

Environmental Assessment Works

South Australian Environment Protection Authority

37 - 41 Cliff Street, Glenelg East

Appendix C: Down-hole Geophysical Testing Summary Report



"Defining Your Resource"

ABN 20 117 435 211

781 South Rd

(PO Box 21)

Black Forest

SOUTH AUSTRALIA 5035

P 08 8351 3255

SUMMARY REPORT

CLIFF ST, GLENELG

Geophysical Logging

August 2014

Report Prepared for:

***Greencap.
12 Greenhill Rd
Wayville
SA. 5034***

1. Overview.

This report summarises the geophysical logging undertaken in three shallow investigation boreholes drilled at Cliff St, Glenelg.

A natural gamma probe (NGRS) and an induction (conductivity) probe (EM50) were run separately inside 50mm PVC casing installed in each borehole. The probes were able to reach close to the drilled depth of each borehole.

All data recorded by each probe have been combined in a composite log for each borehole. The composite log includes (where available):

- Geophysical logging data.
- A summary interpretation of the geophysical logging data.
- All logging data referenced to the local ground level.
- Drill data.

Digital log data has been provided in LAS, PDF and WCL format.

2. Summary Logging Information.

Probe Stack Configurations:

Probe	Recording Direction	Standard Acquisition Speed	Mnemonic
GAMMA	UPHOLE	2.5 m/min	NGRS
INDUCTION CONDUCTIVITY	UPHOLE	2.5 m/min	EM50

Probe Stack Mnemonics:

Probe Mnemonic	Description	Logs
NGRS	Total Gamma	GRA
EM50	Short & Deep Induction Conductivity	ILS, ILD

Log Mnemonics:

Log Mnemonic	Probe	Description	Units
GRA	NGRS	Total Gamma – API units	API
ILS	EM50	Short Spaced Induction (Conductivity)	mS/m
ILD	EM50	Deep Spaced Induction (Conductivity)	mS/m
SPED	LOGGING	Logging Speed during data acquisition	m/min
TENS	LOGGING	Cable Tension during data acquisition	Kgs



Appendix A: Borehole DC1 – Composite Log.

LOG DATE **08/08/14**
 LOGGED DEPTH **11.83m**

LOGGER **MJE**
 DATUM **GL (US = 0.0m)**

UNIT **BW38**
 CASING **50mm PVC**

EASTING
 DRILLED DEPTH **12.5m**

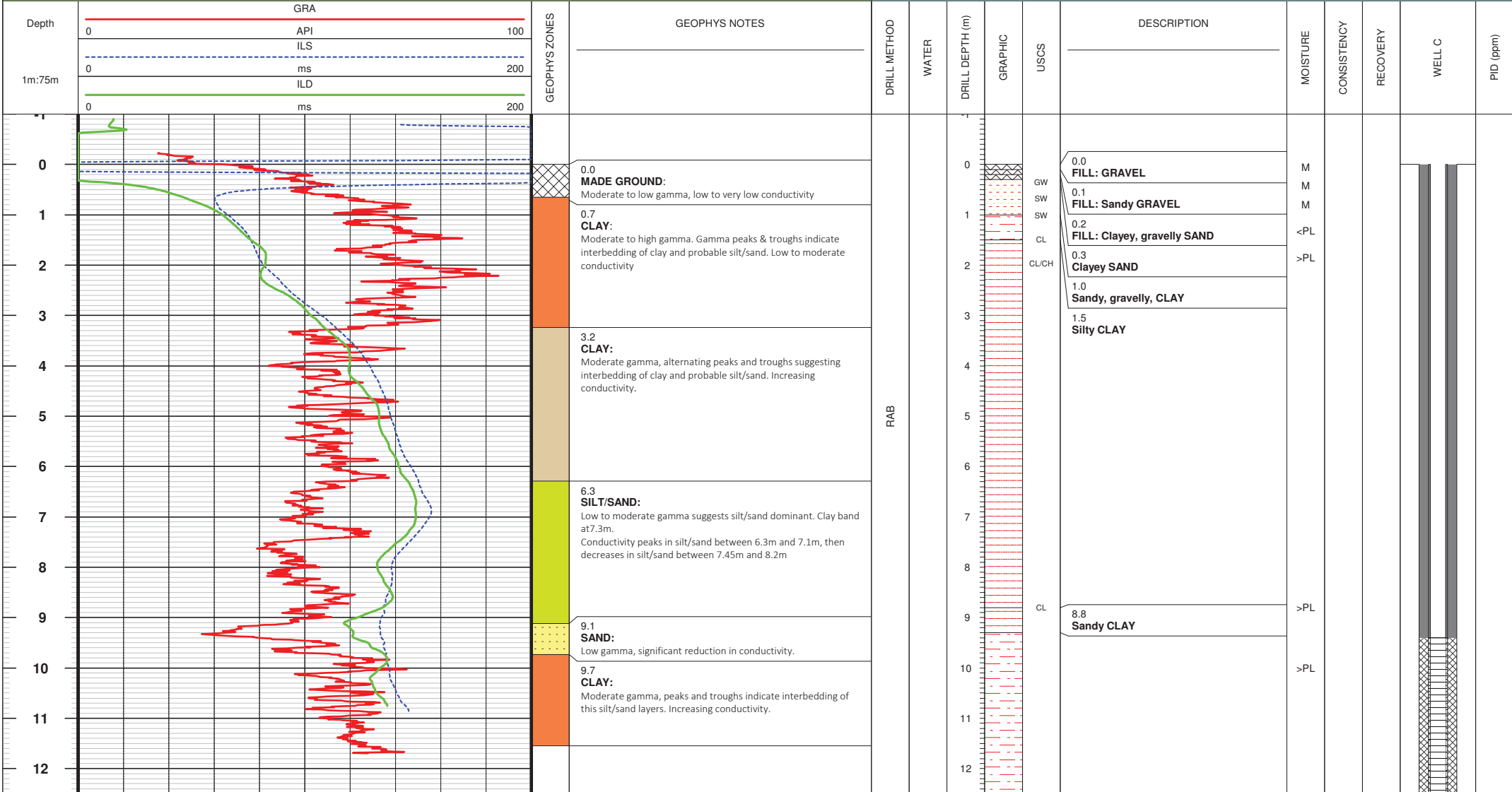
NORTHING
 BH FLUID **WATER**

ELEVATION
 LEVEL **m**

REMARKS

Sandy CLAY	Clayey SAND	SAND	CLAY (Dominant)
Silty CLAY	Made Ground	CLAY (thin silt/sand bands)	SILT/SAND (with clay bands)

GEOPHYSICAL LOGGING | **DRILL DATA**





Appendix B: Borehole GW2 – Composite Log.



Appendix C: Borehole GW8 – Composite Log.

Appendix D: Example Borehole Correlation.

MULTI-WELL CORRELATION LOG

Client : GREENCAP

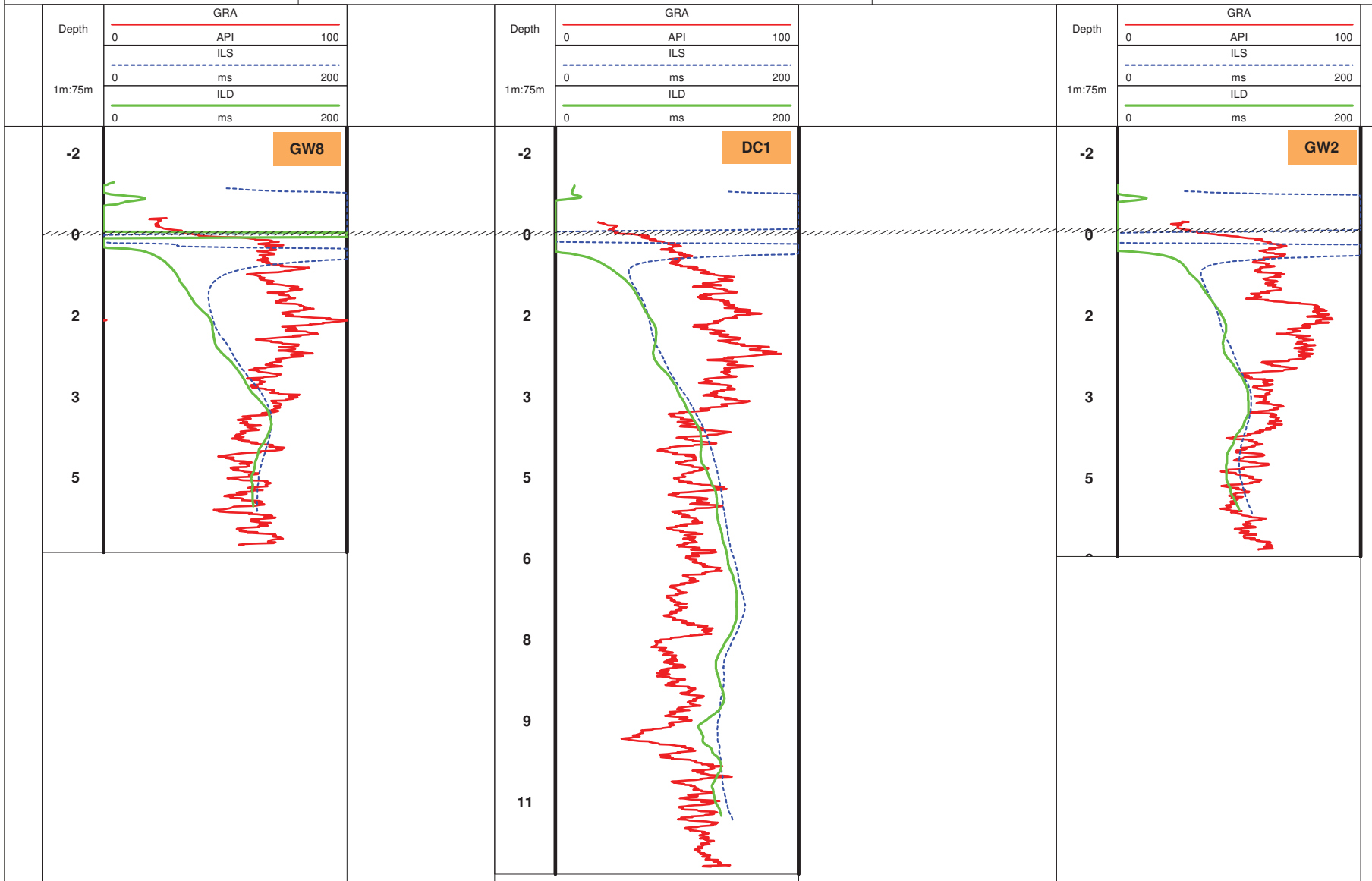
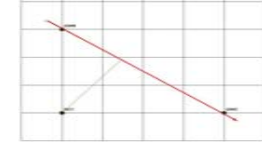
LINE No : EG 1

MAP SCALE: 1:50

DEPTH SCALE: 1:75

Remarks

EXAMPLE MULTIWELL CORRELATION.





Appendix E: Probe Specification Sheets.

GEOPHYSICAL LOGGING PROBES

**Total
Gamma**

NGRS

MEASUREMENT PRINCIPLE

The total gamma probe measures naturally occurring radioactivity. The most common naturally occurring radioactivity is associated with K^{40} , Th^{232} and $U^{232-238}$ which are associated with certain rocks (eg clays/shales) making the gamma curves an excellent lithological identifier tool. A scintillation detector system consisting of a sodium iodide crystal and a photomultiplier tube to measure gamma radiation.

Ideally suited for:

- Uranium exploration and mining.
- Uranium grade determination.
- Coal and iron ore exploration
- Sedimentary studies.
- Logging run depth matching.

Operations & Calibration:

- Minimum borehole diameter of 50mm.
- Air and/or fluid filled borehole.
- Open borehole and/or cased borehole.

Typically recorded in an uphole logging direction at logging speeds of 3 – 5 m/min.

(Downhole logging can be recorded for QA purposes)

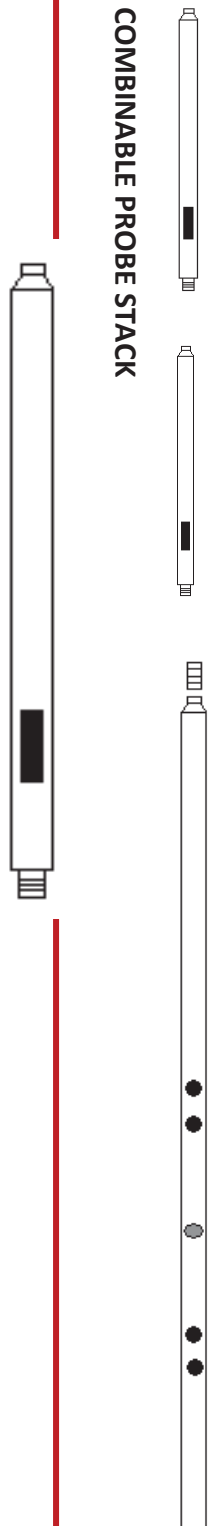
Calibration via Adelaide Models – AM1, AM2, AM3 for Uranium grade and AM6 for API calibration.

Probes can be stacked to the top and the bottom of the probe. Typical combinations are:

Gamma, filtered gamma, magnetic deviation, caliper, fluid temperature/conductivity dual laterolog, dual induction, formation density, fullwave sonic, gyroscopic deviation.

SINGLE PROBE

COMBINABLE PROBE STACK



PHYSICAL SPECIFICATIONS

Weight	5.0kg
Length	0.63m
Diameter	38mm
Crystal size	25mm x 50mm
Maximum Pressure	20 MPa
Maximum Temperature	80°C



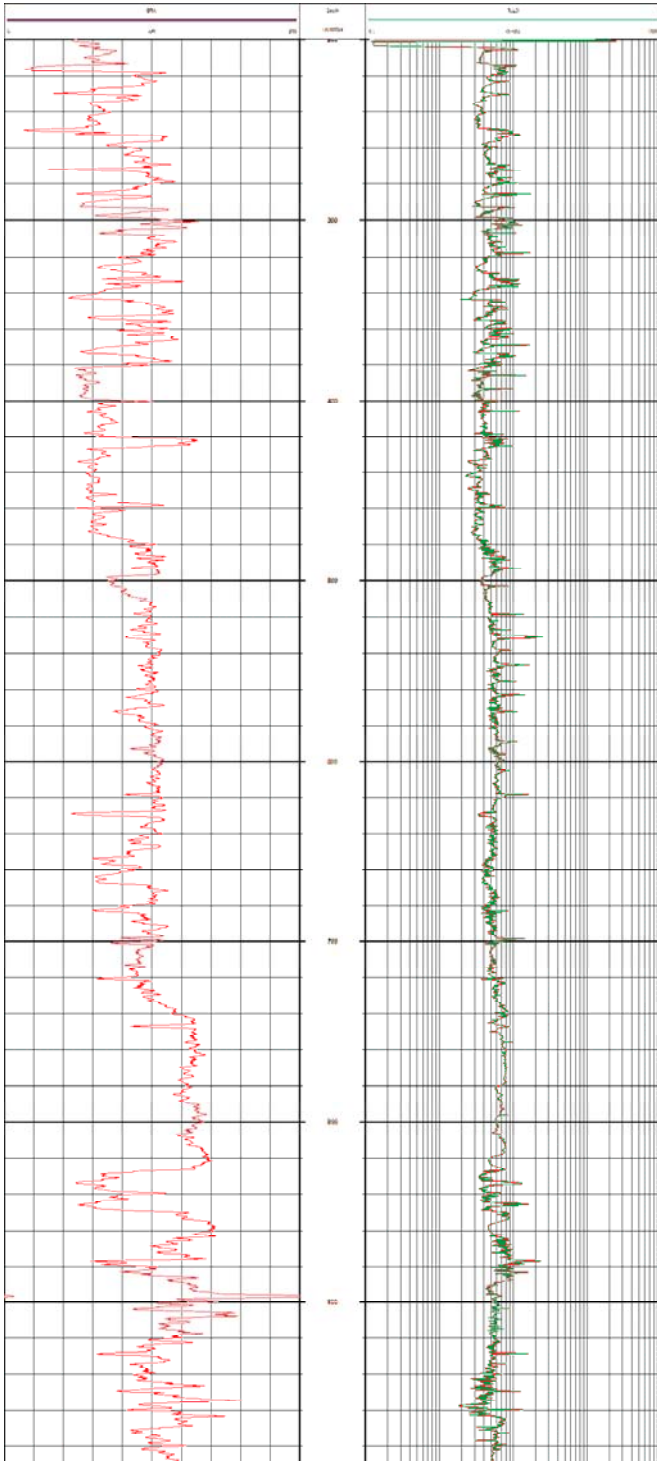


GEOPHYSICAL LOGGING PROBES

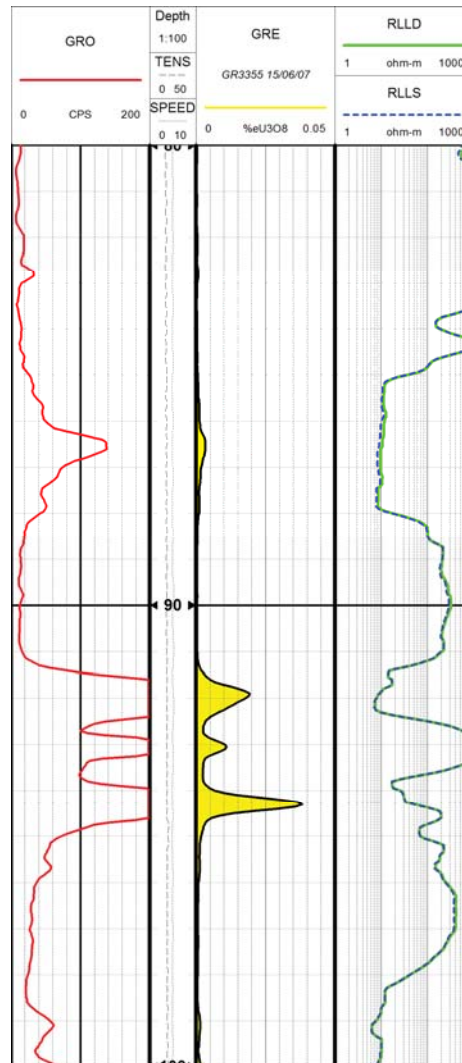
Total Gamma

NGRS

SEDIMENTARY

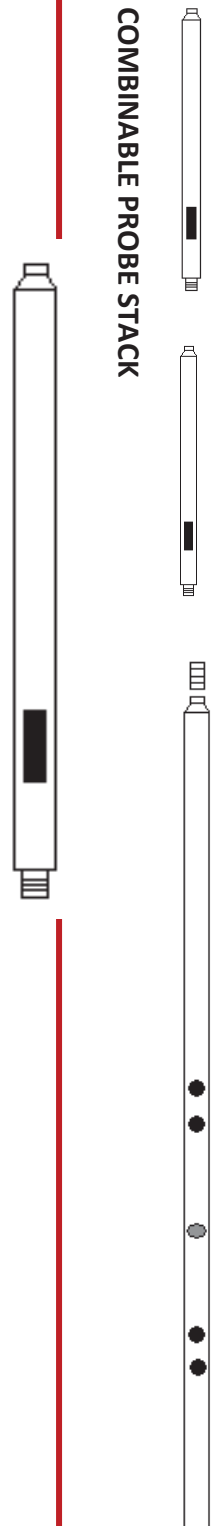


URANIUM



SINGLE PROBE

COMBINABLE PROBE STACK





GEOPHYSICAL LOGGING PROBES

Dual Induction (Conductivity)

MEASUREMENT PRINCIPLE

The dual induction/conductivity probe generates an electromagnetic field in the vicinity of the borehole and measures the response of the formation to this applied field.

Medium and deep induction/conductivity curves are recorded. The probe can operate in either air filled or fluid openhole boreholes as well cased PVC cased boreholes. The optimum probe operating conditions is in high conductivity (low resistivity) formation.

Ideally suited for:

- Groundwater investigations – saline monitoring.
- Iron ore exploration and mining.
- Contamination studies.
- Base metals exploration and mining.

Operations & Calibration:

- Minimum borehole diameter of 50mm.
- Air and/or fluid filled borehole.
- Open borehole and/or PVC cased borehole.

Typically recorded in an uphole logging direction at logging speeds of 7 – 8 m/min. (Downhole logging can be recorded for QA purposes).

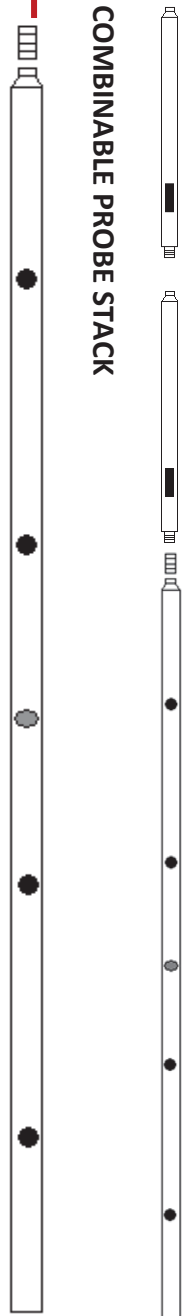
Final curve units can be counts per second, milli siemens per metre, milli-mohms per metre. Calibration via conductivity rings.

Probes can be stacked to the top of the probe. Typical combinations are:

Gamma, gamma & magnetic deviation, dual laterolog.

SINGLE PROBE RUN

COMBINABLE PROBE STACK



PHYSICAL SPECIFICATIONS

Weight	5.0kg
Length	1.70m
Diameter	45mm
TX-RX Spacing	15cm & 40cm
Frequency	25 kHz
Conductivity range	1–3000 mS/m
Maximum Pressure	20 MPa
Maximum Temperature	80°C

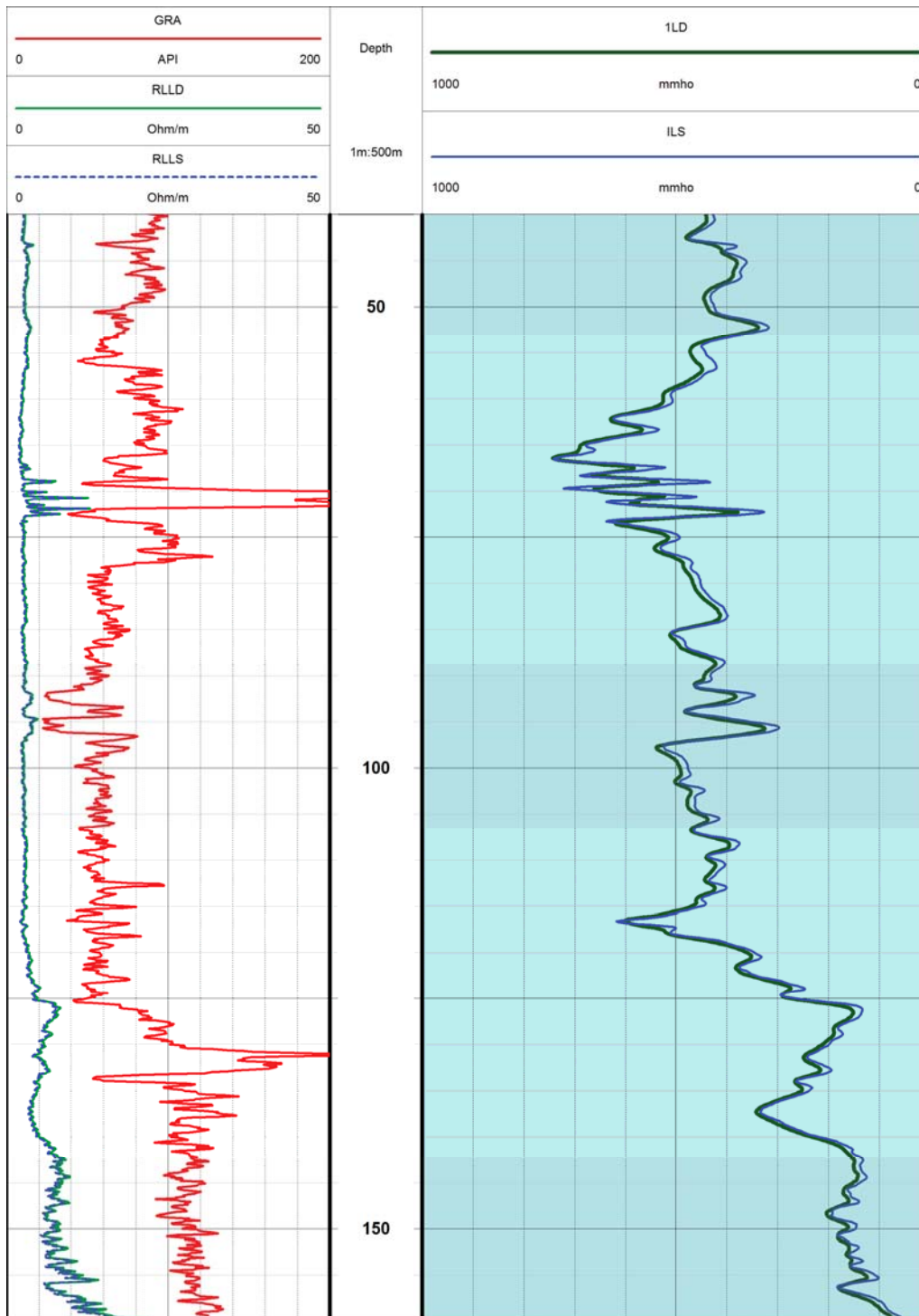




GEOPHYSICAL LOGGING PROBES

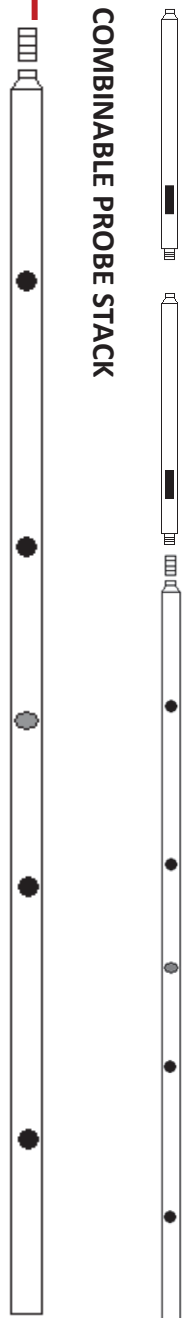
Dual Induction (Conductivity)

EM50



SINGLE PROBE RUN

COMBINABLE PROBE STACK

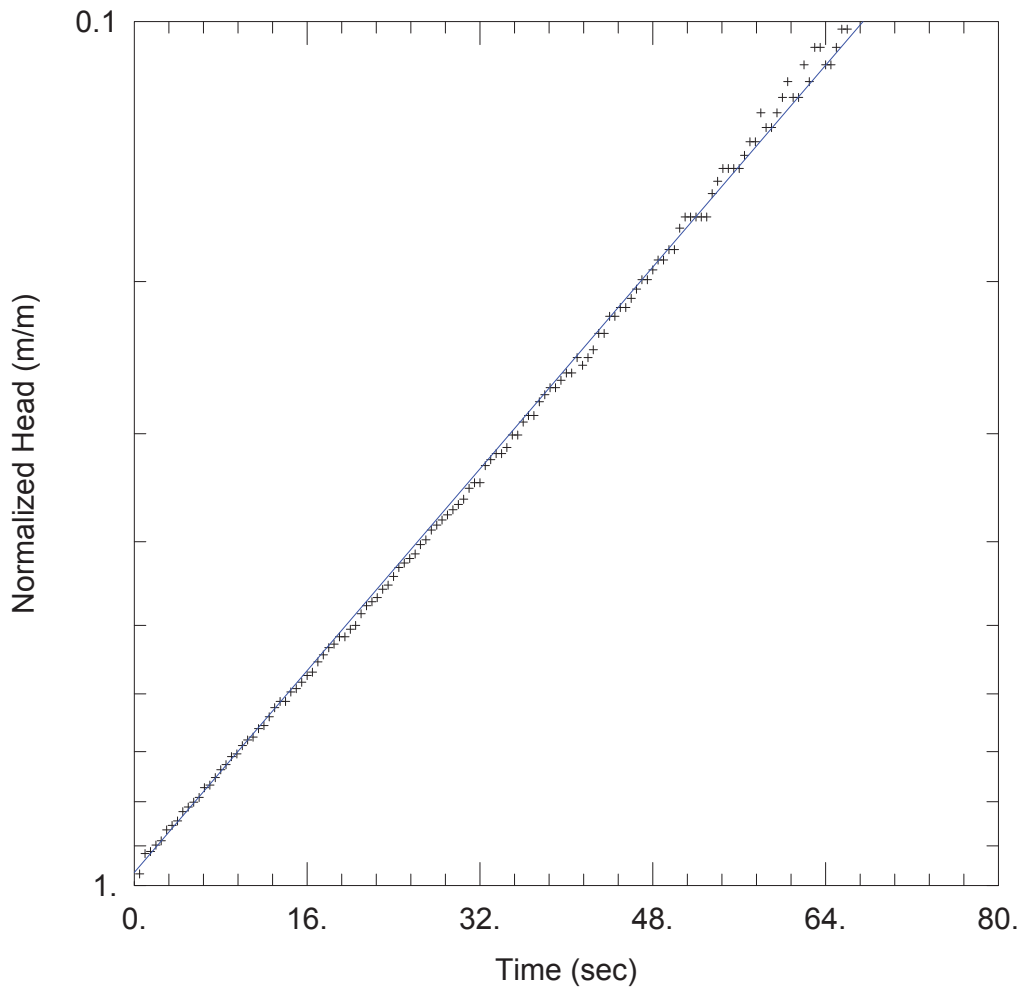


Environmental Assessment Works

South Australian Environment Protection Authority

37 - 41 Cliff Street, Glenelg East

Appendix D: Slug Test Analyses



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt
 Date: 11/21/14 Time: 16:23:22

PROJECT INFORMATION

Company: Greencap
 Client: South Australian EPA
 Project: J125792
 Location: 37-41 Cliff Street
 Test Well: GW8_Rising Head 2
 Test Date: 8 Aug 2014

AQUIFER DATA

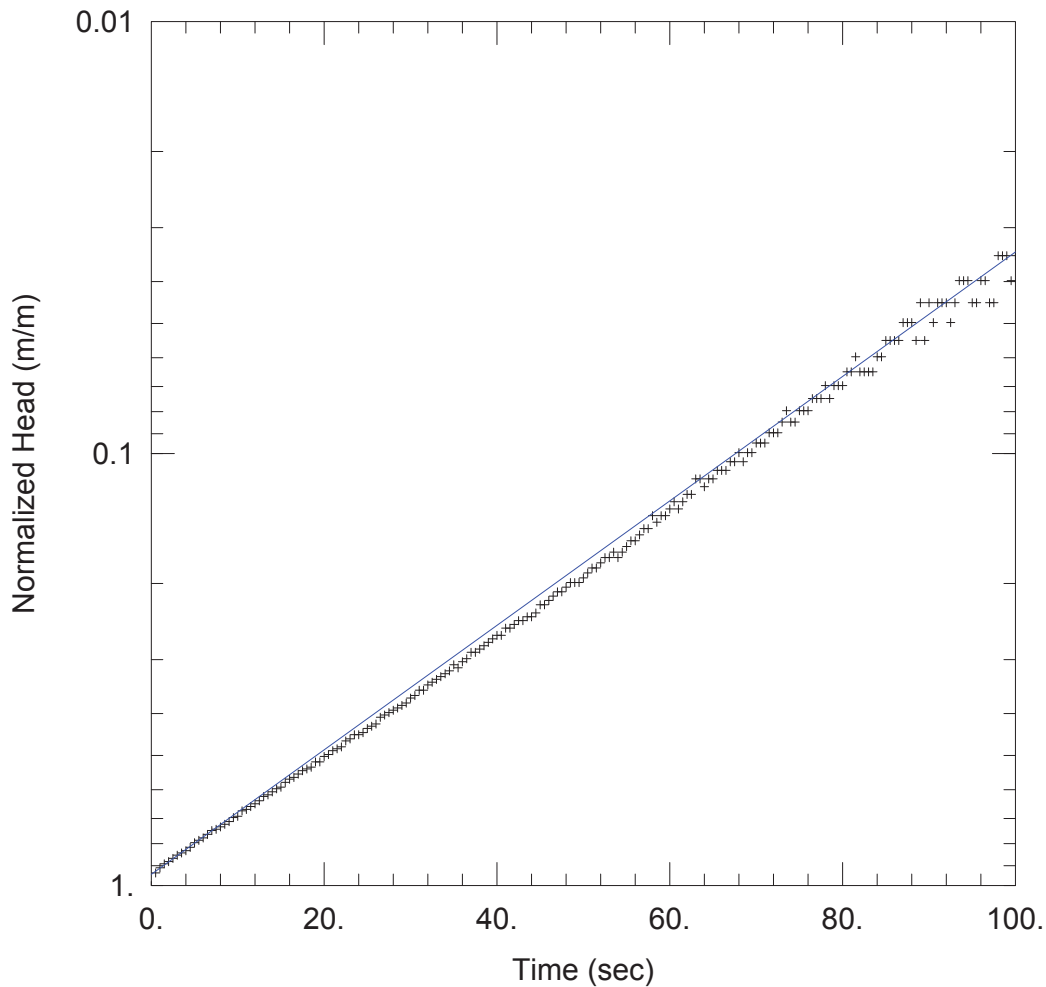
Saturated Thickness: 5. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW8)

Initial Displacement: 0.196 m Static Water Column Height: 2.738 m
 Total Well Penetration Depth: 2.738 m Screen Length: 2.738 m
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 1.077 m/day y0 = 0.1893 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt

Date: 11/21/14

Time: 16:15:30

PROJECT INFORMATION

Company: Greencap

Client: South Australian EPA

Project: J125792

Location: 37-41 Cliff Street

Test Well: GW8_Rising Head 1

Test Date: 8 Aug 2014

AQUIFER DATA

Saturated Thickness: 5. m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW8)

Initial Displacement: 0.201 m

Static Water Column Height: 2.738 m

Total Well Penetration Depth: 2.738 m

Screen Length: 2.738 m

Casing Radius: 0.025 m

Well Radius: 0.025 m

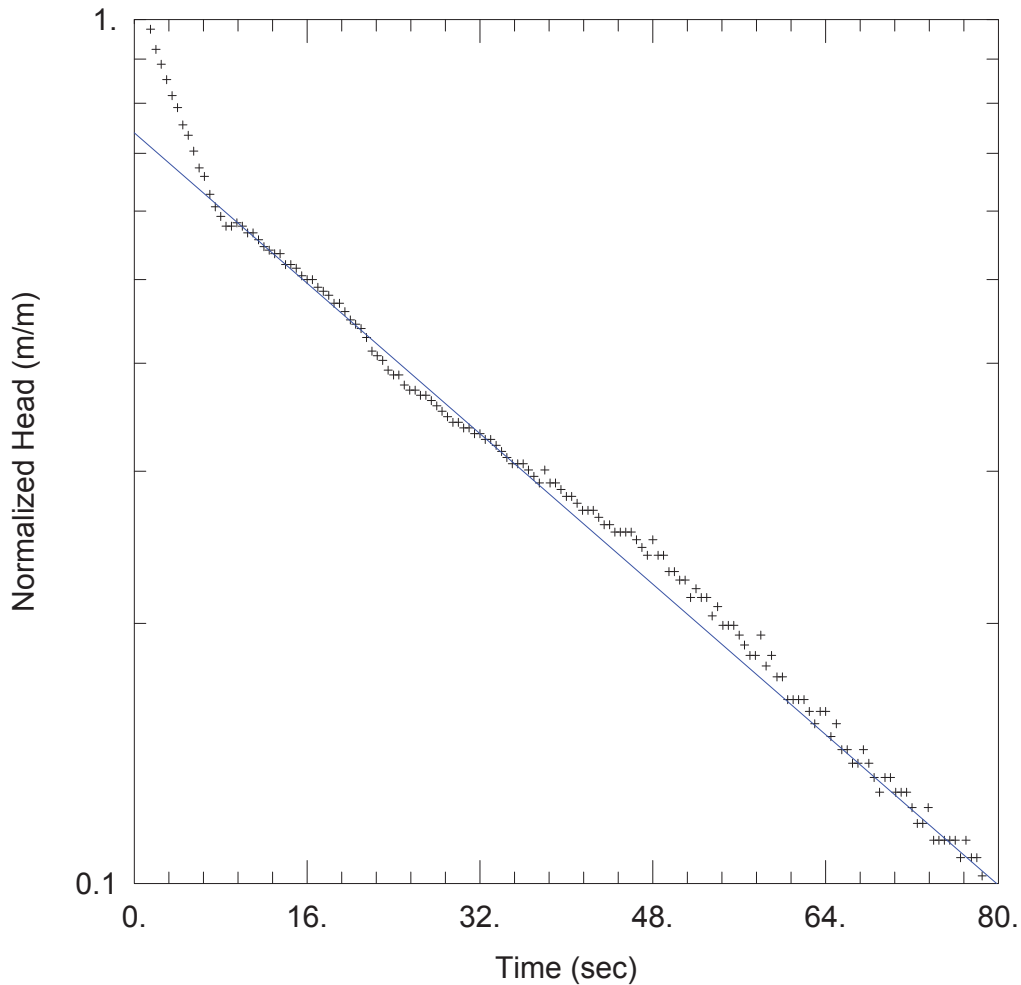
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 1.063 m/day

y0 = 0.1894 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt
 Date: 11/21/14 Time: 16:41:26

PROJECT INFORMATION

Company: Greencap
 Client: South Australian EPA
 Project: J125792
 Location: 37-41 Cliff Street
 Test Well: GW8_Falling Head 2
 Test Date: 8 Aug 2014

AQUIFER DATA

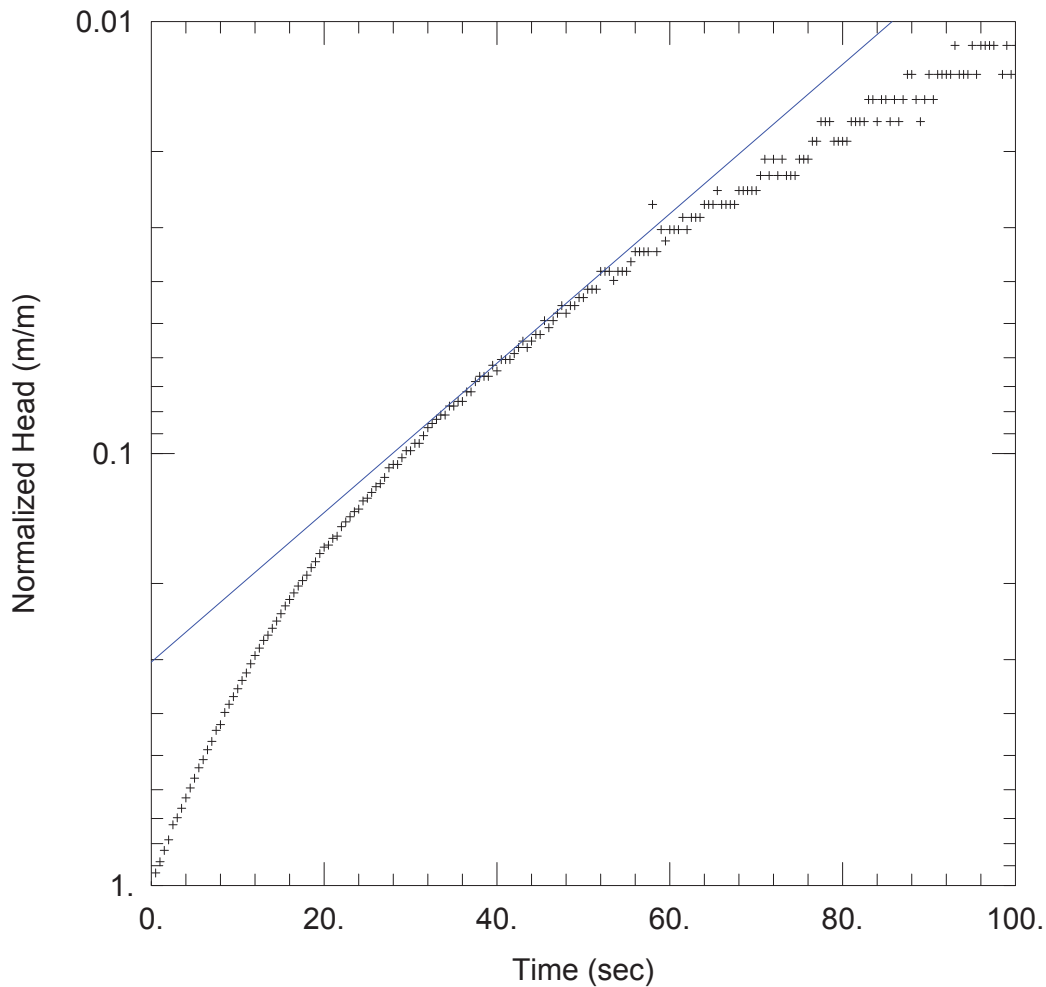
Saturated Thickness: 5. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW8)

Initial Displacement: 0.196 m Static Water Column Height: 2.738 m
 Total Well Penetration Depth: 2.738 m Screen Length: 2.738 m
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 0.8026 m/day y0 = 0.1449 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt

Date: 11/21/14

Time: 17:21:33

PROJECT INFORMATION

Company: Greencap

Client: South Australian EPA

Project: J125792

Location: 37-41 Cliff Street

Test Well: GW2_Rising Head 2

Test Date: 8 Aug 2014

AQUIFER DATA

Saturated Thickness: 5. m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW2)

Initial Displacement: 0.528 m

Static Water Column Height: 2.678 m

Total Well Penetration Depth: 2.678 m

Screen Length: 2.678 m

Casing Radius: 0.025 m

Well Radius: 0.025 m

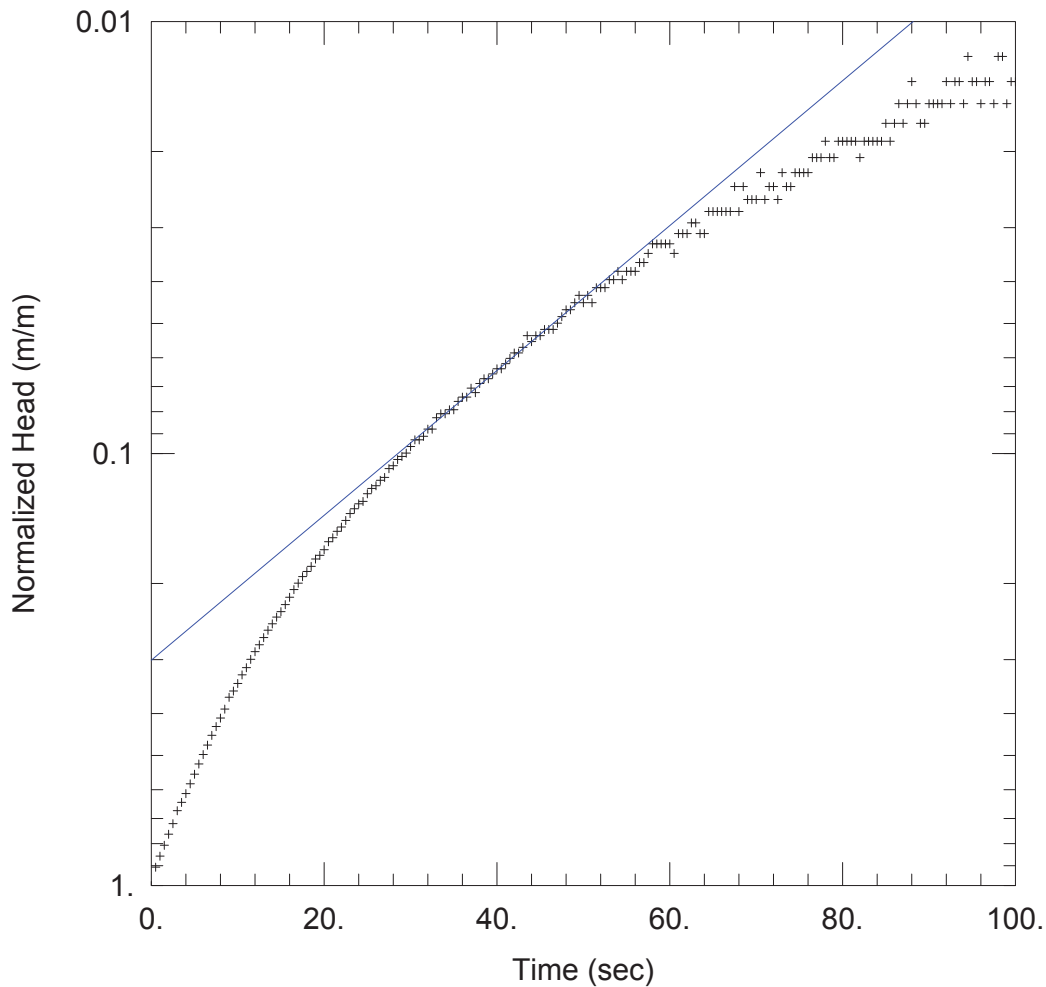
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 1.296 m/day

y0 = 0.1605 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt
 Date: 11/21/14 Time: 17:20:00

PROJECT INFORMATION

Company: Greencap
 Client: South Australian EPA
 Project: J125792
 Location: 37-41 Cliff Street
 Test Well: GW2_Rising Head 1
 Test Date: 8 Aug 2014

AQUIFER DATA

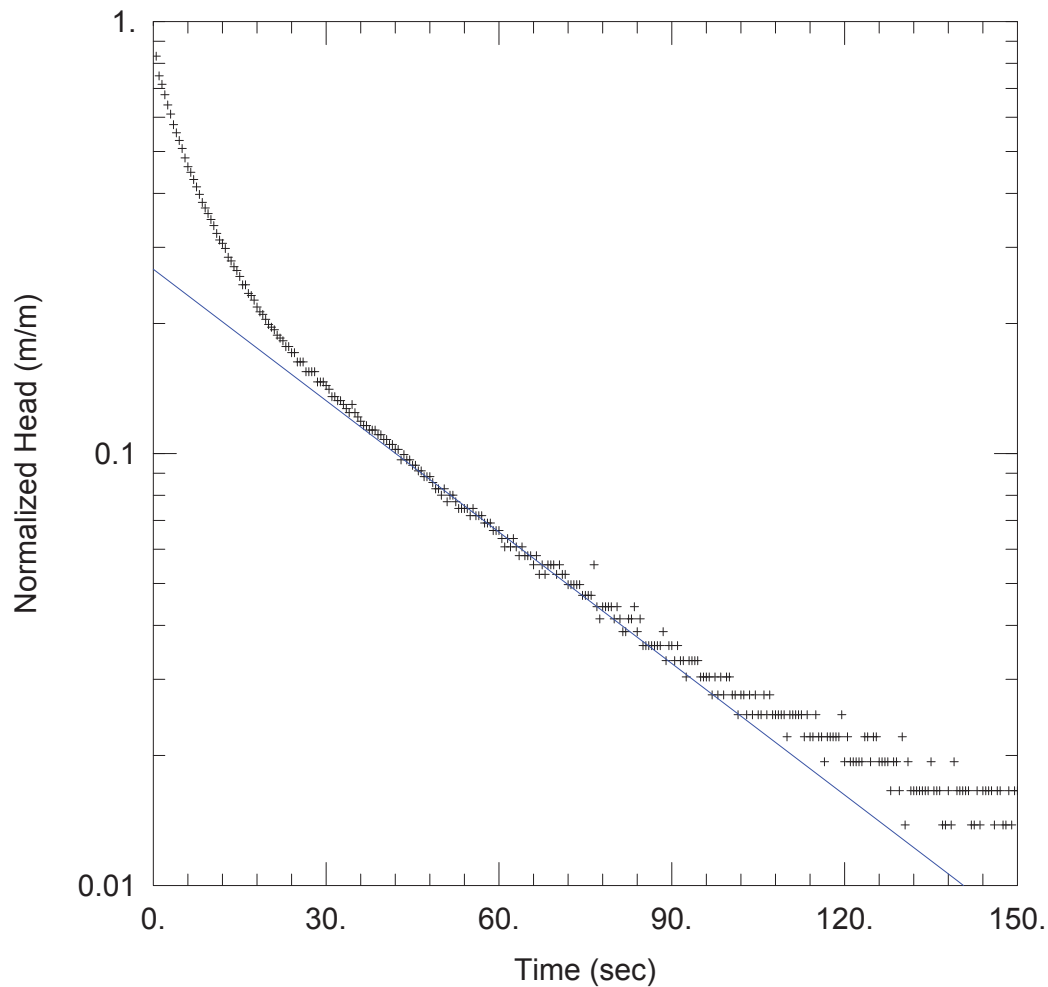
Saturated Thickness: 5. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW2)

Initial Displacement: 0.581 m Static Water Column Height: 2.678 m
 Total Well Penetration Depth: 2.678 m Screen Length: 2.678 m
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 1.256 m/day y0 = 0.1749 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt
 Date: 11/21/14 Time: 17:16:50

PROJECT INFORMATION

Company: Greencap
 Client: South Australian EPA
 Project: J125792
 Location: 37-41 Cliff Street
 Test Well: GW2_Falling Head 2
 Test Date: 8 Aug 2014

AQUIFER DATA

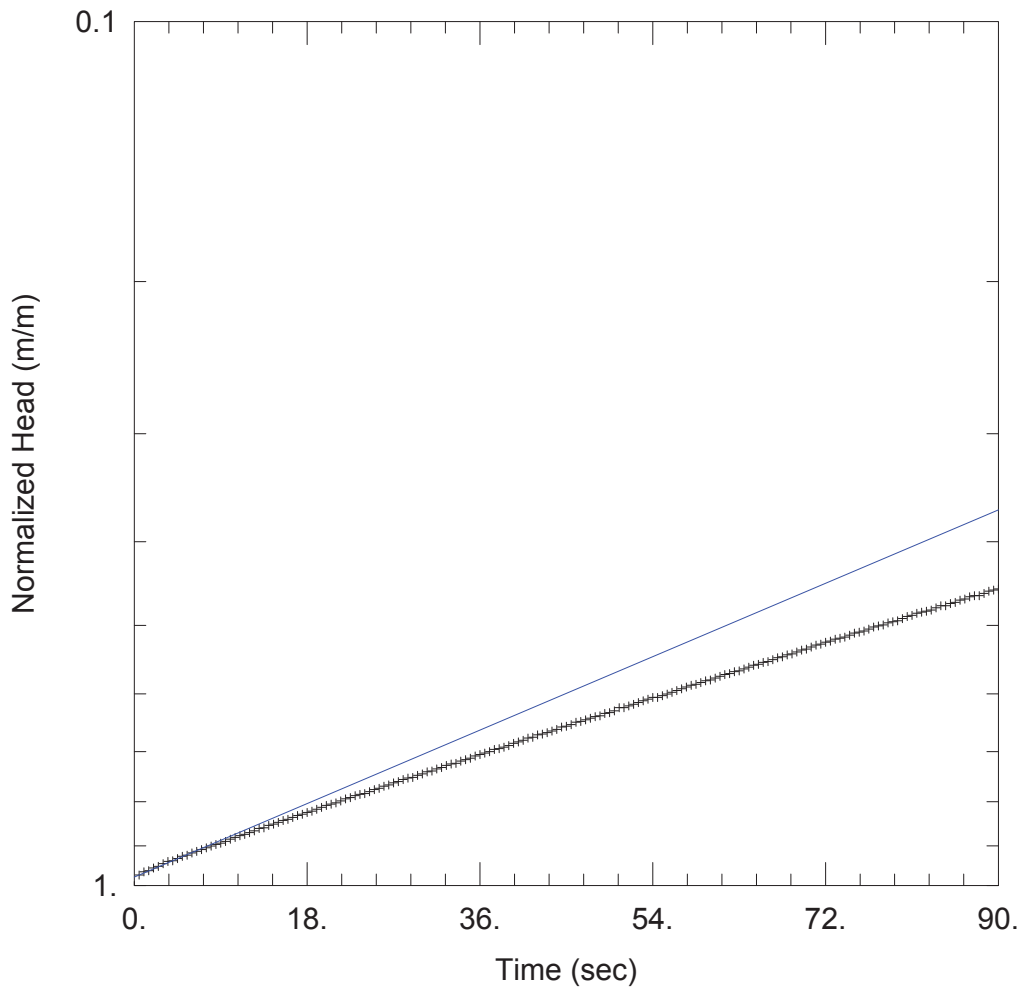
Saturated Thickness: 5. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW2)

Initial Displacement: 0.362 m Static Water Column Height: 2.678 m
 Total Well Penetration Depth: 2.678 m Screen Length: 2.678 m
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 0.7598 m/day y0 = 0.09665 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt
 Date: 11/21/14 Time: 13:12:15

PROJECT INFORMATION

Company: Greencap
 Client: South Australian EPA
 Project: J125792
 Location: 37-41 Cliff Street
 Test Well: DC1_Rising Head 2
 Test Date: 8 Aug 2014

AQUIFER DATA

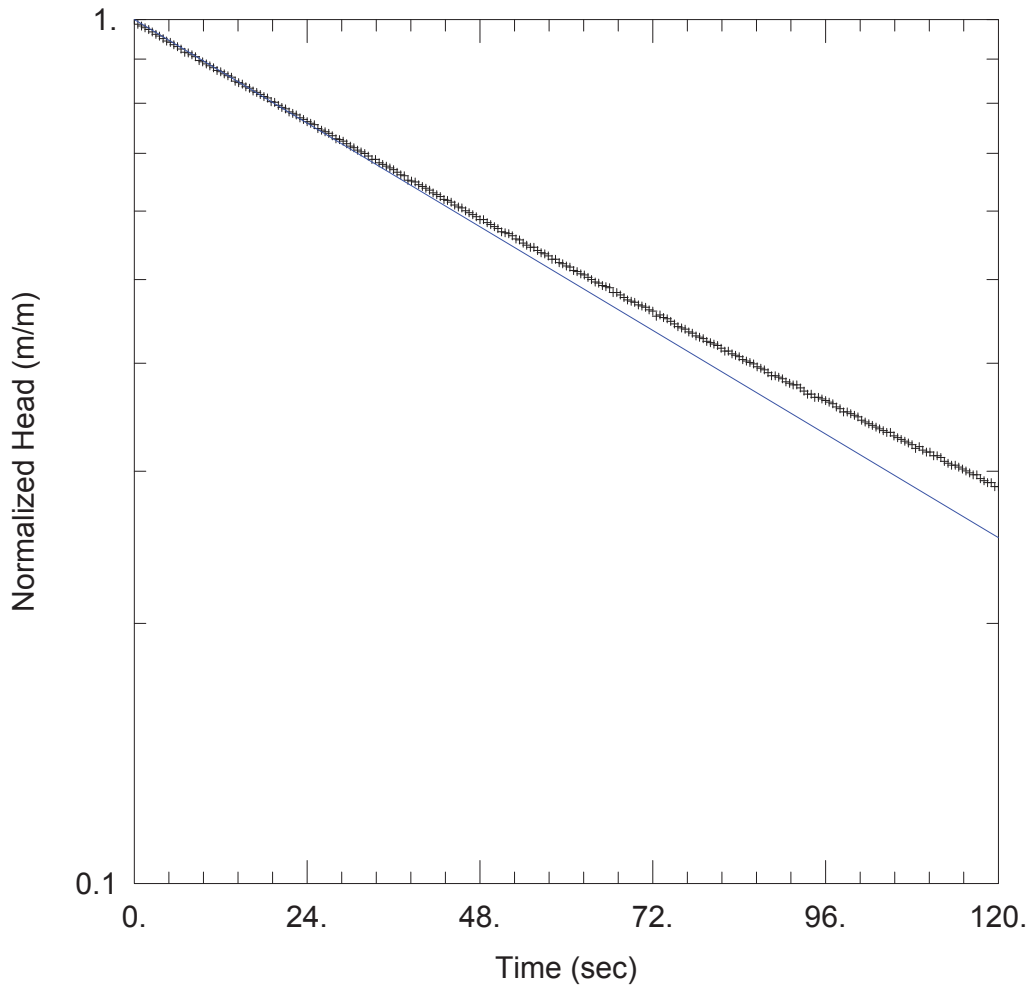
Saturated Thickness: 5. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DC1)

Initial Displacement: 0.723 m Static Water Column Height: 8.306 m
 Total Well Penetration Depth: 8.306 m Screen Length: 2.078 m
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
 K = 0.7225 m/day y0 = 0.707 m



WELL TEST ANALYSIS

Data Set: C:\Users\Simon.Welsh\Desktop\Glenelg East.aqt
 Date: 11/21/14 Time: 13:03:26

PROJECT INFORMATION

Company: Greencap
 Client: South Australian EPA
 Project: J125792
 Location: 37-41 Cliff Street
 Test Well: DC1_Falling Head 2
 Test Date: 8 Aug 2014

AQUIFER DATA

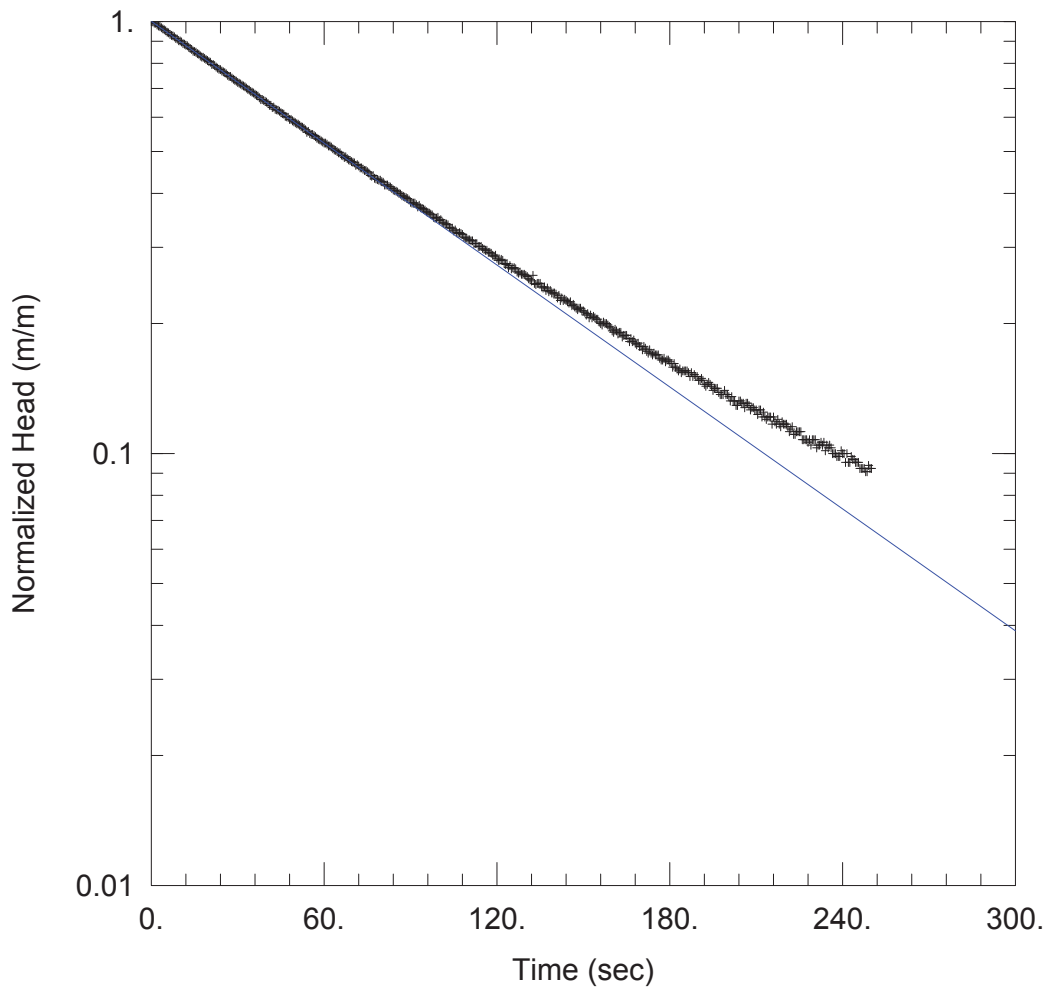
Saturated Thickness: 5. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DC1)

Initial Displacement: 0.646 m Static Water Column Height: 8.306 m
 Total Well Penetration Depth: 8.306 m Screen Length: 2.078 m
 Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
 K = 0.7646 m/day y0 = 0.646 m



WELL TEST ANALYSIS

Data Set:

Date: 11/21/14

Time: 12:23:00

PROJECT INFORMATION

Company: Greencap

Client: South Australian EPA

Project: J125792

Location: 37-41 Cliff Street

Test Well: DC1_Falling Head 1

Test Date: 8 Aug 2014

AQUIFER DATA

Saturated Thickness: 5. m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DC1)

Initial Displacement: 0.65 m

Static Water Column Height: 8.306 m

Total Well Penetration Depth: 8.306 m

Screen Length: 2.078 m

Casing Radius: 0.025 m

Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

K = 0.7196 m/day

y0 = 0.651 m

Environmental Assessment Works

South Australian Environment Protection Authority

37 - 41 Cliff Street, Glenelg East

Appendix E: Groundwater Well Survey Results

Well Survey

37-41 Cliff Street, Glenelg East
Surveyed by Fyfe - Job # 21855-1-1
Date of Survey - 23rd July, 2014

Well Name	Easting	Northing	Top of Pipe Elevation	Ground Elevation
GW03	274314.551	6125654.074	8.435	8.58
GW10	274321.585	6125634.194	8.560	8.67
GW02	274325.723	6125619.773	8.792	8.84
GW14	274278.996	6125610.026	8.797	8.83
GW09	274309.675	6125621.630	8.818	8.92
GW13	274307.593	6125633.614	8.768	8.82
GW05	274288.318	6125607.089	8.941	9.00
GW01	274296.534	6125605.929	8.870	8.94
GW07	274299.080	6125599.949	8.855	8.94
DC01	274293.766	6125625.669	8.685	8.71
GW04	274293.051	6125631.738	8.543	8.69
GW06	274287.754	6125625.185	8.766	8.87
GW08	274287.122	6125651.827	8.462	8.54
GW15	274265.558	6125667.996	8.198	8.27
GW12	274275.389	6125630.187	8.525	8.68
GW11	274278.884	6125626.643	8.615	8.68

*All Coordinates are MGA

*All Elevations are AHD