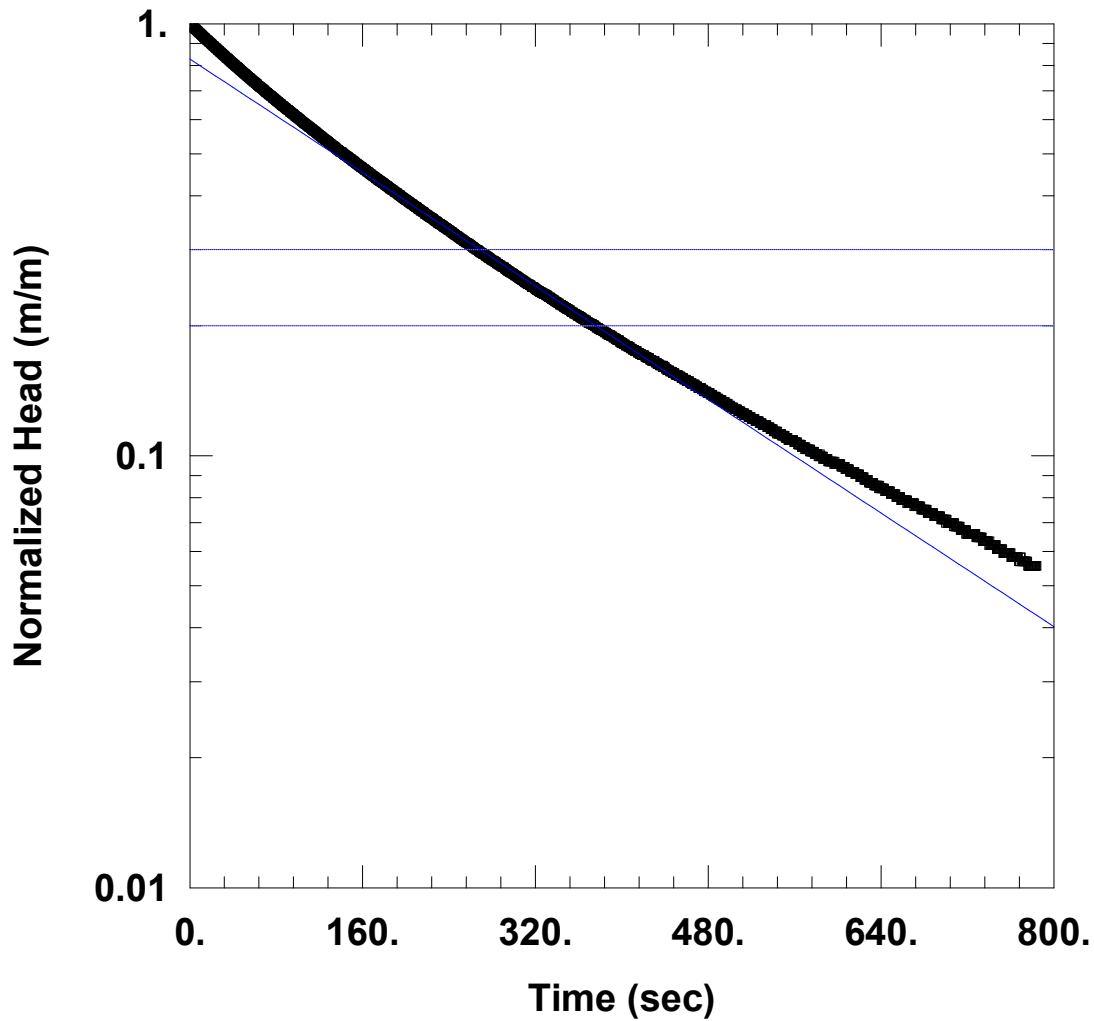
Aquifer Model: Unconfined

Kr = 0.0429 m/day

Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.0001139 m<sup>-1</sup>



### WELL TEST ANALYSIS

Data Set: \...\OEMB08 rising head test\_BR.aqt

Date: 01/31/24

Time: 12:44:26

### PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB08

Test Date: 15/12/2023

### AQUIFER DATA

Saturated Thickness: 14.93 m

Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (OEMB08)

Initial Displacement: 0.773 m

Static Water Column Height: 14.93 m

Total Well Penetration Depth: 14.93 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

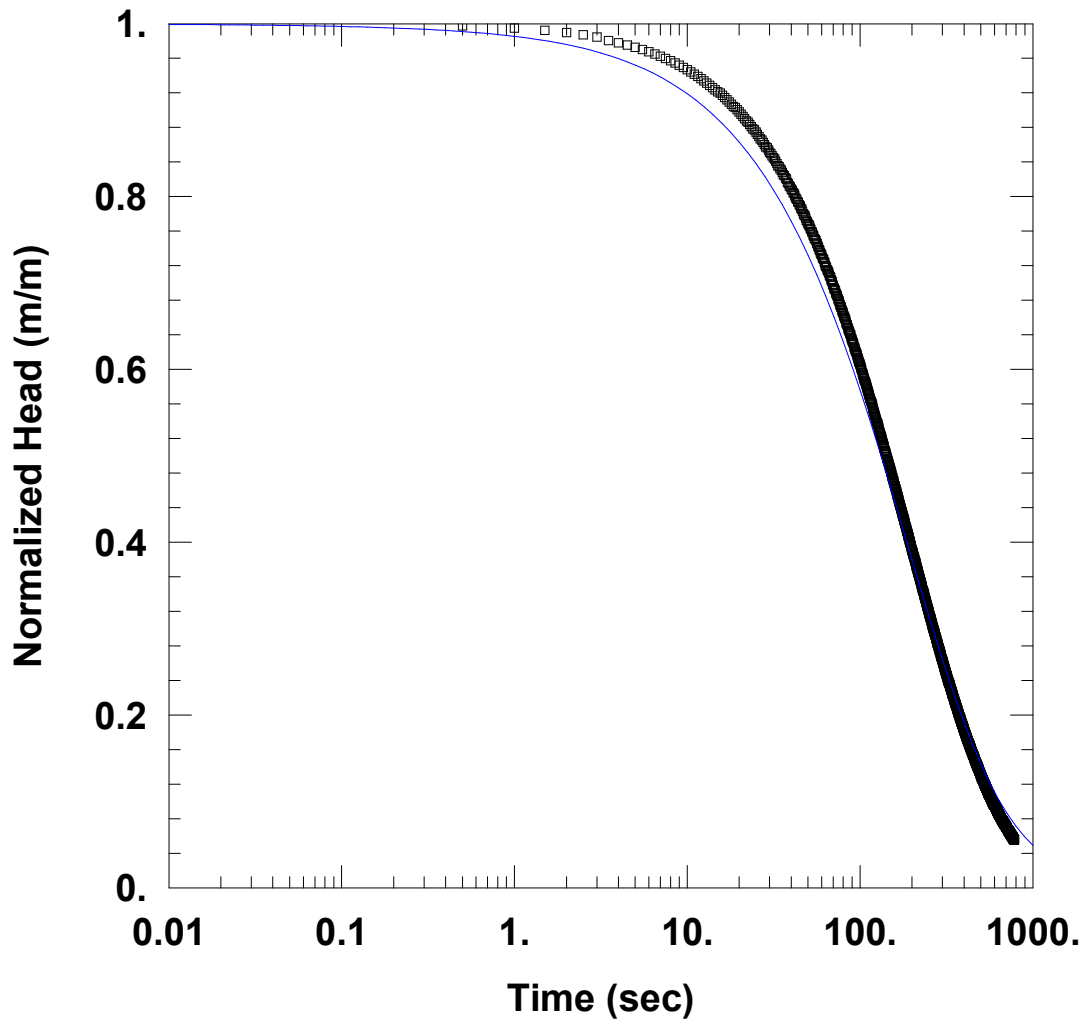
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.08341 m/day

y0 = 0.6407 m



WELL TEST ANALYSIS

Data Set: \...\OEMB08 rising head test\_cooper.aqt

Date: 01/31/24

Time: 12:44:50

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB08

Test Date: 15/12/2023

AQUIFER DATA

Saturated Thickness: 14.93 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB08)

Initial Displacement: 0.773 m

Static Water Column Height: 14.93 m

Total Well Penetration Depth: 14.93 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

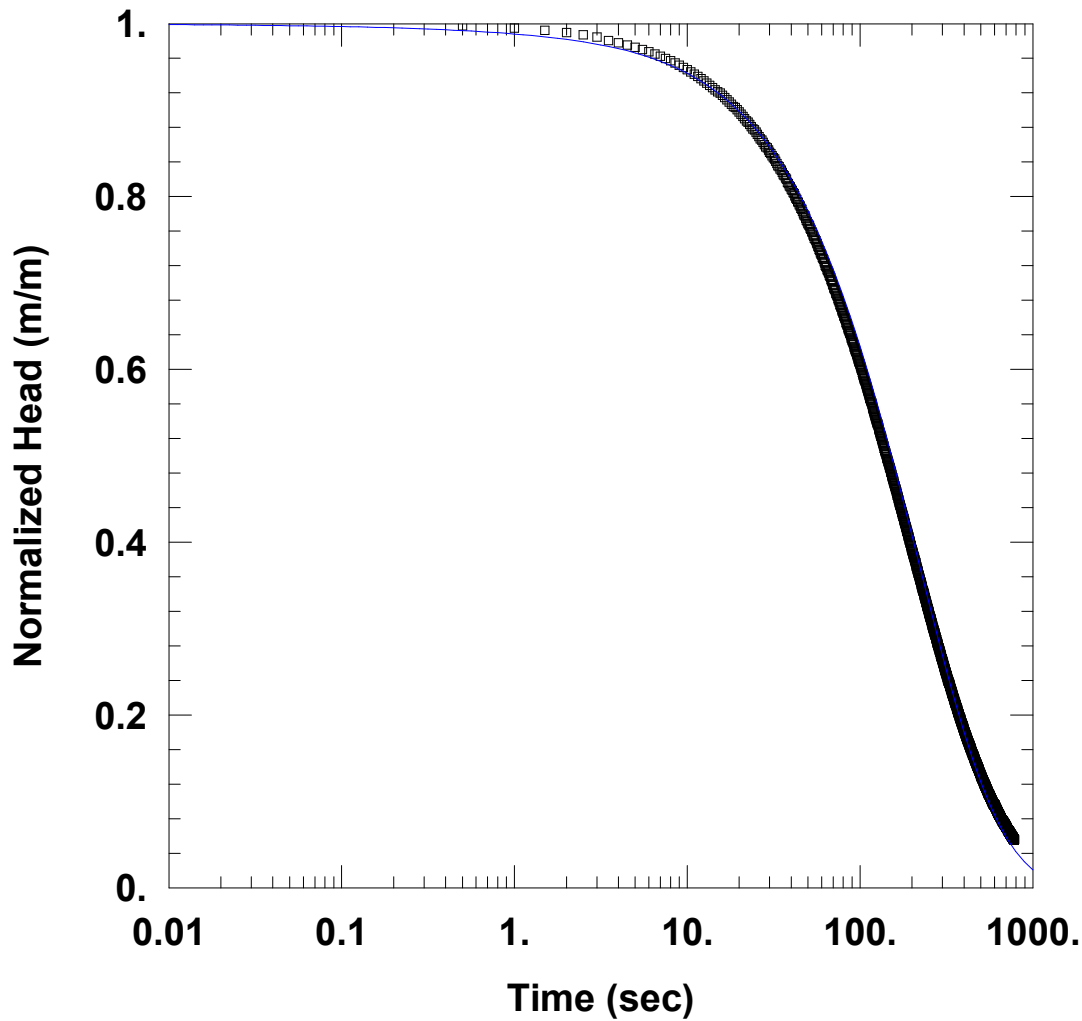
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopoulos

T = 0.5336 m<sup>2</sup>/day

S = 0.001



WELL TEST ANALYSIS

Data Set: \...\OEMB08 rising head test\_KGS with skin.aqt  
 Date: 01/31/24 Time: 12:45:21

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: OEMB08  
 Test Date: 15/12/2023

AQUIFER DATA

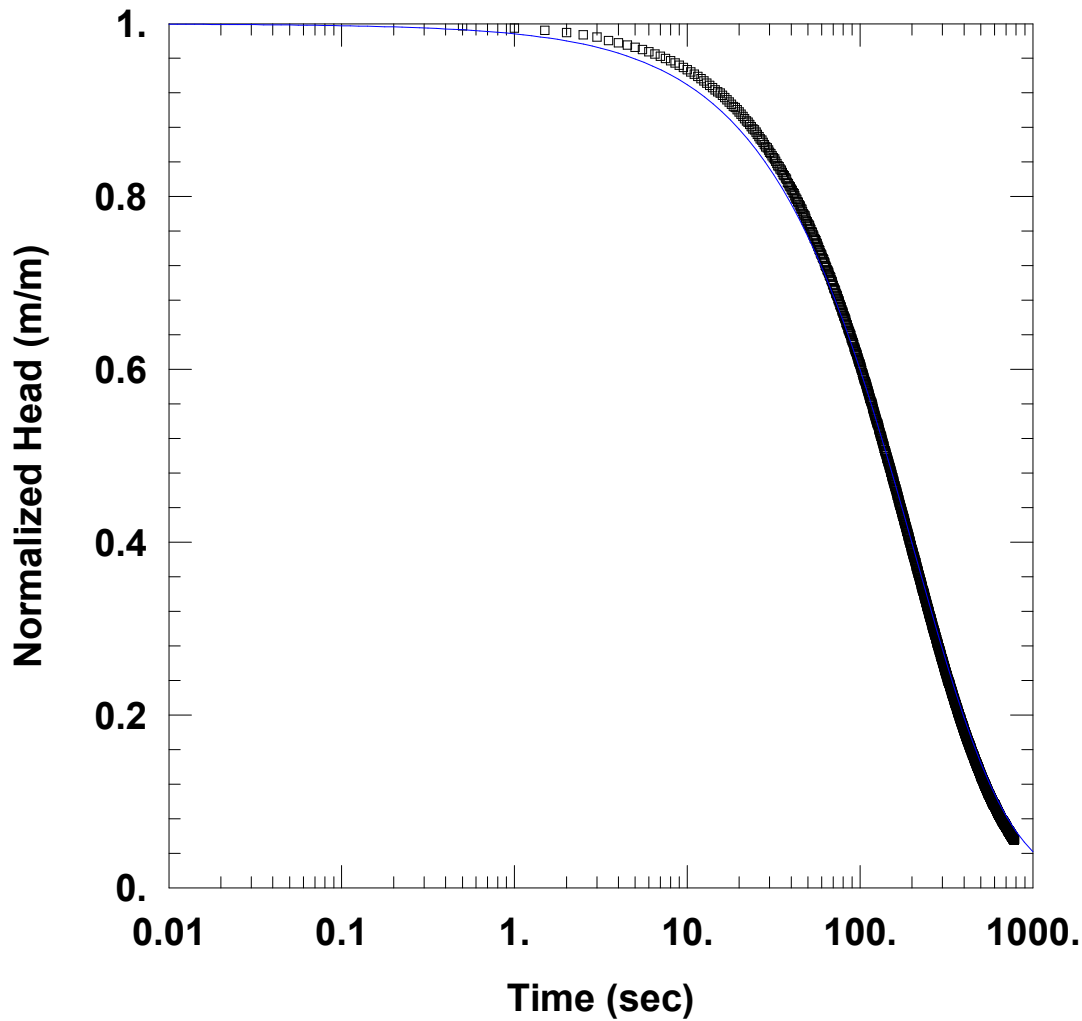
Saturated Thickness: 14.93 m

WELL DATA (OEMB08)

Initial Displacement: <u>0.773 m</u>	Static Water Column Height: <u>14.93 m</u>
Total Well Penetration Depth: <u>14.93 m</u>	Screen Length: <u>6. m</u>
Casing Radius: <u>0.025 m</u>	Well Radius: <u>0.025 m</u>
Well Skin Radius: <u>0.0625 m</u>	

SOLUTION

Aquifer Model: <u>Unconfined</u>	Solution Method: <u>KGS Model w/skin</u>
Kr = <u>0.2767 m/day</u>	Ss = <u>6.698E-5 m<sup>-1</sup></u>
Kz/Kr = <u>1.</u>	Kr' = <u>0.0256 m/day</u>
Ss' = <u>0.001 m<sup>-1</sup></u>	Kz/Kr' = <u>1.</u>



WELL TEST ANALYSIS

Data Set: \...\OEMB08 rising head test\_KGS.aqt

Date: 01/31/24

Time: 12:46:26

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB08

Test Date: 15/12/2023

AQUIFER DATA

Saturated Thickness: 14.93 m

WELL DATA (OEMB08)

Initial Displacement: 0.773 m

Total Well Penetration Depth: 14.93 m

Casing Radius: 0.025 m

Static Water Column Height: 14.93 m

Screen Length: 6. m

Well Radius: 0.025 m

SOLUTION

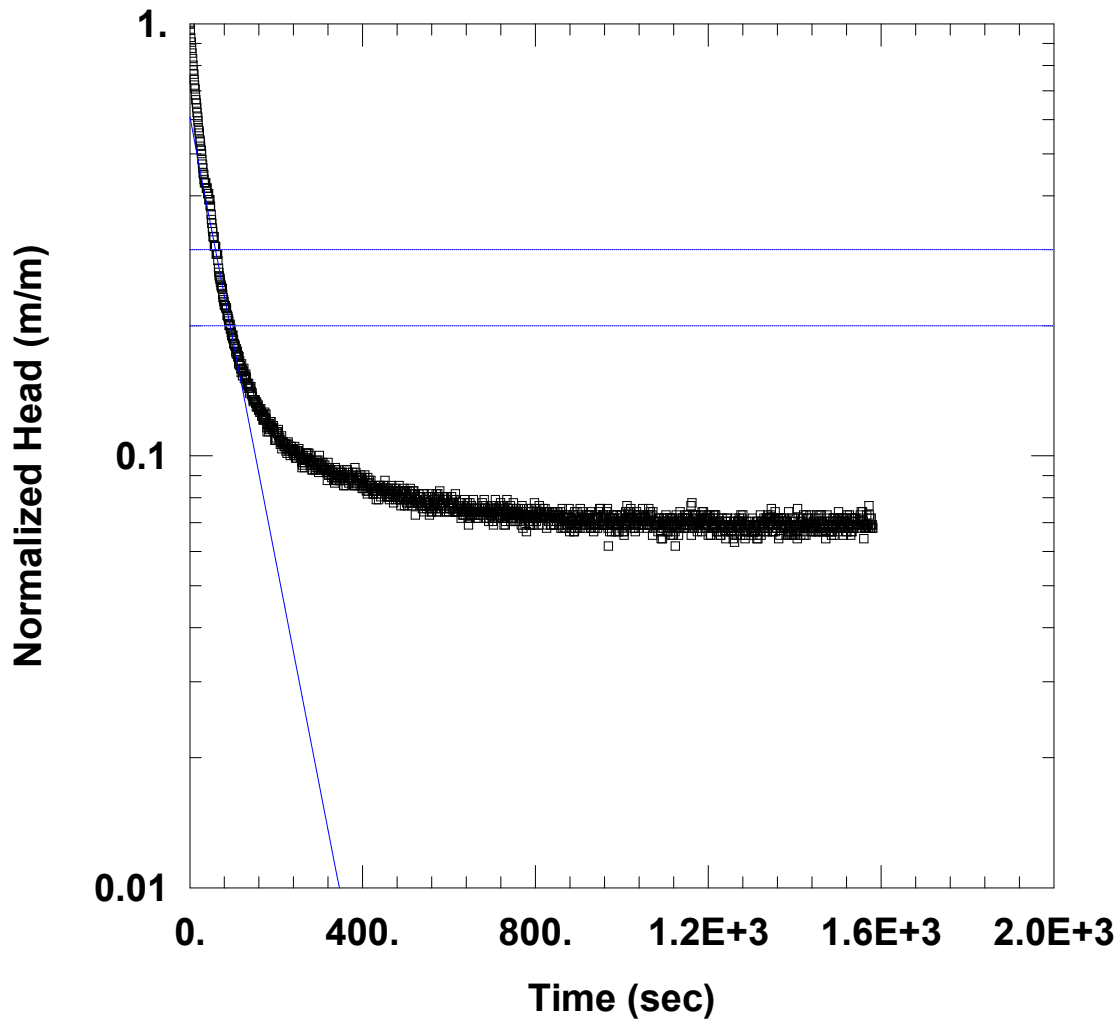
Aquifer Model: Unconfined

Kr = 0.09035 m/day

Kz/Kr = 1.

Solution Method: KGS Model

Ss = 6.698E-5 m<sup>-1</sup>



WELL TEST ANALYSIS

Data Set: \...\OEMB09\_rising head test\_BR.aqt

Date: 01/31/24

Time: 12:47:15

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB09

Test Date: 18/01/2024

AQUIFER DATA

Saturated Thickness: 8.85 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB09)

Initial Displacement: 0.809 m

Static Water Column Height: 8.85 m

Total Well Penetration Depth: 8.85 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

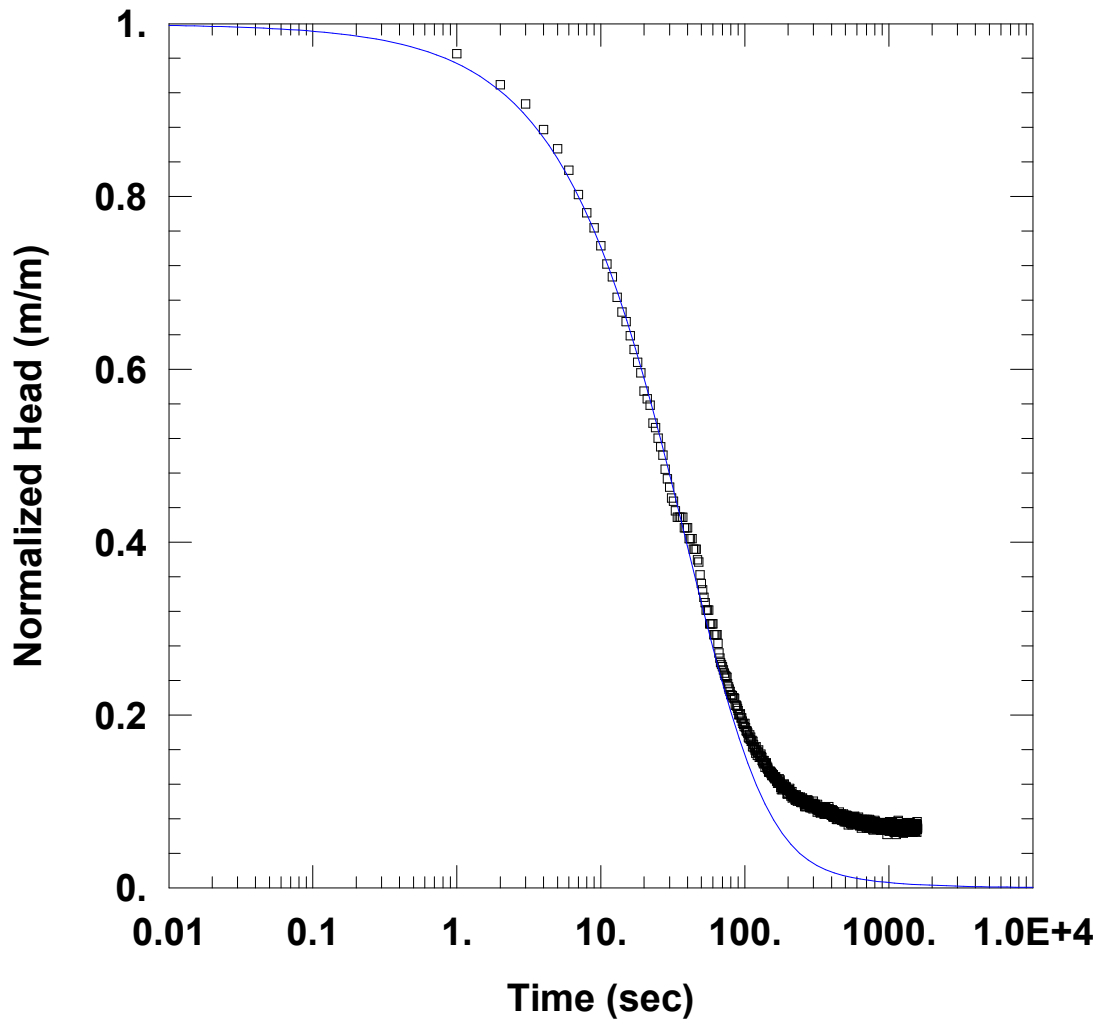
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.2435 m/day

y0 = 0.492 m



WELL TEST ANALYSIS

Data Set: \...\OEMB09\_rising head test\_cooper.aqt

Date: 01/31/24

Time: 12:47:46

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB09

Test Date: 18/01/2024

AQUIFER DATA

Saturated Thickness: 8.85 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB09)

Initial Displacement: 0.809 m

Static Water Column Height: 8.85 m

Total Well Penetration Depth: 8.85 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

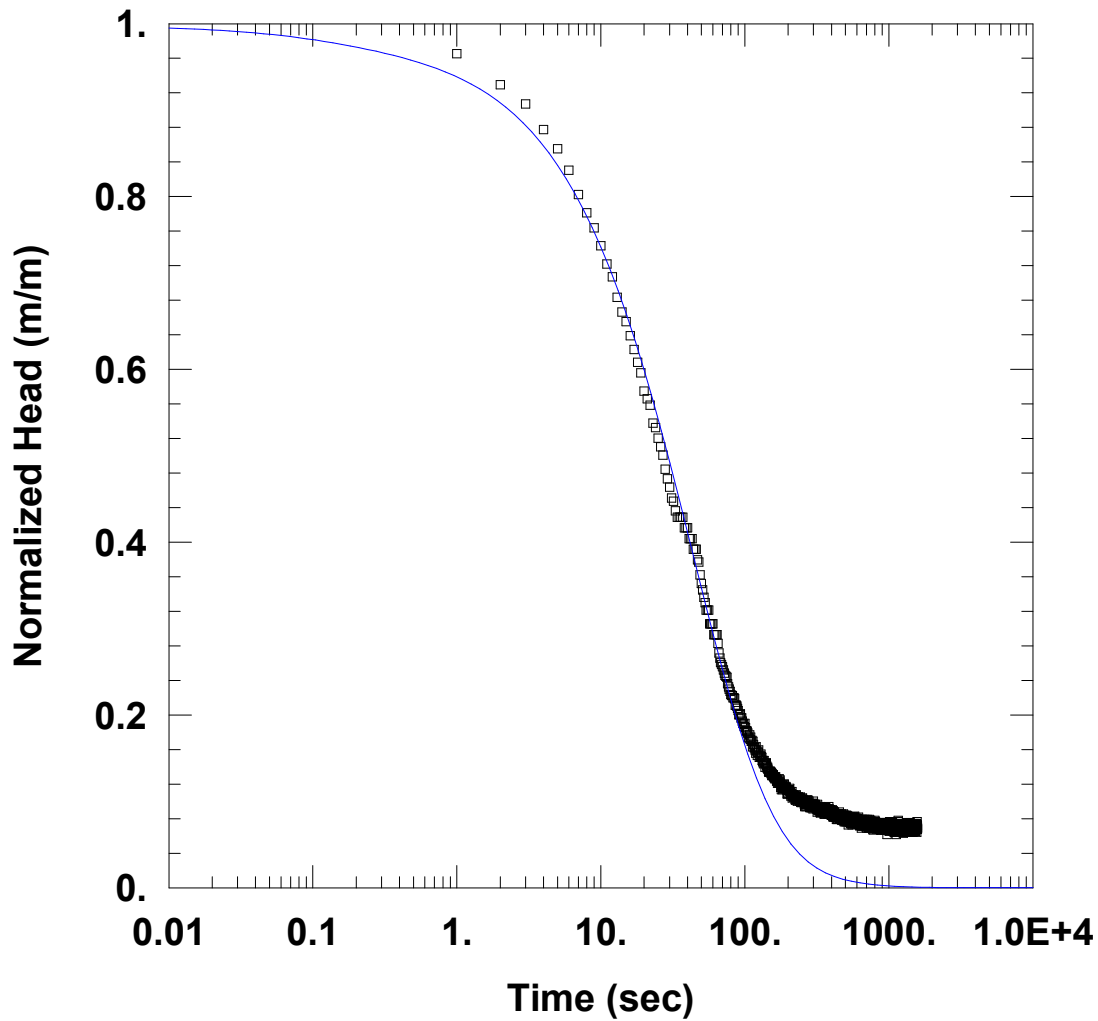
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopoulos

T = 2.534 m<sup>2</sup>/day

S = 0.001



WELL TEST ANALYSIS

Data Set: \...\OEMB09\_rising head test\_KGS with skin.aqt  
 Date: 01/31/24 Time: 12:49:07

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: OEMB09  
 Test Date: 18/01/2024

AQUIFER DATA

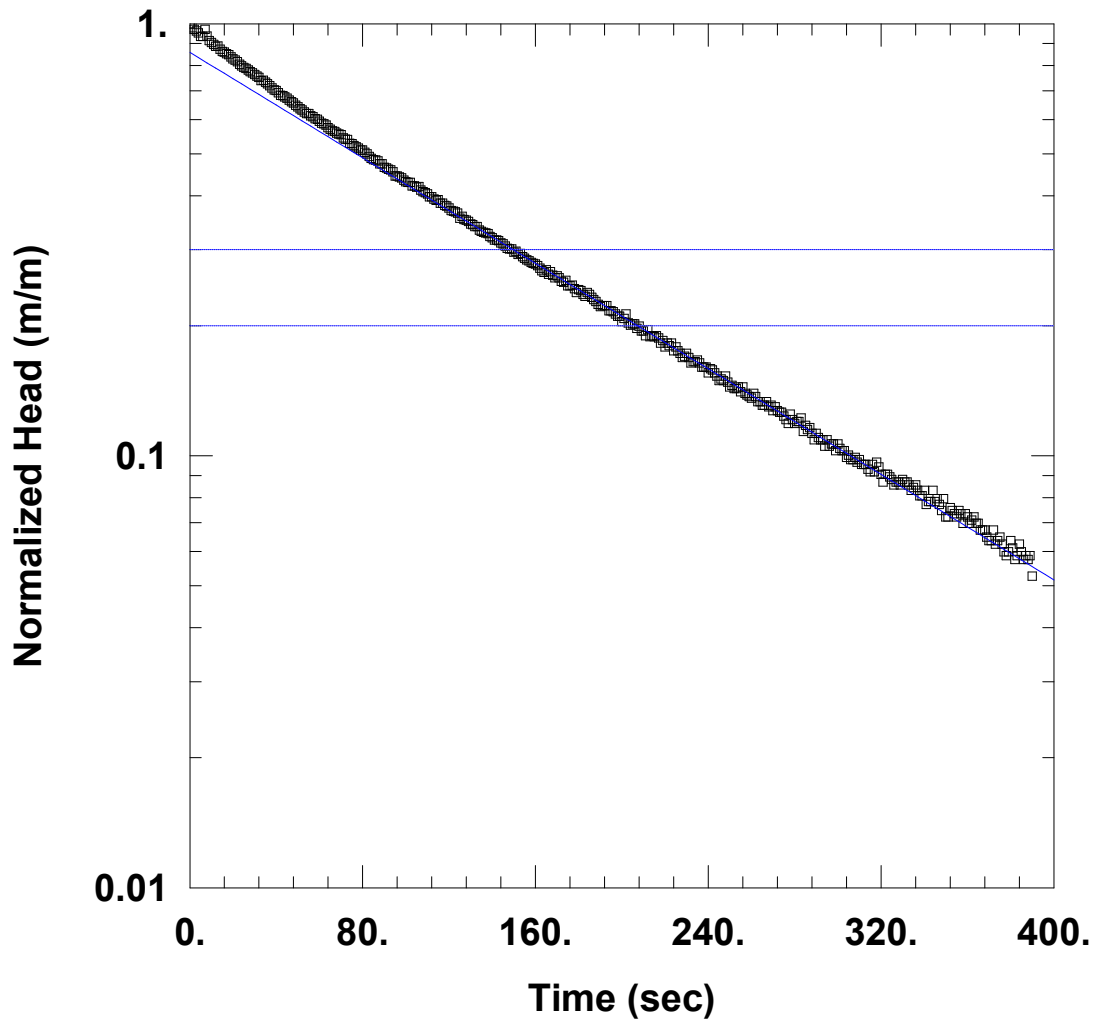
Saturated Thickness: 8.85 m

WELL DATA (OEMB09)

Initial Displacement: <u>0.809 m</u>	Static Water Column Height: <u>8.85 m</u>
Total Well Penetration Depth: <u>8.85 m</u>	Screen Length: <u>6. m</u>
Casing Radius: <u>0.025 m</u>	Well Radius: <u>0.025 m</u>
Well Skin Radius: <u>0.0625 m</u>	

SOLUTION

Aquifer Model: <u>Unconfined</u>	Solution Method: <u>KGS Model w/skin</u>
Kr = <u>0.3745 m/day</u>	Ss = <u>0.000113 m<sup>-1</sup></u>
Kz/Kr = <u>1.</u>	Kr' = <u>0.5396 m/day</u>
Ss' = <u>0.001 m<sup>-1</sup></u>	Kz/Kr' = <u>1.</u>



WELL TEST ANALYSIS

Data Set: \...\OEMB10 falling head test\_BR.aqt

Date: 01/31/24

Time: 12:50:25

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB10

Test Date: 18/01/2024

AQUIFER DATA

Saturated Thickness: 15.67 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB10)

Initial Displacement: 0.817 m

Static Water Column Height: 15.67 m

Total Well Penetration Depth: 15.67 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

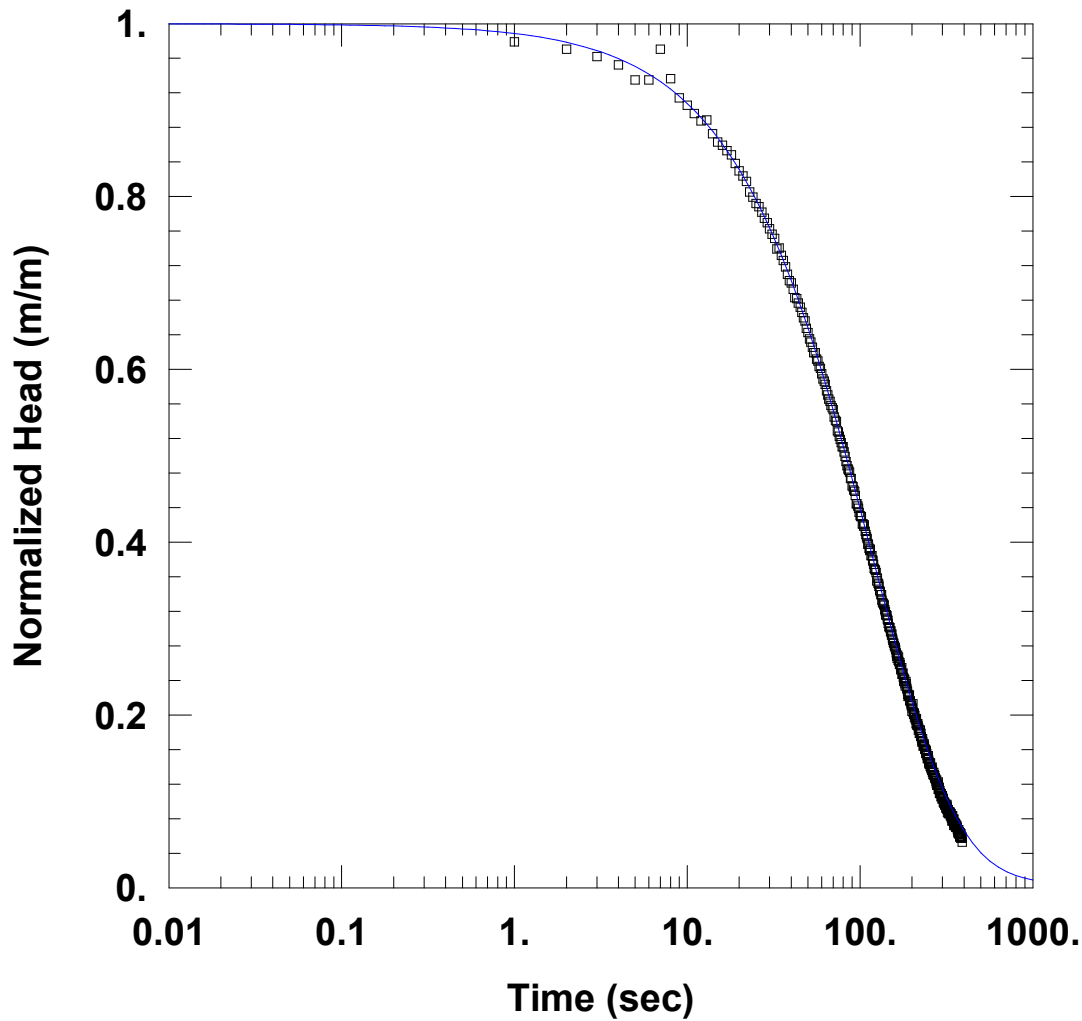
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.1561 m/day

y0 = 0.7018 m



WELL TEST ANALYSIS

Data Set: \...\OEMB10 falling head test\_cooper.aqt

Date: 01/31/24

Time: 12:50:53

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB10

Test Date: 18/01/2024

AQUIFER DATA

Saturated Thickness: 15.67 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OEMB10)

Initial Displacement: 0.817 m

Static Water Column Height: 15.67 m

Total Well Penetration Depth: 15.67 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

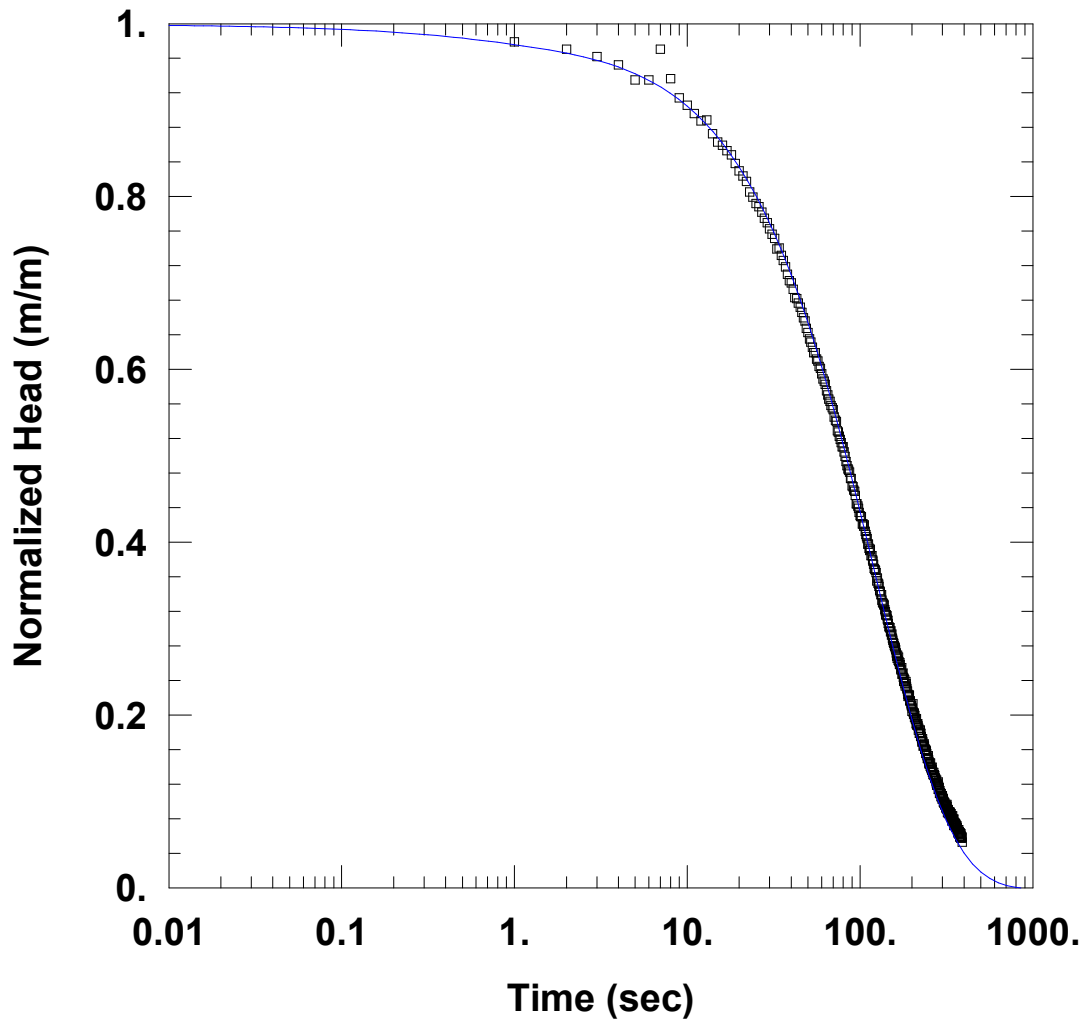
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopoulos

T = 2.051 m<sup>2</sup>/day

S = 5.288E-8



WELL TEST ANALYSIS

Data Set: \...\OEMB10 falling head test\_KGS\_skin.aqt

Date: 01/31/24

Time: 12:51:17

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: OEMB10

Test Date: 18/01/2024

AQUIFER DATA

Saturated Thickness: 15.67 m

WELL DATA (OEMB10)

Initial Displacement: 0.817 m

Total Well Penetration Depth: 15.67 m

Casing Radius: 0.025 m

Well Skin Radius: 0.0625 m

Static Water Column Height: 15.67 m

Screen Length: 6. m

Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined

Kr = 0.2773 m/day

Kz/Kr = 1.

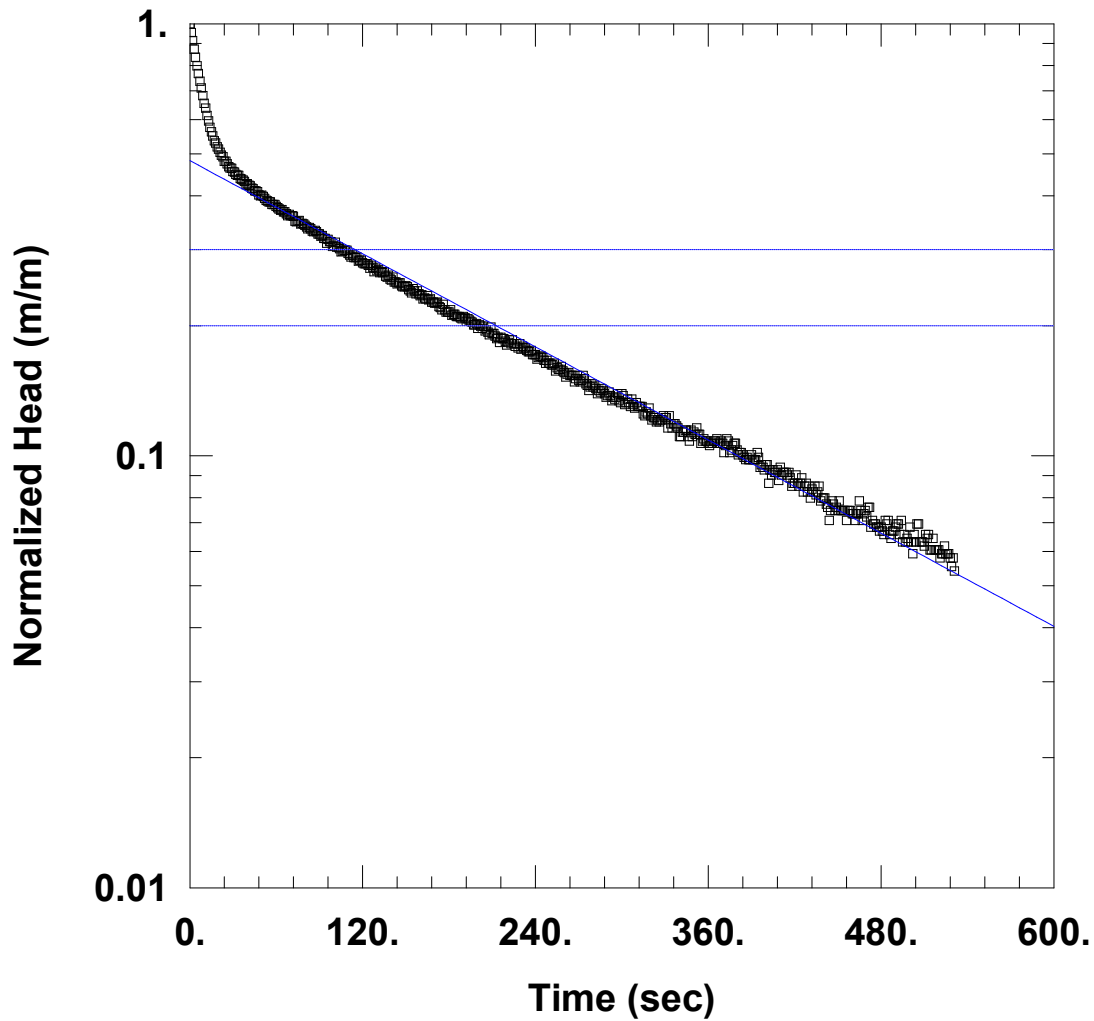
Ss' = 0.001 m<sup>-1</sup>

Solution Method: KGS Model w/skin

Ss = 3.374E-9 m<sup>-1</sup>

Kr' = 0.0915 m/day

Kz/Kr' = 1.



WELL TEST ANALYSIS

Data Set: \...\ONMB01 rising head test\_BR.aqt

Date: 01/31/24

Time: 12:57:47

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: ONMB01

Test Date: 16/01/2024

AQUIFER DATA

Saturated Thickness: 5.65 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (ONMB01)

Initial Displacement: 0.776 m

Static Water Column Height: 5.65 m

Total Well Penetration Depth: 6.35 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

Gravel Pack Porosity: 0.3

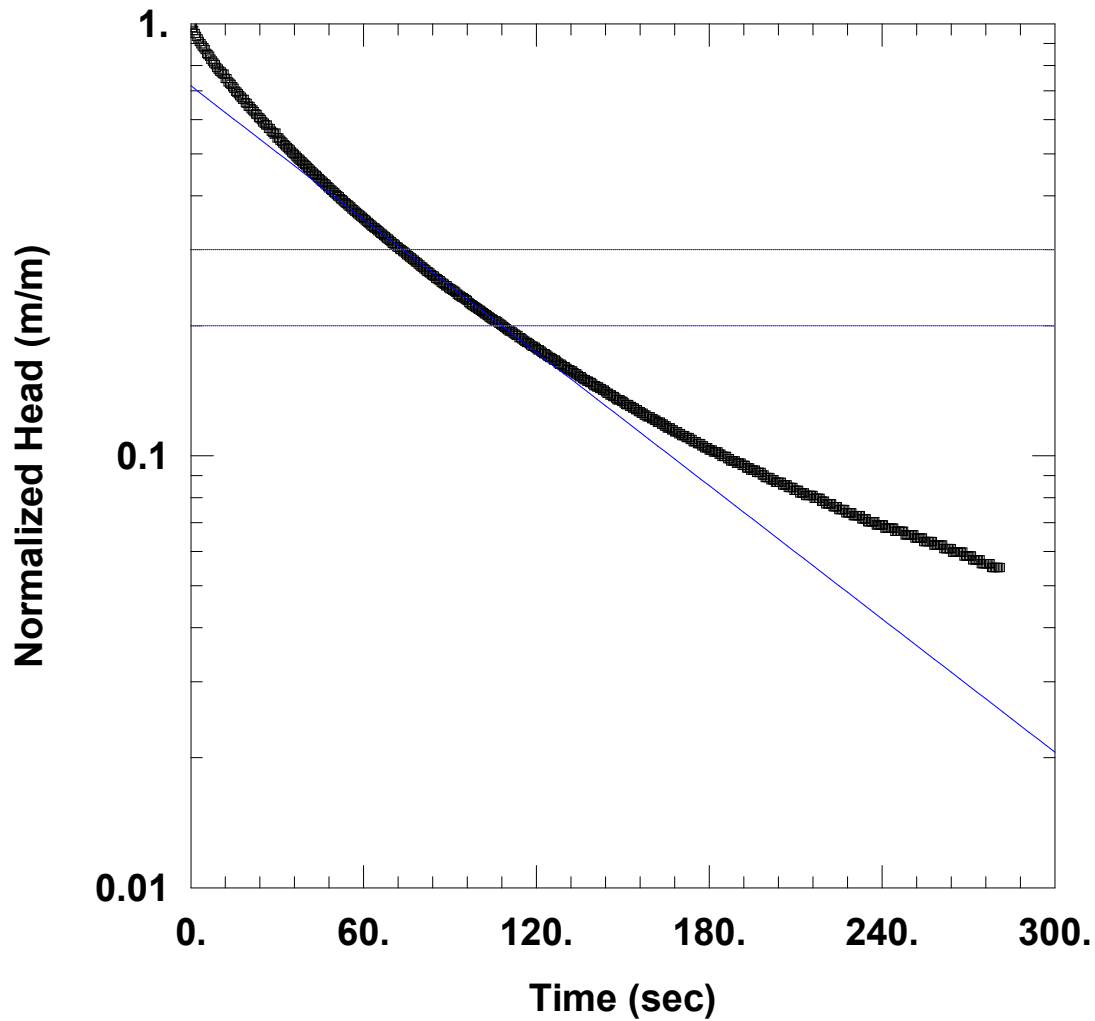
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.08542 m/day

y0 = 0.3742 m



WELL TEST ANALYSIS

Data Set: \...\ONMB02D-falling head test\_BR.aqt

Date: 01/31/24

Time: 13:51:31

PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: ONMB02D

Test Date: 15/12/2023

AQUIFER DATA

Saturated Thickness: 10.17 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (ONMB02D)

Initial Displacement: 0.853 m

Static Water Column Height: 10.17 m

Total Well Penetration Depth: 10.27 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

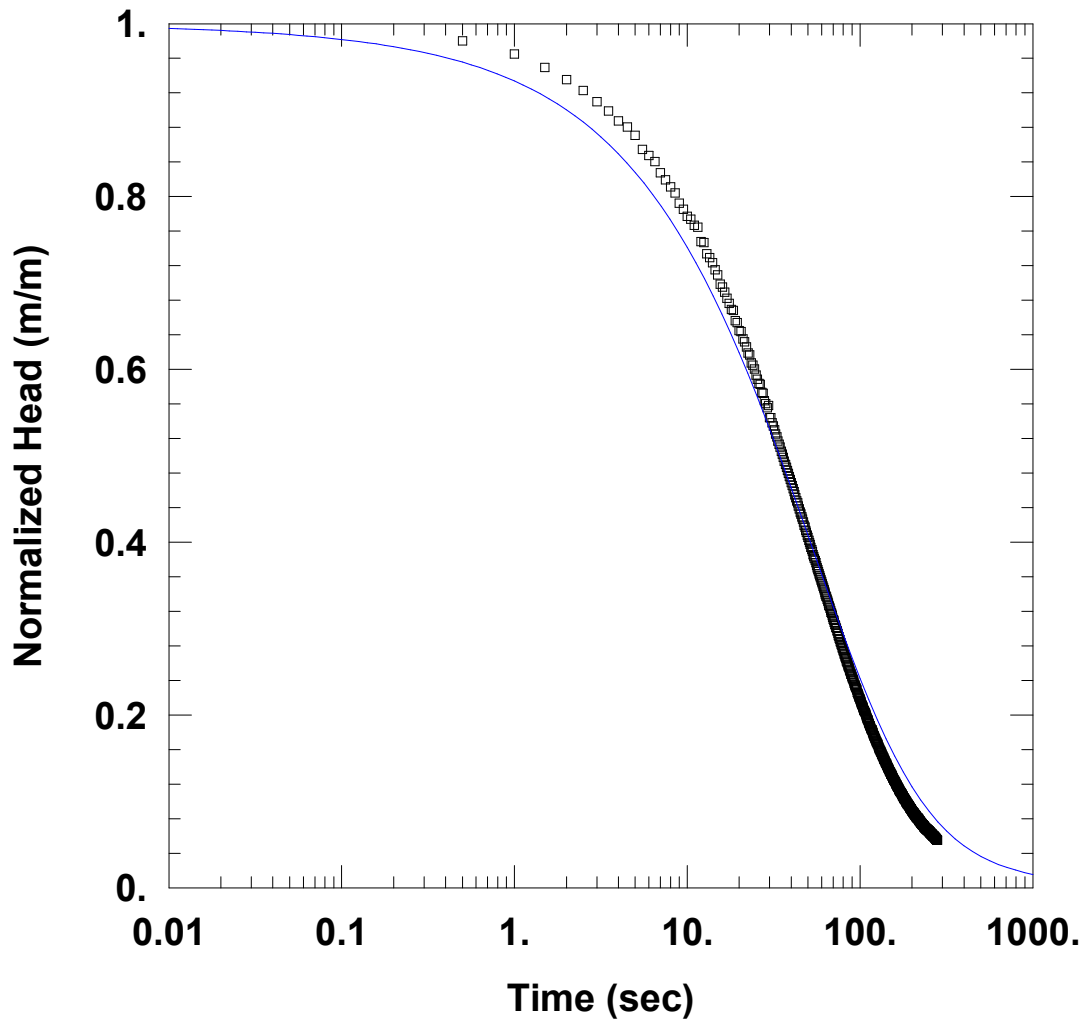
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.2481 m/day

y0 = 0.6126 m



WELL TEST ANALYSIS

Data Set: \...\ONMB02D-falling head test\_cooper.aqt  
 Date: 01/31/24 Time: 13:52:29

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: ONMB02D  
 Test Date: 15/12/2023

AQUIFER DATA

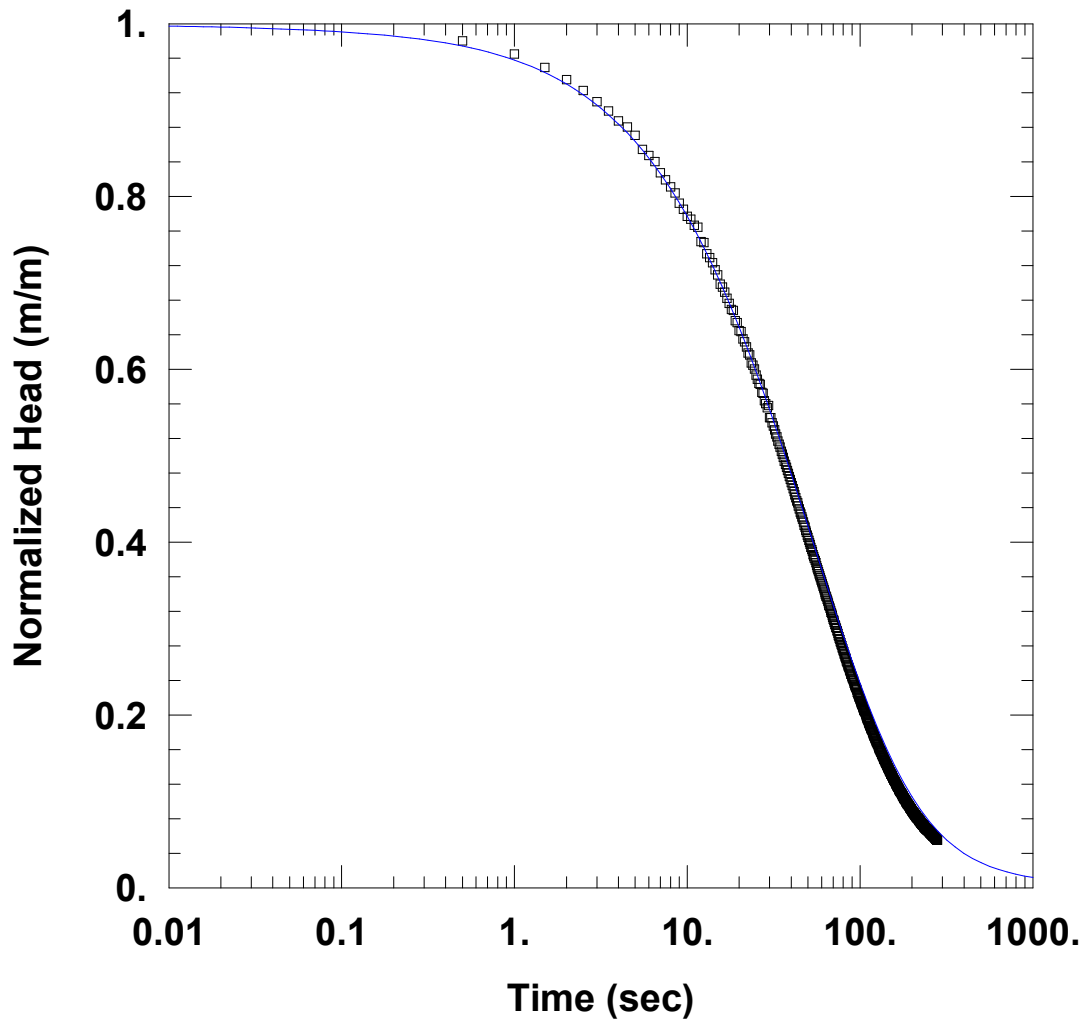
Saturated Thickness: 10.17 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (ONMB02D)

Initial Displacement: 0.853 m Static Water Column Height: 10.17 m  
 Total Well Penetration Depth: 10.27 m Screen Length: 6. m  
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Bredehoeft-Papadopoulos  
 T = 1.031 m<sup>2</sup>/day S = 0.02833



WELL TEST ANALYSIS

Data Set: \...\ONMB02D-falling head test\_KGS with skin.aqt  
 Date: 01/31/24 Time: 13:53:29

PROJECT INFORMATION

Company: GHD  
 Client: Alcoa  
 Project: 12565572  
 Location: MCRA/O'Neil  
 Test Well: ONMB02D  
 Test Date: 15/12/2023

AQUIFER DATA

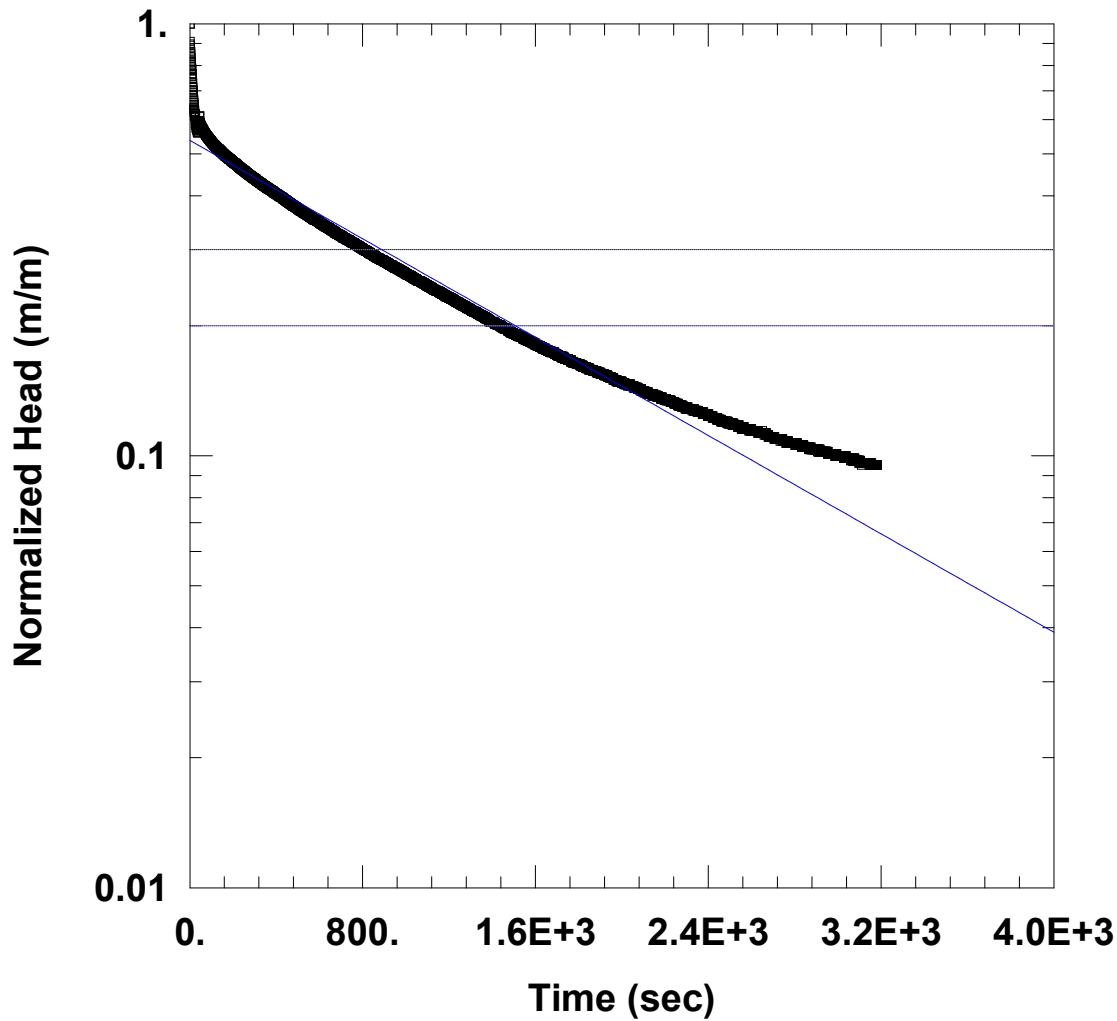
Saturated Thickness: 10.17 m

WELL DATA (ONMB02D)

Initial Displacement: <u>0.853 m</u>	Static Water Column Height: <u>10.17 m</u>
Total Well Penetration Depth: <u>10.27 m</u>	Screen Length: <u>6. m</u>
Casing Radius: <u>0.025 m</u>	Well Radius: <u>0.025 m</u>
Well Skin Radius: <u>0.0625 m</u>	

SOLUTION

Aquifer Model: <u>Unconfined</u>	Solution Method: <u>KGS Model w/skin</u>
Kr = <u>0.2081 m/day</u>	Ss = <u>0.002786 m<sup>-1</sup></u>
Kz/Kr = <u>1.</u>	Kr' = <u>0.1835 m/day</u>
Ss' = <u>0.001 m<sup>-1</sup></u>	Kz/Kr' = <u>1.</u>



### WELL TEST ANALYSIS

Data Set: \...\ONMB04\_falling head test\_BR.aqt

Date: 01/31/24

Time: 13:47:54

### PROJECT INFORMATION

Company: GHD

Client: Alcoa

Project: 12565572

Location: MCRA/O'Neil

Test Well: ONMB04

Test Date: 15/12/2023

### AQUIFER DATA

Saturated Thickness: 4.51 m

Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (ONMB04)

Initial Displacement: 0.841 m

Static Water Column Height: 4.51 m

Total Well Penetration Depth: 7.59 m

Screen Length: 6. m

Casing Radius: 0.025 m

Well Radius: 0.025 m

Gravel Pack Porosity: 0.3

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 0.01718 m/day

y0 = 0.4518 m



[ghd.com](http://ghd.com)

→ **The Power of Commitment**