APPENDIX IX

Field Verification Report

Klohn Crippen Berger

Senex Energy Ltd

Project Atlas

Field Verification Report

Final

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1 INTRODUCTION

Klohn Crippen Berger Ltd (KCB) were commissioned by Senex Energy Limited, to undertake groundwater and surface water assessments for Project Atlas (the Project).

Senex propose to develop a coal seam gas (CSG) field within Petroleum Lease (PL) 1037 to produce gas exclusively for the domestic market. The Project will include up to 113 CSG production wells and supporting infrastructure. At least 25 years of commercial gas production is anticipated from the proposed development.

Project Atlas covers an area of approximately 58 km^2 and is located approximately 15 km southwest of the township of Wandoan, within PL1037. The CSG target coal seam for the project is the Walloon Coal Measures (WCM).

Surface water and groundwater features mapped within the Project area include several watercourses, alluvium associated with the watercourses, a potential baseflow-fed reach and potential terrestrial groundwater dependent ecosystems. A field verification program was undertaken to collect site-specific information related to these features.

The field verification program included:

- Field mapping and surface water sampling (where possible) of watercourses across the project area, including Wandoan Creek, Splitter Creek, Ogle Creek and Woleebee Creek;
- Data collection and observation related to the nature and extent of the alluvium, creek flow, groundwater-surface water connectivity and verification of hydrogeological conditions in the areas of mapped potential Groundwater Dependent Ecosystems (GDEs) (DES 2018b); and
- Groundwater and surface water sample collection in the area of Woleebee Creek, a potentially gaining stream identified in OGIA (2017a), to assist in the characterisation of potential spring and identification of the source aquifer.

This draft report presents the results and interpretation of the field verification program undertaken within the Project area.

2 SITE SETTING

2.1 Surface Water Overview

Project Atlas is located within the Upper Dawson River sub-basin, which is part of the Fitzroy River Basin. The Fitzroy River Basin is the second largest externally drained basin in Australia and the largest that flows to the east coast. Covering an area of 150,000 km^2, the basin contains several significant tributaries, including the Nogoa, Comet, Mackenzie and Dawson Rivers. The basin discharges into the Coral Sea east of Rockhampton.

The catchment divide between the upper Dawson River sub-basin and the Condamine-Balonne Rivers sub-basin is located ~16 km to the south of the Project area, as shown in Figure 2.1

Key aspects of the watercourses associated with the Project area include:

- Woleebee Creek is a major watercourse within the Project area which flows north from its headwaters flanking the eastern boundary of the Project to join Juandah Creek to the northeast.
- Smaller headwater tributaries of Woleebee Creek, present within the Project area, include Wandoan Creek, Splitter Creek and Ogle Creek.
- The Project area lies almost entirely within the sub-catchment of Woleebee Creek.

Watercourses within the Project area are classified as Stream Orders 1 to 5 using the Strahler method, with the majority being Stream Order 1 (minor streams) (DNRM 2017). Reaches of Stream Order 5 (major streams) are associated with Woleebee Creek to the east of the Project area.

The watercourses across the Project area are characteristically ephemeral and typically flow during significant runoff events. This is likely a consequence of the watercourses being in the upper most reaches of the catchment where limited runoff area is present.

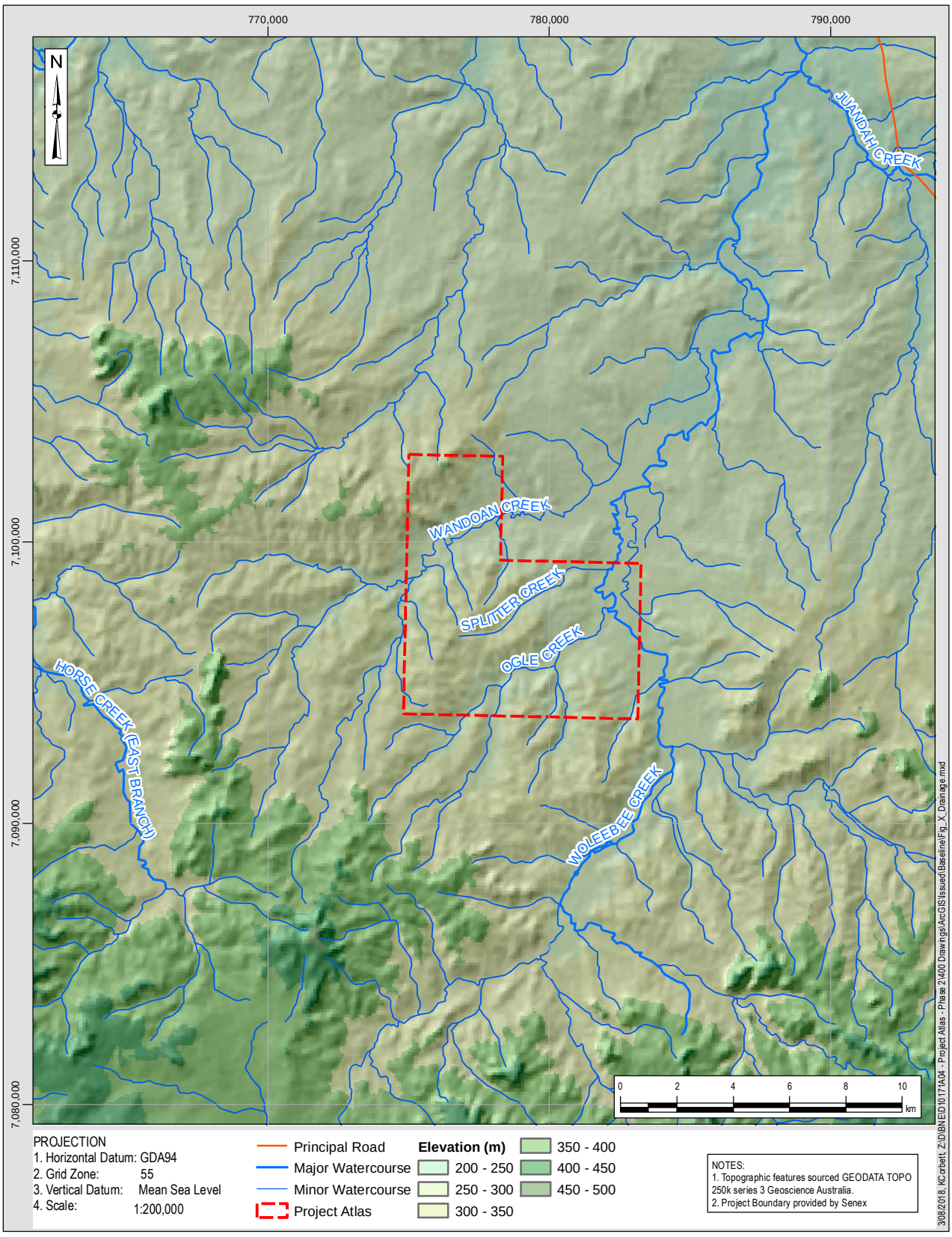

Figure 2.1: Drainage within the Project Area

2.2 Hydrogeology Overview

Project Atlas lies within the geographical extent of the Surat Basin, a basin of Jurassic-Cretaceous age, which is underlain by the Permo-Triassic Bowen Basin. Cenozoic-age formations are present overlying the Surat Basin formations. The Surat Basin also forms part of the Great Artesian Basin (GAB). The surface geology within the Project area is shown on Figure 2.2.

2.2.1 Alluvium

Quaternary-age alluvium is mapped as occurring within the Project area and is associated with Wandoan, Woleebee and Ogle Creeks. The alluvium is mapped as relatively thin across the Project lease, with increased lateral extent towards the north as Wandoan and Ogle Creeks flow into Woleebee Creek.

2.2.2 Surat Basin Units

The solid geology outcropping at surface within the Project area include the Gubberamunda Sandstone and Westbourne Formation. A description of these units is provided in the following:

The Gubberamunda Sandstone *Aquifer*

Regionally, the Gubberamunda Sandstone conformably overlies the Westbourne Formation, but locally is disconformable, particularly around the margins of the basin (Green 1997). It was deposited by braided and meandering stream systems draining surrounding highlands (Exon 1976). Consistent with a fluvial depositional environment, repeated packages of siltstone and fine to coarse sandstone were deposited. Deposits of carbonaceous shale along with minor coal fragments are typically present. Within the GAB, the Gubberamunda Sandstone is considered a usable aquifer.

The Westbourne Formation *Aquitard*

The Westbourne Formation conformably overlies the Springbok Sandstone. It was deposited in an environment with characteristics consistent with a low energy, lacustrine deltaic plain (Green 1997). The Westbourne Formation comprises predominately siltstone layers with thick interbeds of fine to medium grained sandstone and minor mudstone. Small coal fragments, lenses and lamina are common throughout the formation. Within the GAB sequence, the Westbourne Formation is considered an aquitard.

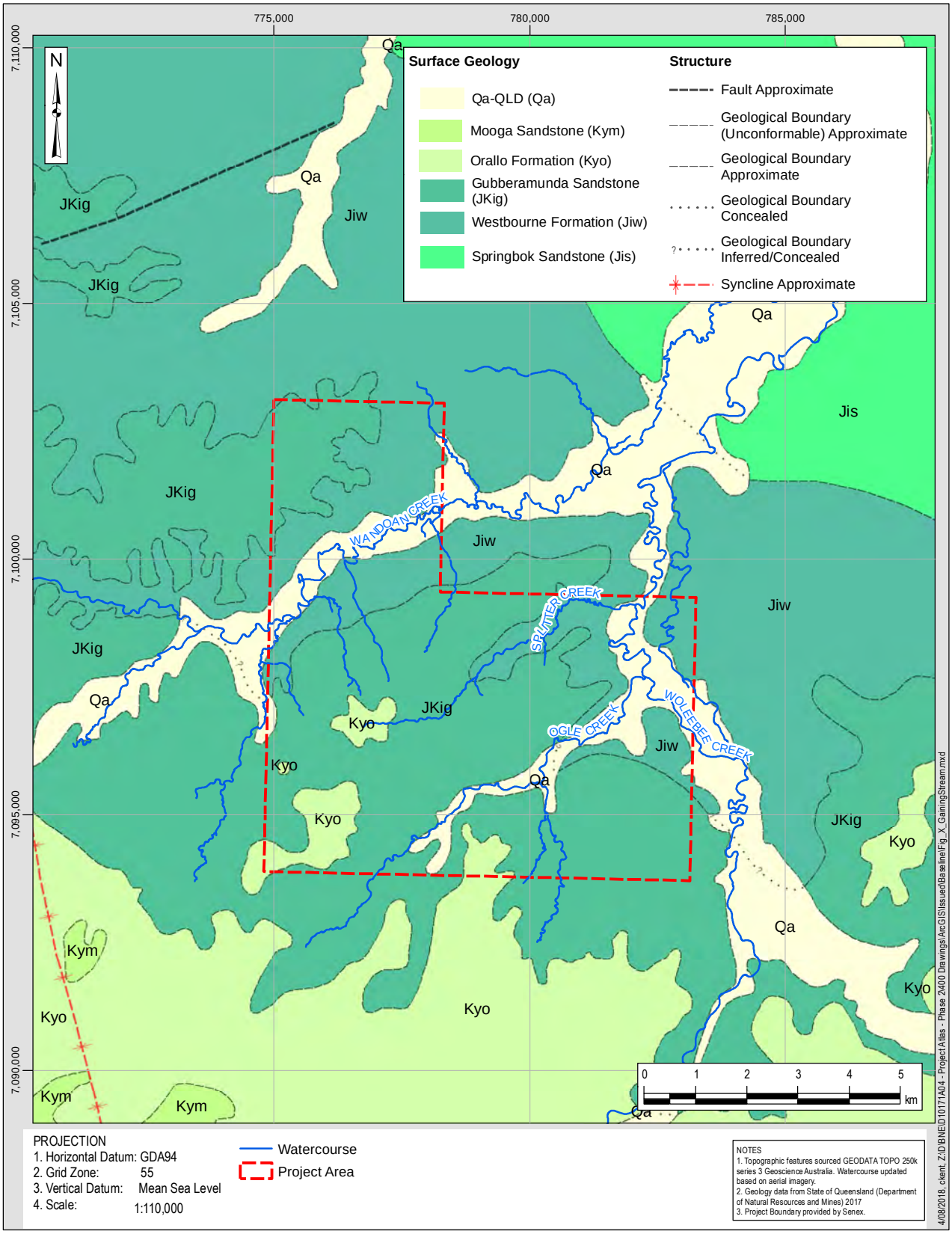

Figure 2.2: Surface Geology Map

2.3 Groundwater Dependent Ecosystems

2.3.1 Potentially Gaining Streams

The Office of Groundwater Impact Assessment (OGIA) identified potentially gaining streams (or baseflow-fed reaches, watercourse springs) within the Surat Cumulative Management Area (OGIA, 2017a). This report identified sections of Woleebee Creek as a potentially gaining stream. The OGIA assessment identifies with a high level of confidence that the reaches of Woleebee Creek are gaining streams (supported by the groundwater).

2.3.2 Mapped Potential GDEs

Potential GDEs have been mapped within the vicinity of the Project by the State of Queensland, Department of Science and Environment (DES) (DES 2018b), as shown in Figure 2.3. GDEs are defined in 'Modelling water-related ecological responses to coal seam gas extraction and coal mining' (DoEE 2015) as:

> *Natural ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services (Richardson et al. 2011). The broad types of GDE are (Eamus et al. 2006):*
>
> - *ecosystems dependent on surface expression of groundwater,*
> - *ecosystems dependent on subsurface presence of groundwater,*
> - *subterranean ecosystems.*

Potential GDEs within the Project area include surface expression GDEs and terrestrial GDEs which rely on the subsurface presence of groundwater. These are defined as:

> **Surface expression GDEs** are ecosystems dependent on the discharge of groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. Surface expression GDEs include drainage lines, spring wetlands and regional ecosystems that have some groundwater dependency (DSITI 2015).
>
> **Terrestrial GDEs** are defined as ecosystems dependent on the sub-surface presence of groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. Terrestrial GDE features include riverine wetlands and treed (deep rooted) regional ecosystems that have some groundwater dependency (DSITI 2015).

Low to moderate confidence potential surface expression GDEs are mapped along Woleebee, Ogle and Wandoan Creeks in the Project area. Potential terrestrial GDEs are mapped along the same creeks. These potential GDEs are also mapped as being low to moderate confidence and described as Quaternary alluvial aquifers overlying sandstone ranges with fresh, intermittent groundwater connectivity regime. The source aquifer for these potential GDEs is identified as the alluvium within the GDE dataset.

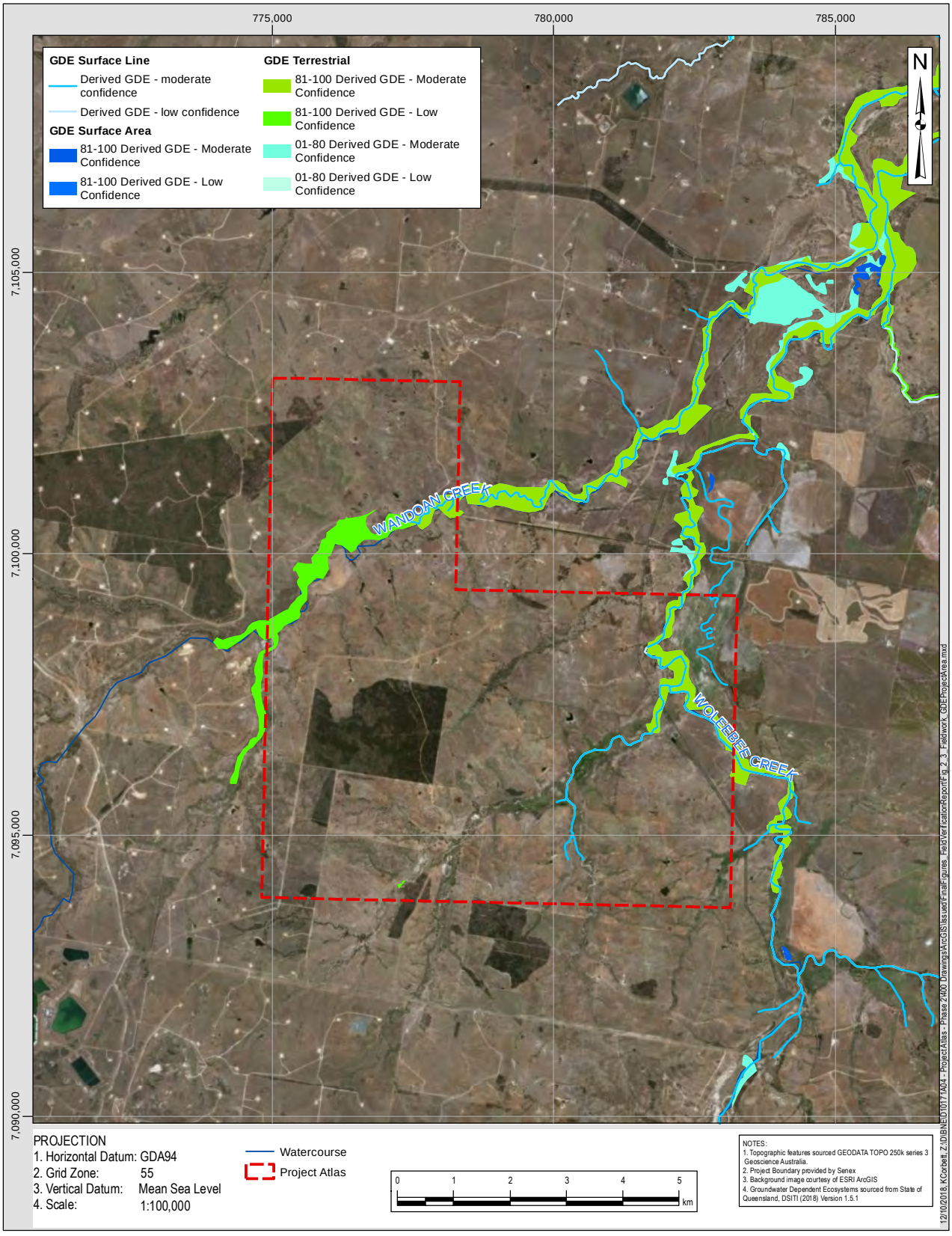

Figure 2.3: Location of Mapped Potential GDEs

3 METHODOLOGY

3.1 Field Verification Program

The field verification program was undertaken on the June 26 and July 12, 2018 by KCB Senior Hydrogeologist Carly Waterhouse. The program was completed in conjunction with ecological field mapping of terrestrial GDEs, and aquatic ecology undertaken by Ausecology, Hydrobiology and ERM.

Verification sites for the field program were selected by KCB and with final site locations confirmed by Senex's land access permissions.

3.2 Observations and Data Collection

Field hydrogeological observations included:

- Geological observations, including outcrop description;
- Alluvium extent and description;
- Watercourse description; and
- Verification of the presence of baseflow (groundwater) or pooled surface water in the creek beds.

The criteria assisting in the determination of the presence of groundwater versus surface water in creek beds is detailed in Table 3.1.

Table 3.1: Criteria Assisting in Determination of Groundwater versus Surface Water in Creek Beds

Criteria Indicating Presence of Groundwater	Criteria Indicating Presence of Surface Water
Pools of less turbid water (clear or fresh water) which indicate a constant new supply of fresh low-turbidity water	Pools within low lying areas within creeks
Feature lies within an area known to have a high water table	Pools of turbid water suggesting there is no constant fresh flow of water from an aquifer
Feature within an area of distinct geological change (i.e. change in geological formation or presence of fault).	Generally low salinity
Generally high salinity	

3.2.1 Field Water Sampling

Water quality samples were collected from select locations during the field program. Samples were collected in accordance with the DES Monitoring and Sampling Manual (2018a) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000). Laboratory analysis of the collected samples was undertaken by ALS, which is accredited by the National Association of Testing Authorities (NATA).

The analysis results were also reviewed against existing data (from the DNRME groundwater database and DNRME surface water gauge) to understand the water quality signature and assist with determination of surface water or groundwater.

4 FIELD VERIFICATION RESULTS

4.1 Overview

A summary of the pre-field investigation rainfall conditions measured at the Bureau of Meteorology (BOM) Woleebee Nevasa rainfall station (located ~ 5 km south of the Project area) prior to each site visit is summarised in the following:

- The first field verification visit was undertaken following a prolonged dry period, with the previous major rainfall event occurring approximately 4 months prior to the visit (41 mm on March 5 to 7, 2018; Figure 4.1). Minor rainfall events occurred on April 14 (5 mm), May 8 (5 mm), and June 14 (2 mm).
- One day of field investigations was completed during the first site visit, however the remainder of the visit was postponed due to heavy rainfall (30 mm) occurring on June 27 and 28, 2018.
- The second field visit occurred 4 days after a minor rainfall event (3 mm on July 6, 2018).
- Site conditions were identified as dry on both trips, despite the minor rainfall events experienced between the field trips, the region is experiencing a dryer than usual dry season resulting in drought conditions.

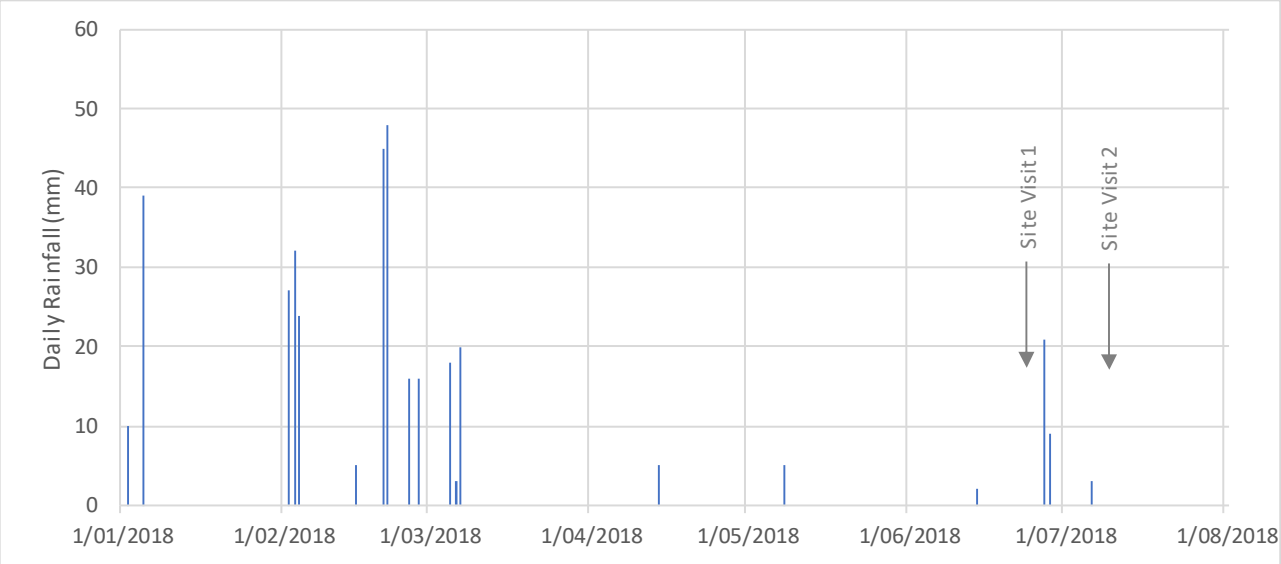

Figure 4.1: Rainfall Prior to Field Verification at Woleebee Nevasa Rainfall Station 35081 (BOM 2018) located ~5 km south

Two creek systems within in the Project area were mapped:

- Wandoan Creek; and
- Woleebee Creek.

The location of these creeks is shown in Figure 4.2. A summary of these sites is provided in the following sections.

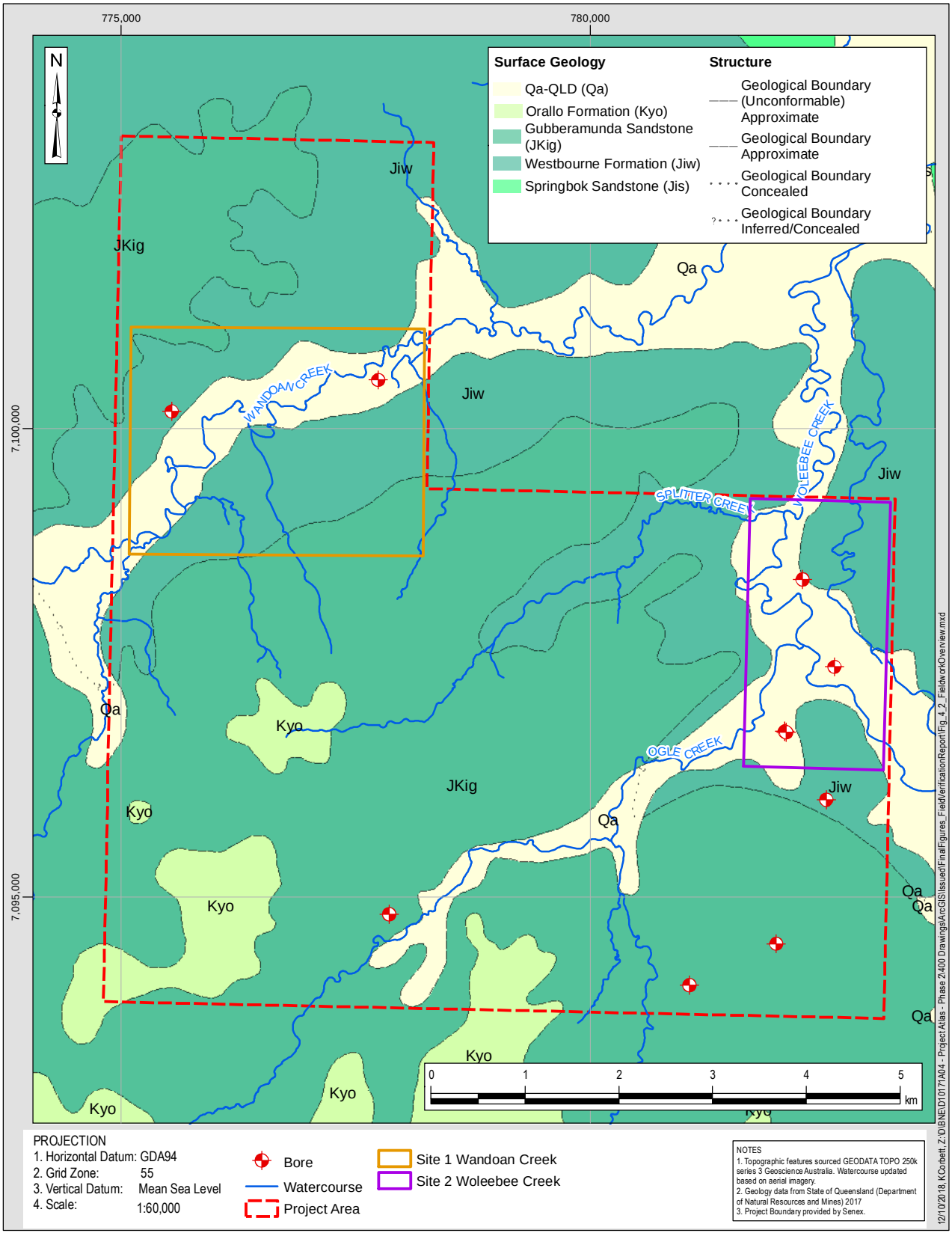

Figure 4.2: Location of Wandoan and Woleebee Creeks and the underlying Bedrock Geology within the Project Area

4.2 Wandoan Creek

4.2.1 Description

Wandoan Creek is located on properties 26FT165, 19FT60 and 27FT132 within the Project area. It is a tributary of the Fitzroy River catchment. The creek flows through the Project area from the west to the northeast, eventually flowing into Woleebee Creek approximately 12 km northeast of the Project area. It is classified as Stream order 1 to 4, within the Project area the Stream order varies from 3 to 4. The creek is ephemeral.

Wandoan Creek consists of large alluvial floodplain with gentle slopes towards the creek channel. The floodplains have largely been cleared for beef cattle grazing with some remnant riparian vegetation present along the creek lines. The Mount Organ State Forest is situated in the upper reaches of the Wandoan Creek catchment.

Wandoan Creek, downstream of the Project area, has been previously assessed in the field by Golder Associates (Golder Associates 2009) for the QGC Northwest Development Area (neighbouring CSG tenure) . It was described as C6 in the Rosgen stream classification system (Rosgen D 1942). C6 stream types have silt-clay bed and bank material. No flowing water was observed in the November 2008 survey completed by Golder. The creek bed and banks were well vegetated with some debris in the channel.

4.2.2 Watercourse Field Observations

The following watercourse observations were observed during the field verification:

- No flowing water was observed in the watercourse.
- Some pooled water was observed. The pools were generally turbid in nature and of a low salinity indicating a surface water, rather than a groundwater source. The pools were generally located in shaded or low points of the creek bed. The frequency of pooling increased downstream where the base of the creek changed in consistency from sand to silt, clay and silty sand (Figure 4.3).
- Water samples were taken at two of the larger pools (Figure 4.3), one upstream towards the west and one downstream towards the east.
- In one of the larger downstream pools to the east, aquatic organisms were identified as part of the aquatic ecology survey.
- Debris (fallen trees) was encountered in the channel at several points along the creek.
- The creek geomorphology generally consisted of shallow creek banks (1 to 2 m high), highly meandering and 10 to 15 m wide. Upstream near the western Project area boundary (within the Project area), the creek is very shallow, narrow and highly vegetated.

Photographs taken along the surveyed stretch of the creek are presented in Figure 4.4

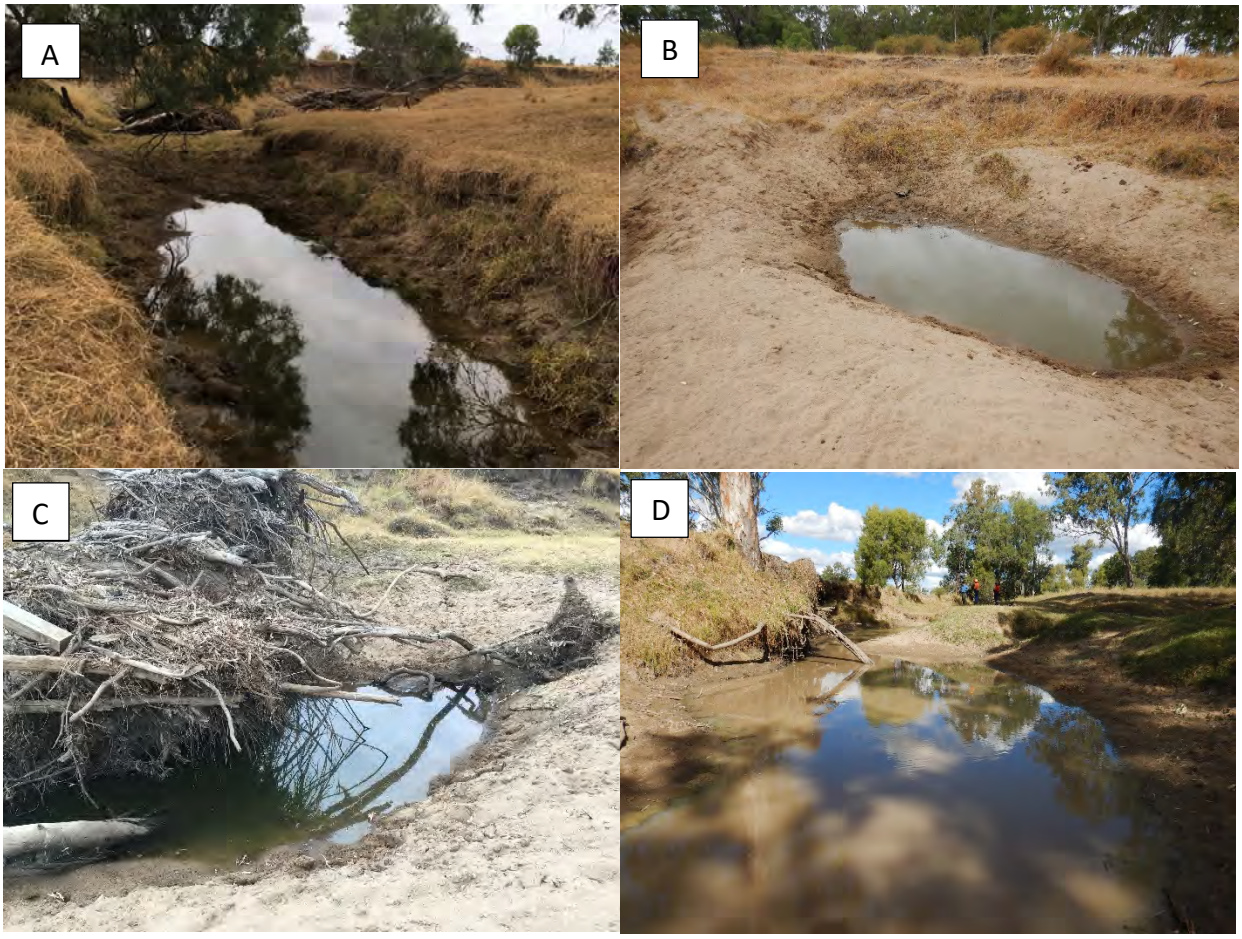

Figure 4.3: Water Pooling in Wandoan Creek (water samples collected from B and D)

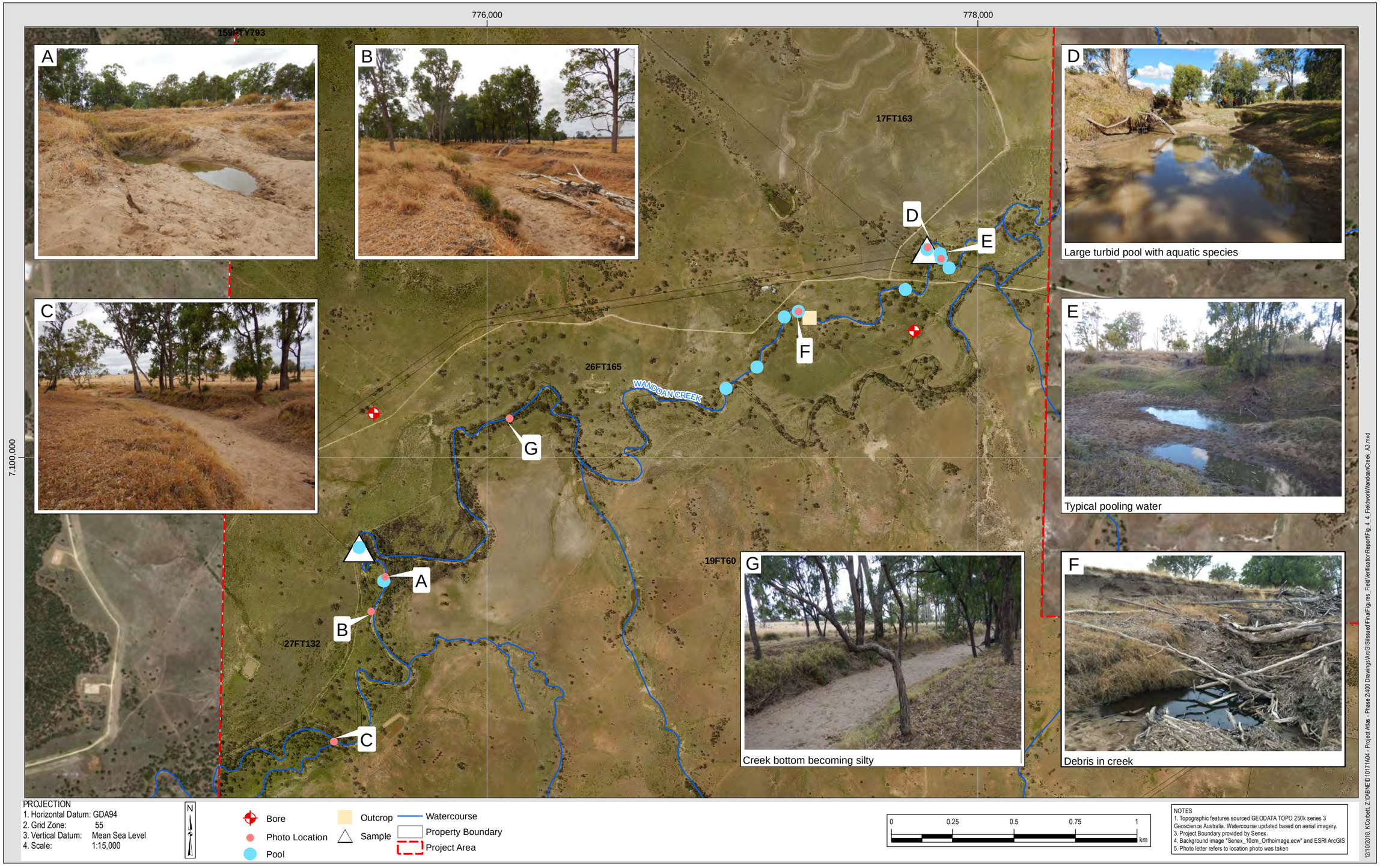

Figure 4.4: Wandoan Creek Photographs, pooling water, outcrop and sample locations

4.2.3 Geology

The bedrock geology beneath Wandoan Creek is the Westbourne Formation. The Westbourne Formation conformably overlies the Springbok Sandstone. It was deposited in an environment with characteristics consistent with a low energy, lacustrine deltaic plain (Green 1997). The Westbourne Formation comprises predominately siltstone layers with thick interbeds of fine to medium grained sandstone and minor mudstone. This formation is considered an aquitard. Alluvium is present within and adjacent to the creek. The Gubberamunda Sandstone outcrops within the creek upstream of the Project area to the west.

The following geological observations were observed during the field verification:

- The creek bed generally consists of silt / silty sand. The creek bed is generally sandier upstream, closer to the Gubberamunda Sandstone outcrop, and becomes silty and clayey downstream consistent with the underlying geology (Westbourne Formation).
- One small rock outcrop was identified, comprising a fine-grained sandstone, which was friable and considered to be a lithology of the Westbourne Formation. The outcrop had been molded by surface water flow within the watercourse (Figure 4.5).
- Alluvial sand was encountered approximately 400 m from the creek bed, south of Weldons Road, which passes north of Wandoan Creek. This is consistent with the geological mapping.

Figure 4.5: Bedrock and surface geology encountered at Wandoan Creek A) Outcrop of fine grained Sandstone; B) Sandy creek bed in the upstream sections of the creek

4.2.4 Water Chemistry

Two water samples were collected from pools in Wandoan Creek. Samples were collected in standing water (no flowing water was identified), with one sample collected upstream to the west in sandy creek bed conditions and the second collected downstream to the east (silty creek bed). The locations of these samples are shown in Figure 4.4.

The results of the field measurements are provided in Table 4.1. The full laboratory analysis results are provided in Appendix I.

Table 4.1: Water Quality Field Measurements – Wandoan Creek

Location	Date	pH	Electrical Conductivity (µS/cm)	Temperature (°C)
Wandoan Creek - Upper stretch	26/06/2018	8	345.7	13.5
Wandoan Creek – Lower stretch	11/07/2018	7.42	252.2	13.8

The results of the laboratory analysis have been processed and plotted in a piper plot (Figure 4.5). The plot also includes, for comparison, surface water samples from Juandah Creek, downstream of the Project site (DNRME gauge – Juandah Creek at Windermere), and groundwater sample results sourced from the DNRME groundwater database (GWDB) (DNRME 2018), and assigned to the Gubberamunda Sandstone and Westbourne Formation using OGIA Aquifer Attribution (OGIA 2017b).

The piper plot indicates that samples collected in Wandoan Creek are more similar to that of surface water than the underlying Surat Basin units. GWDB results for alluvium also present as similar characteristics to surface water in this area, reflecting recharge from surface water rather than the underlying Surat Basin units.

The pools of water observed in Wandoan Creek are therefore interpreted to be surface water ponding. No evidence of groundwater baseflow into Wandoan Creek was observed.

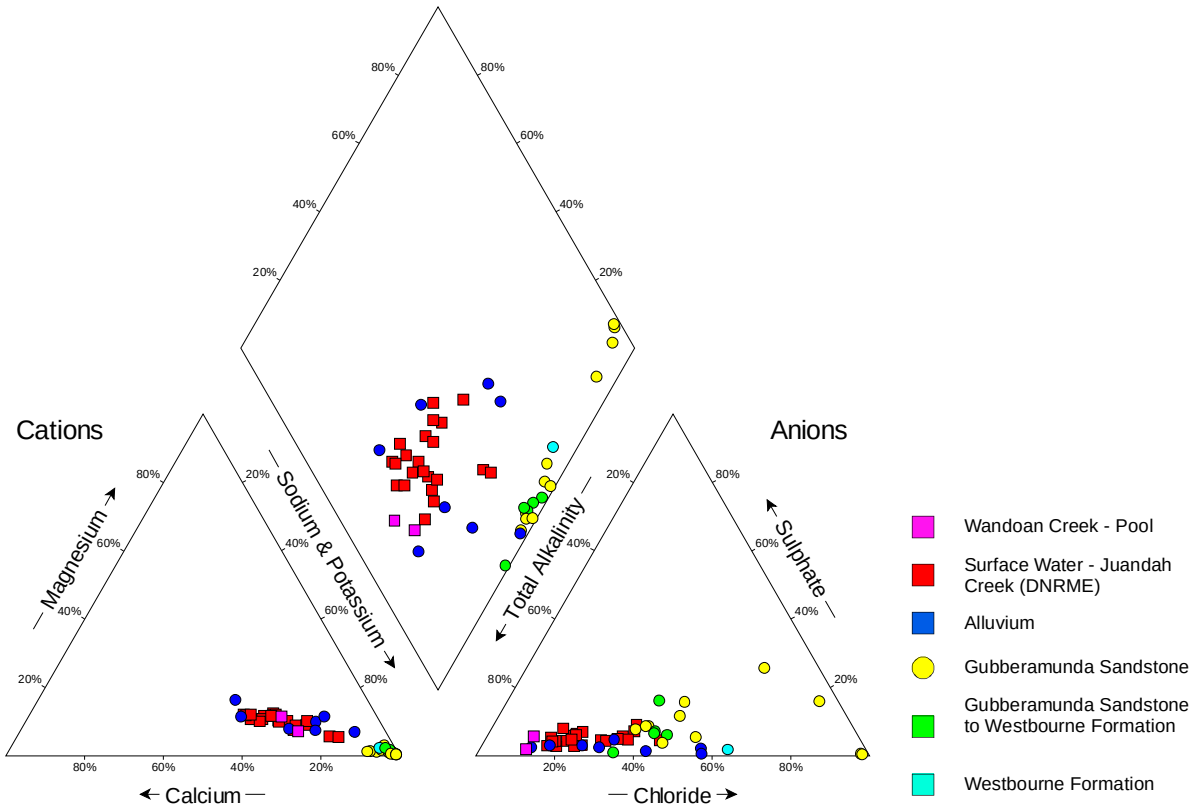

Figure 4.6: Piper Diagram with Wandoan Creek Samples and Available Surface Water and Groundwater Samples

4.2.5 Conclusion

Based on field observations and water quality results, it is interpreted that Wandoan Creek does not receive groundwater baseflow contributions. The pools of water observed and tested were consistent with surface water. No surface expressions of groundwater were observed in the Wandoan Creek system.

4.3 Woleebee Creek

4.3.1 Description

Woleebee Creek is located on properties 20FT672, 23FT41 and 222RP868424 within the Project area flowing from south to north. It is classified as Stream Order 5 (major streams) and has been identified as a potential gaining stream (OGIA 2017a). Woleebee Creek flows into Juandah Creek downstream of the Project area (to the northeast), which is a major tributary to the Dawson River. Woleebee Creek is known to be ephemeral. Ogle Creek and Splitter Creek feed into Woleebee Creek in the Project area from the west. Land use surrounding the creek is grazing and some remnant riparian vegetation is present along the creek lines.

Woleebee Creek, downstream within the Project area, has been previously assessed in the field by Golder Associates (Golder Associates 2009). It was described as C6 in the Rosgen stream classification system (Rosgen D 1942). C6 stream types have silt-clay bed and bank material. The creek is described as a meandering channel, wide with flat overbank areas, clay bed and banks, and very murky water. Ogle Creek, which flows into Woleebee Creek in the Project area, was also assessed and was described as a small creek, not well defined with a sandy silt soil bed and C4 stream type predominantly gravel channel material with lesser amounts of cobble, sand and silt/clay (Rosgen D 1942).

4.3.2 Watercourse Field Observations

The following watercourse observations was observed:

- The creek morphology varies through the Project area. Downstream within the Project area, the creek consists of a meandering channel approximately 10 m wide with banks approximately 2 to 3 m high. Upstream towards the southeast of the Project area, the creek was approximately 25 m wide with 5 to 7 m high banks and generally straight.
- No flowing water was observed in the watercourse.
- Three small pools of water were observed downstream in the lower stretches of Woleebee Creek. These pools were a maximum size of 3 x 6 m, depth is unknown but estimated at 0.5 m. All pools were in low lying, shaded areas of the creek and were turbid (Figure 4.7). The creek bed in these locations generally consisted of silt and silty sand consistent with the Westbourne Formation which underlies the creek. All pools were small, turbid and deemed most likely to consist of surface water.
- The upper stretches of the creek within the Project area were dry. This section of creek was very sandy, with the sand being very coarse grained and considered to be sourced from the Gubberamunda Sandstone. An area of wet sand was identified in a low section within the creek, however it cannot be confirmed as to whether this was associated with groundwater or surface water.

Photographs taken along the surveyed stretch of Woleebee Creek are presented in Figure 4.7 and Figure 4.8.

Figure 4.7: Water pooling in Woleebee Creek, field water quality measurements were taken from B

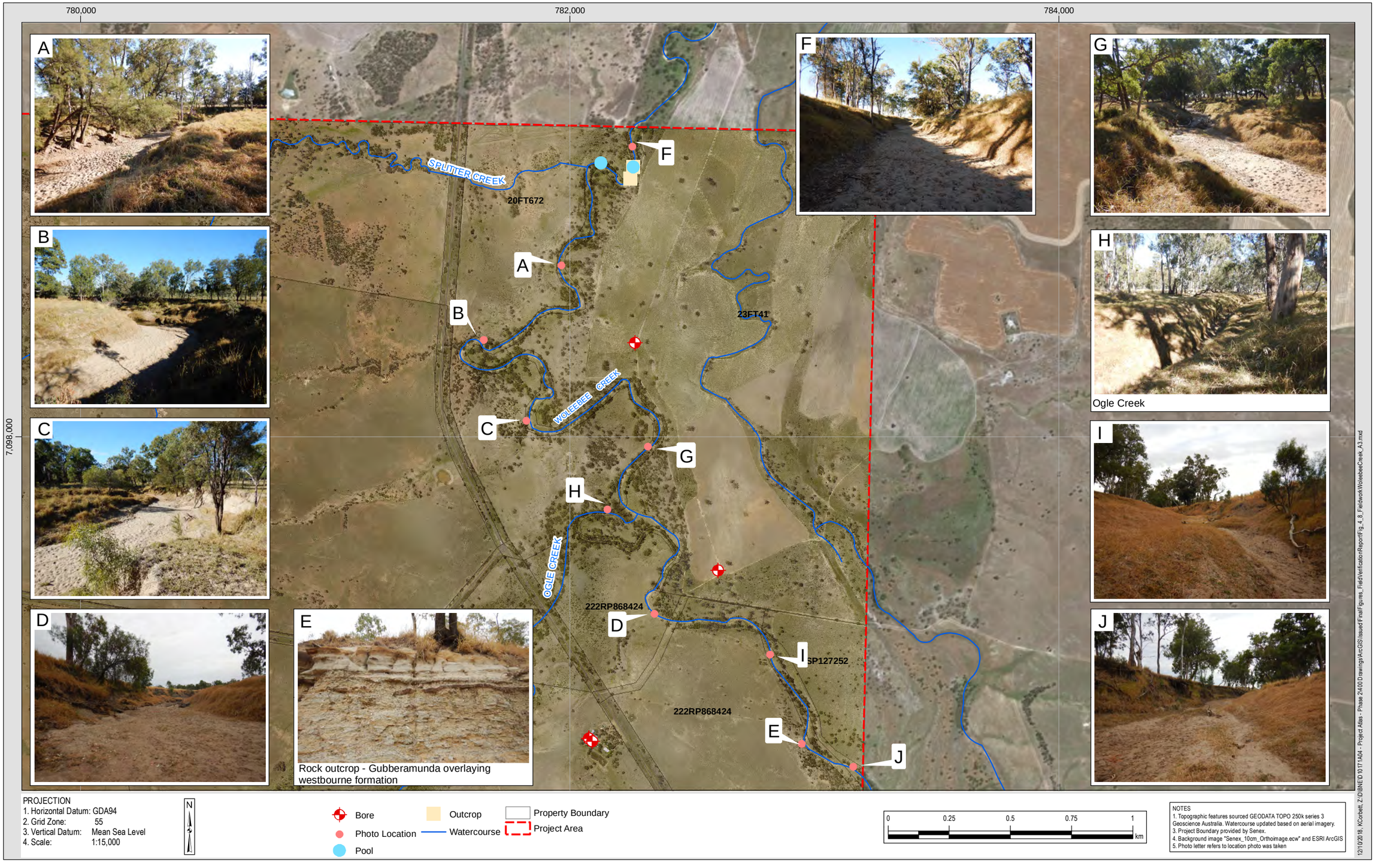

Figure 4.8: Woleebee Creek Photographs and Photograph Locations

4.3.3 Geology

The mapped geology (Figure 2.2) indicates that the bedrock geology beneath Woleebee Creek consists of the Westbourne Formation. As discussed in Section 3.1.3, the Westbourne Formation comprises predominately siltstone layers with thick interbeds of fine to medium grained sandstone and minor mudstone. Surface alluvial deposits are mapped along the stretch of Woleebee Creek and are wide and possibly deep in places.

The Westbourne Formation underlies the Gubberamunda Sandstone, which is mapped as outcropping to the southwest of Woleebee Creek, and is interpreted to be deposited by braided and meandering stream systems draining surrounding highlands (Exon 1976). Consistent with a fluvial depositional environment, repeated packages of siltstone and fine to coarse sandstone were deposited.

The following geological observations were observed during the field investigation:

- In the upper stretches of the creek, the creek bed is sandy. The sand is coarse grained and considered to be associated with the Gubberamunda Sandstone (which outcrops upstream). Downstream of the confluence with Ogle Creek and within the interpreted outcrop of the Westbourne Formation, the creek bed becomes more silty and clayey.
- A rock outcrop was identified in the upper stretches of the creek (Figure 4.9). The base of the outcrop consisted of mudstones considered to be part of the Westbourne Formation, this is overlain by an 'ironstone' which has been formed by the chemical precipitation of iron and manganese. Overlaying the ironstone is a fine gravel conglomerate which is overlain with coarse grained sandstone comprising cross-bedding. The coarse-grained sandstone is typical of the Gubberamunda Sandstone. The outcrop is considered to present the conformity between the Gubberamunda Sandstone and the underlying Westbourne Formation.
- Other rock outcrops were observed downstream of the confluence of Ogle Creek in Woleebee Creek to the north. These outcrops consist of mudstones and fine-grained sandstone associated with the Westbourne Formation (Figure 4.10). These rocks were weak and friable.

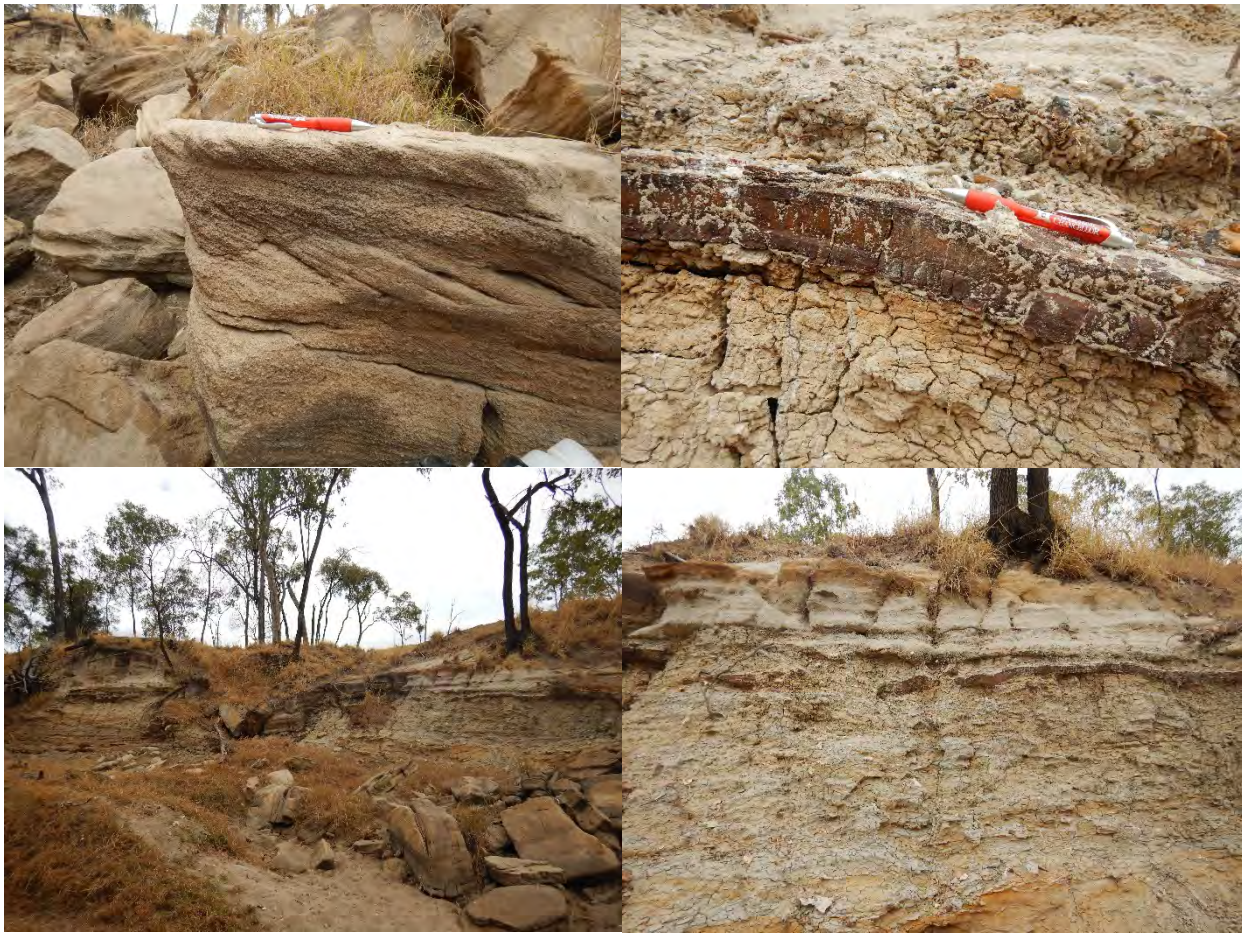

Figure 4.9: Transition between Westbourne Formation and the Gubberamunda Sandstone with an iron rich transition zone

Figure 4.10: Bedrock and superficial geology encountered at Woleebee Creek A) Outcrop of fine grained Sandstone and mudstone (Westbourne Formation); B) Typical sandy creek bed

4.3.4 Water Chemistry

Due to the absence of large pools of water within the Woleebee Creek watercourse, no water samples were collected for laboratory analysis. Field water quality measurements were recorded from the larger of the two identified pools (Table 4.2). The pool has a low electrical conductivity (547 µS/cm) indicating that surface water rather than groundwater, is the source.

Table 4.2: Water Quality Field Measurements – Woleebee Creek

Location	Date	pH	Electrical Conductivity µS/cm	Temperature	Observations
Woleebee Creek	11/07/2018	7.47	547	9.7	Turbid

4.3.5 Conclusion

Although the water encountered in the lower stretches of Woleebee Creek at the time of field verification is likely to be surface water, there is also potential that during some periods groundwater levels in the alluvium will rise into the sandy base of the creek in the upper stretches. Groundwater is likely to be present at depth in the sandy alluvium. Areas of dampness were observed in a section of the sandy portion of the creek. It is likely that any terrestrial GDEs along this creek bed are sourcing groundwater from the alluvium at depth. However, surface expressions of groundwater were not made at the time of visit in the dry season.

5 CONCLUSION

Field observation and data mapping has been undertaken of Wandoan Creek and Woleebee Creek within the Project area. Observations were made in terms of the nature of the alluvium, creek flow and groundwater-surface water connectivity. Water samples were taken in Wandoan Creek.

A summary of the conceptual understanding for Wandoan Creek and Woleebee Creek is provided in Table 5.1.

Table 5.1: Field Observations Conclusions

Location	Conceptual Summary
Wandoan Creek	No evidence of groundwater baseflow. Pooled water concluded to be surface water
Woleebee Creek	Water present in pools in the base of the creek were turbid in nature. Pooled water concluded to be surface water. No evidence of groundwater baseflow. Likely to be groundwater present in the alluvium at depth below the creek.

6 CLOSING

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of Senex Energy Ltd. (Client) for the specific application to the Project Atlas – Groundwater and Surface Water Assessments. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. In this report, Klohn Crippen Berger has endeavoured to comply with generally-accepted professional practice common to the local area. Klohn Crippen Berger makes no warranty, express or implied.

Yours truly,

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APPENDIX I

Laboratory Water Quality Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1815570**	Page	: 1 of 4
Client	: **KLOHN CRIPPEN BERGER LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CLAIRE KENT	Contact	: Customer Services EB
Address	: PO BOX 3276 SOUTH BRISBANE QLD, AUSTRALIA 4101	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: SENEX ATLAS	Date Samples Received	: 27-Jun-2018 16:25
Order number	: D2018PO-113	Date Analysis Commenced	: 28-Jun-2018
C-O-C number	: ----	Issue Date	: 03-Jul-2018 08:13
Sampler	: CARLY WATERHOUSE		
Site	: ----		
Quote number	: EN/333/17		
No. of samples received	: 2		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- It is recognised that EG020T (Total Metals) is less than EG020F (Dissolved Metals) for some samples. However, the difference is within experimental variation of the methods.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WANDOANCK_1	----	----	----	----
			Client sampling date / time	26-Jun-2018 13:10	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1815570-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.42**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**324**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	**9**	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**201**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**210**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**4**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**21**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**25**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**7**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**68**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**14**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.002**	----	----	----	----
Boron	7440-42-8	0.05	mg/L	**0.07**	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.063**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.002**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.006**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.003**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**1.00**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WANDOANCK_1	----	----	----	----
				Client sampling date / time	26-Jun-2018 13:10	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1815570-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020T: Total Metals by ICP-MS - Continued									
Arsenic	7440-38-2	0.001	mg/L		**0.002**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.06**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		**0.001**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.001**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.002**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.150**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.004**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.004**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.006**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.82**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**4.87**	----	----	----	----
Total Cations	----	0.01	meq/L		**5.14**	----	----	----	----
Ionic Balance	----	0.01	%		**2.68**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1816940**	Page	: 1 of 4
Client	: **KLOHN CRIPPEN BERGER LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CLAIRE KENT	Contact	: Customer Services EB
Address	: PO BOX 3276 SOUTH BRISBANE QLD, AUSTRALIA 4101	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: SENEX ATLAS	Date Samples Received	: 13-Jul-2018 09:00
Order number	: D2018PO-130	Date Analysis Commenced	: 14-Jul-2018
C-O-C number	: ----	Issue Date	: 19-Jul-2018 14:01
Sampler	: Carly Waterhouse		
Site	: ----		
Quote number	: EN/333/17		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

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- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- It is recognised that EG020T (Total Metals) is less than EG020F (Dissolved Metals) for some samples. However, the difference is within experimental variation of the methods.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WANDOANCK_2	----	----	----	----
			Client sampling date / time	11-Jul-2018 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1816940-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.75**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**547**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**143**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**143**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**9**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**15**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**16**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**3**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**54**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**8**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.002**	----	----	----	----
Boron	7440-42-8	0.05	mg/L	**0.12**	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.036**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.002**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.009**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.004**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**15.6**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WANDOANCK_2	----	----	----	----
				Client sampling date / time	11-Jul-2018 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1816940-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020T: Total Metals by ICP-MS - Continued									
Arsenic	7440-38-2	0.001	mg/L		**0.004**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.05**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		**0.001**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		**0.005**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.001**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		**0.007**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.008**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.177**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.002**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.011**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.007**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		**0.02**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.037**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**13.5**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.34**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.34**	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**3.47**	----	----	----	----
Total Cations	----	0.01	meq/L		**3.60**	----	----	----	----
Ionic Balance	----	0.01	%		**1.86**	----	----	----	----

APPENDIX X

Site Investigation Report (Atlas-13M-D/S, Atlas-14M-D/S and Atlas-15M-D/S)

Klohn Crippen Berger

Senex Energy

Atlas Stage 3 EPBC Groundwater Assessment

Site Investigation Report

Final

ISO 9001 14001 45001

DX10171A12

March 2023

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(continued)

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of KCB Australia Pty Ltd (KCB). The report was prepared for the exclusive use of Senex Energy Pty Ltd (Client) for the specific application to the Atlas Stage 3 Gas Project, and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
2. Observations, findings, and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
3. The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
4. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
5. This report is electronically signed and sealed, and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

1 INTRODUCTION

KCB Australia Pty Ltd (KCB) was commissioned by Senex Energy Pty Ltd (Senex) to provide hydrogeological support for a bore drilling and installation program at the Atlas Stage 3 site near Wandoan, Queensland.

Senex, on behalf of its subsidiary, Senex Assets 2 Pty Ltd (ABN 50 008 942 827), is currently authorised to conduct petroleum exploration activities in accordance with its Environmental Authority (EA) (EA0002524) within Petroleum Leases (PL) 445 and 209. PL 209 and PL 445 are located 10 km southwest of Wandoan in Southern Queensland. Senex proposes to develop, operate, decommission, and rehabilitate new coal seam gas (CSG) wells and associated infrastructure on PL 445 and PL 209.

Senex are currently investigating the potential for a groundwater connection between shallow Quaternary Alluvium and underlying Upper Springbok Sandstone hydrostratigraphic units. Groundwater modelling performed by the Office of Groundwater Impact Assessments (OGIA) to simulate proposed Senex CSG activities indicate a potential drawdown of 0.9 m in the Upper Springbok Sandstone associated with proposed development (OGIA 2021). This potential drawdown was predicted in the vicinity of Woleebee Creek in areas of potential groundwater dependent ecosystems (GDEs). Predicted drawdown in the Upper Springbok Sandstone is greater than the Queensland *Water Act 2000* trigger threshold for springs and GDEs (0.2 m drawdown). Current understanding suggests that those potential GDEs are likely intermittently supported by groundwater in alluvium (which is not predicted to experience drawdown), however, hydraulic connection between alluvium and the Upper Springbok Sandstone was not fully understood and required further investigation.

This factual report provides a summary of the site investigation (SI) completed at the Project site. Geological and hydrogeological data collected as part of this SI were used to increase confidence in the hydrogeological conceptual model of the area.

1.1 Site Investigation Overview

Key objectives of the SI include:

- Drill, construct and develop six monitoring bores at three locations across the Project site.
- Collect groundwater samples from the installed monitoring bores for laboratory water quality analyses.
- Collect and record geological data from each bore to develop bore logs.
- Collect groundwater level and hydraulic conductivity data from each bore.

1.2 Drilling Rationale

Drilling rationale for each bore is provided in Table 1.1. Two bores were drilled at each selected location, one deep (D) and one shallow (S), to monitor separate hydrostratigraphic units.

Table 1.1 Drilling Rationale for each Monitoring Bore

Bore ID	Property	Drilled Depth (mbGL)	Groundwater Unit	Rationale
ATLAS-13M-D	Demvale	36.5	Westbourne Formation	Monitor GWL in Westbourne Formation
ATLAS-13M-S	Demvale	11.0	Quaternary Alluvium	Monitor GWL in Alluvium
ATLAS-14M-D	Peco's Valley	46.0	Springbok Sandstone	Monitor GWL in Upper Springbok Sandstone
ATLAS-14M-S	Peco's Valley	11.0	Quaternary Alluvium	Monitor GWL in Alluvium
ATLAS-15M-D	Lara	36.0	Weathered Rock	Monitor GWL in Weathered Rock
ATLAS-15M-S	Lara	11.4	Quaternary Alluvium	Monitor GWL in Alluvium

mbGL = metres below ground level
GWL = Groundwater level

2 HYDROGEOLOGICAL CONTEXT

2.1 Geology

Geology at the Project site is dominated by sedimentary rocks of the Surat Basin including the Gubberamunda Sandstone, Upper Springbok Sandstone, Westbourne Formation, and Quaternary Alluvium (Figure 2.1). Summary descriptions of these units are provided below.

- **Quaternary Alluvium** overlies the Westbourne Formation and comprises unconsolidated fluvial, flood wash, and lacustrine sediments deposited over land by creeks and flood events. Alluvium stratigraphy is locally variable and complex. Please see geological logs for further detail on lithology of the alluvium encountered during the SI (Appendix I).
- **Westbourne Formation** expected lithologies are "*Fluvial-lacustrine sediments: fine-grained sandstone interbedded with siltstone, claystone, minor coal*" (Geoscience Australia 2022). All expected lithologies described in literature were encountered during the SI. Geological logs provide additional lithological detail for this formation (Appendix I).
- **Gubberamunda Sandstone** underlies the Westbourne Formation at some locations. Expected lithologies in this unit are "*Medium- to coarse-grained, largely quartzose, poorly sorted sandstone with minor conglomerates and siltstones*" (Geoscience Australia 2022). Lithologies encountered during the SI at the Lara site (Atlas-15M) were consistent with either this or the Westbourne Formation, however, were too altered by weathering to make a confident determination.
- **Upper Springbok Sandstone** conformably underlies the Westbourne Formation. Expected lithologies in this unit are "*Clayey lithic sublabile to very lithic sandstone; calcareous in part; interbedded with carbonaceous mudstone and siltstone*" (Geoscience Australia 2022). Lithologies encountered during the SI were a series of interbedded siltstones, sandstones, and mudstones with minor coal. Geological logs provide additional lithological detail for this formation (Appendix I).

2.2 Groundwater

Hydrostratigraphic units targeted during the SI correspond to geological units described in Section 2.1. Encountered hydrostratigraphic units are summarised below.

- **Quaternary Alluvium** can represent productive aquifers where they occur due to high porosity and permeability relative to competent rock, however, complex stratigraphy and variable grain size may result in local anisotropy.
  - Alluvium encountered at ATLAS-13M comprised poorly sorted, clayey silt and sand and were dry across their full extent.
  - Alluvium encountered at ATLAS-14M comprised loose, well-sorted sand with a layer of cobbles at the base and were mostly dry with a moist layer at the base.
  - Alluvium encountered at ATLAS-15M comprised loose, well-sorted sand with a layer of cobbles at the base and were partially saturated.
- The **Weathered Rock** unit beneath alluvium at ATLAS-15M (Lara) comprised clay, claystone, mudstone, and siltstone. The rock was too altered by weathering to assign a

geological formation with any confidence. Current data indicate the unit may be either the Westbourne Formation or the Gubberamunda Sandstone. Observed lithologies would be consistent with either formation, therefore, the unit is referred to as the 'Weathered Rock unit beneath alluvium' throughout this report.

- The **Westbourne Formation** is recognised as a regional aquitard (Geoscience Australia 2022), however, minor sandstone and coal layers (with higher K) within the formation may result in local anisotropy. The upper sandstone, siltstone, and mudstone units encountered during the SI were dry, however, a minor coal layer (1 m thick) and weathered siltstone (immediately above the coal layer) produced minor groundwater yields (~0.1 L/s). Deeper siltstones also produced minor groundwater yields (<0.02 L/s).
- The **Upper Springbok Sandstone** is a regional aquifer and is a productive sandstone unit. This unit has interbedded 'lower K' layers such as siltstone and mudstone (Geoscience Australia 2022). Overall flow rates during drilling were extremely low (0.08 L/s from development), however, increased flow was observed when drilling through sandstone layers.

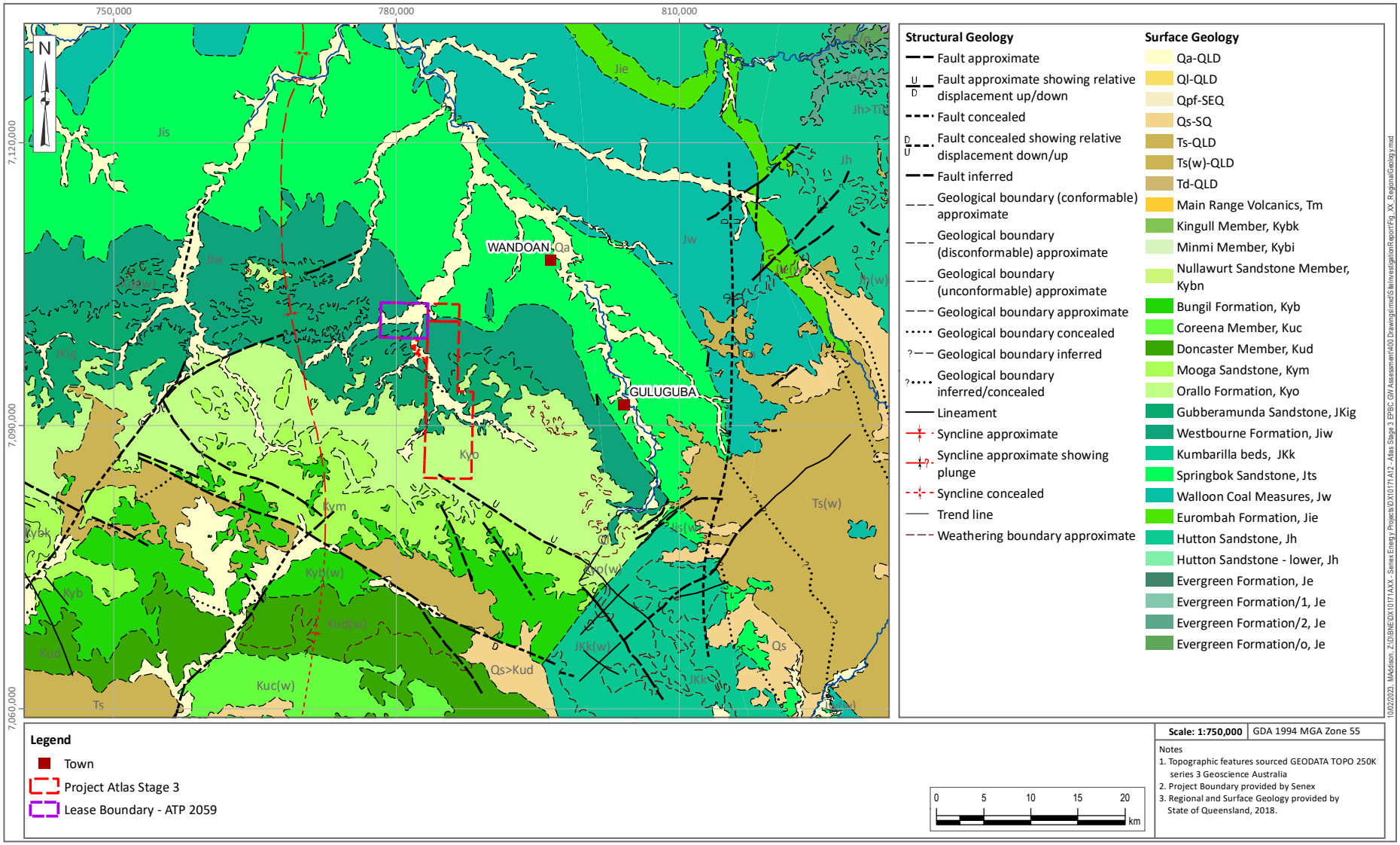

Figure 2.1 Regional Surface Geology

3 SITE INVESTIGATION

3.1 Drilling Program

3.1.1 Overview

A drilling and monitoring bore installation program was completed at the Project site between December 9, 2022, and January 25, 2023. Six bores were installed as part of a multi-phase SI.

Two bores (ATLAS-13M-D & ATLAS 13M-S) were drilled, constructed, and developed by Easternwell, supervised by Cameron Sharp of QLD Groundwater Solutions from December 9 to December 11, 2022.

The remaining four bores (ATLAS-14M-D, ATLAS-14M-S, ATLAS-15M-D, & ATLAS-15-S) were drilled, constructed, and developed by Numac Drilling Services, from January 17 to January 25, 2023.

Geological and hydrogeological data collection, observations, and analyses were performed by KCB hydrogeologist, Dr Marc Addison.

Final bore locations were surveyed by the client and are presented on Figure 3.1. A summary of installed monitoring bores is provided in Table 3.1. Final bore locations are presented on Figure 3.1.

Table 3.1 Bore location summary

Bore ID	GDA94 Zone 56		Stick-up (m)	TOC Elevation (mAHD)	Ground Surface Elevation (mAHD)	Hole Diameter (mm)
	Easting (mE)	Northing (mN)				
ATLAS-13M-D	782185	7101921	0.42	256.10	255.68	125
ATLAS-13M-S	782184	7101917	0.95	256.54	255.59	125
ATLAS-14M-D	783221	7102910	0.73	253.85	253.12	100
ATLAS-14M-S	783217	7102907	0.77	253.91	253.14	100
ATLAS-15M-D	783871	7096028	0.61	267.90	267.29	100
ATLAS-15M-S	783869	7096012	0.58	267.98	267.40	100

Elevations and locations surveyed post-construction by Senex.
'mAHD' = metres above Australian Height Datum.
'TOC' = top of casing.

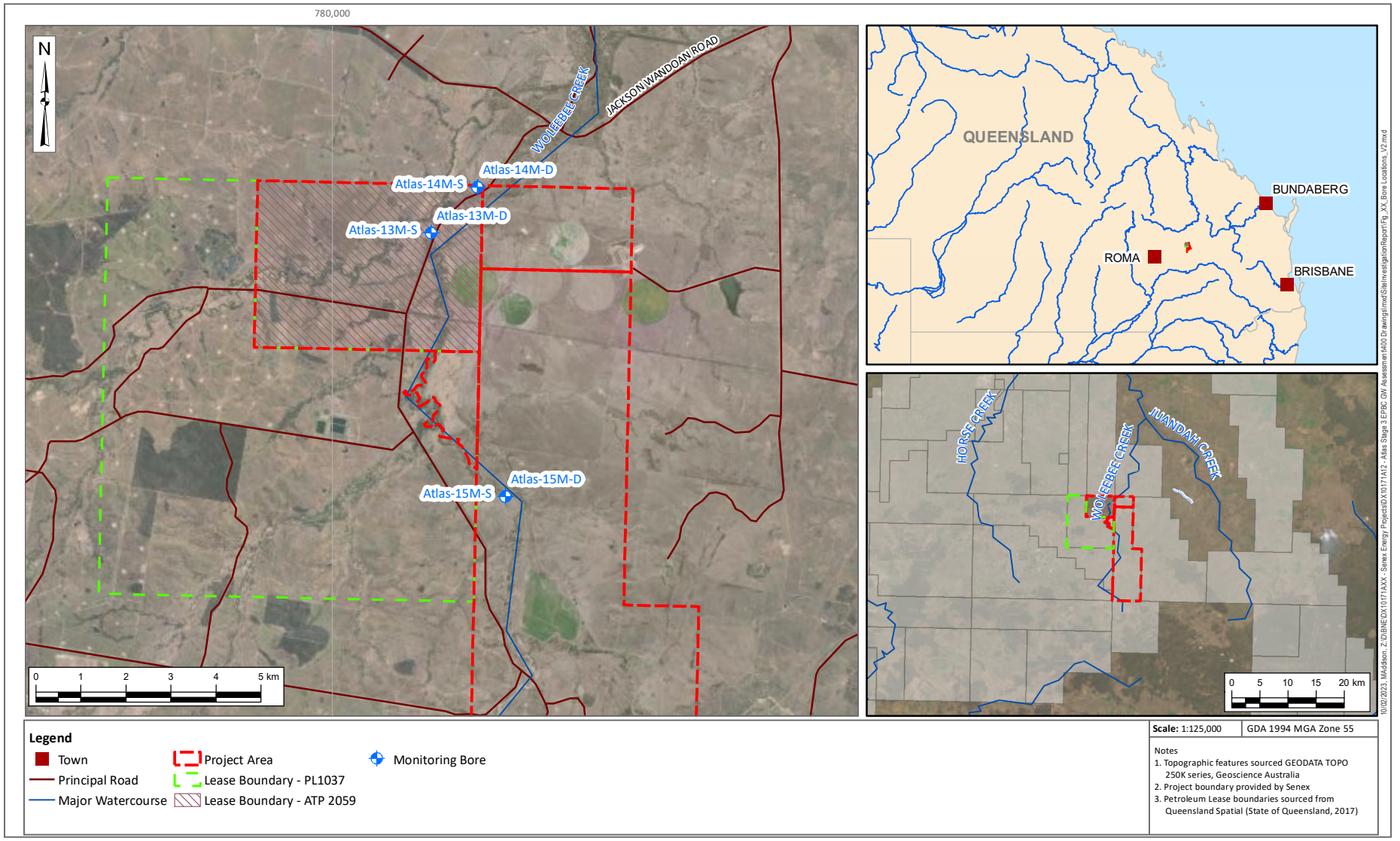

Figure 3.1 Installed Monitoring Bore Locations

3.1.2 Drilling and Sampling

Drilling was completed using conventional air rotary circulation techniques with drill cuttings (chips) transported to the surface via air circulation. Final drill hole depth was determined by the on-site KCB hydrogeologist and was based on drilling observations and the target hydrostratigraphic unit.

Drill cuttings were collected, and lithology logged at 1 m intervals. Hydrogeological observations during drilling included changes to drilling penetration (resistance), water / air return, moisture / water presence, airlifted groundwater flow rates, water quality, and weathering characteristics. Geological logs are provided in Appendix I, photographs of drill cuttings are provided in Appendix II.

ATLAS-13M

Bores at this location were drilled using an Edson 3000WB drill rig equipped with a 125 mm diameter Polycrystalline Diamond (PCD) drill bit. Both shallow and deeper bores were drilled using air rotary, however, water was injected in the deeper hole from 28-31 metres below ground level (mbGL) to aid drilling through resistant rock.

ATLAS-14M

Bores at this location were drilled using a Boart DB520 drill rig equipped with a 100 mm diameter PCD drill bit. 'Advanced' surface casing was used in both holes due to unstable ground (loose sand) beneath residual soil. Subsequently a 100 mm diameter PCD drill bit was used in place of a 125 mm drill bit to permit drilling through the advanced casing. A 125 mm drill bit was used initially to drill to the depth of the advanced casing base.

The first hole drilled (intended for the deeper bore) was abandoned because of a thick layer of cobbles at the base of alluvium which prevented drilling progression. This bore was relocated 32 m northeast and re-drilled.

For the deep bore, the drillers proposed (and executed) a plan to use advanced surface casing to retain hole wall integrity through dry soft sediment in the upper parts of the hole (alluvium), then use the PCD bit to drill below the base of alluvium into the Springbok Sandstone.

For the shallow bore, extended surface casing and an auger drill bit were successfully used to drill the full depth of the hole.

ATLAS-15M

Bores at this location were drilled using a Boart DB520 drill rig equipped with a 100 mm diameter PCD drill bit. Advanced surface casing was used in both holes due to unstable ground (loose sand) beneath residual soil, subsequently a 100 mm diameter PCD drill bit was used in place of a 125 mm drill bit to permit drilling through the advanced casing. A 125 mm drill bit was used initially to drill to the depth of the advanced casing base.

The first hole drilled (intended for the deeper bore) was abandoned because of hole wall collapse.

The second hole was designated the shallow bore when the advanced casing could not be progressed deeper than 11.4 m.

For the deep bore, drillers proposed (and executed) a plan to use advanced surface casing to retain hole wall integrity in the deeper bore through wet soft sediment in the upper parts of the hole, then use polymer to drill past 11.4 m (as encountered in the shallow bore), allowing the advanced surface casing to progress deeper in the hole. It was agreed between Numac, Senex, and KCB that this method was acceptable to 21 m, after which air rotary PCD should be used to reduce contamination risk and allow the return of representative samples.

The above method removed the ability to detect a discrete water level in the Weathered Rock unit beneath alluvium to 21 m, however, air rotary was used below 21 m produced drill cuttings at 1 m intervals (free from polymer/injected water contamination) allowing water to be detected in the deeper formation.

3.1.3 Bore Construction

Bores were constructed under the supervision of a Class II licensed water bore driller and in accordance with the '*Minimum Construction Requirements for Water Bores in Australia*' (NUDLC 2020).

Monitoring bores were constructed using 50 mm uPVC, Class 18 threaded casing with 0.5 mm aperture machine slotted uPVC screens. Screen length and zone selection were determined by the on-site KCB hydrogeologist, based on primary water-bearing zones encountered in the target hydrostratigraphic unit.

An end cap was installed on the casing at the base of each monitoring bore. A 3 mm sand filter pack was installed within the annular space adjacent to the screen, from the base of the screen to at least 1 m above the top of the screen. A 1-3 m thick bentonite seal was installed above the filter pack and in some cases below where drilling extended below target screen depth. The remaining annular space was grouted to the surface using a 25% bentonite-cement grout mix.

All bores were completed with a surface concrete plinth and a lockable, protective galvanised steel monument which was painted yellow. Steel lockable fences were installed around each bore.

A bore installation summary is provided in Table 3.2. Detailed construction schematics for each bore are included in borehole logs (Appendix I).

Table 3.2 Monitoring bore installation summary

Bore ID	Drilled Depth (mbGL)	Water Strike (mbGL)	Screened Interval (mbGL)	Screened Unit
ATLAS-13M-D	36.5	21.0	30.5 – 36.5	Westbourne Formation
ATLAS-13M-S	11.0	^	6.0 – 9.0	Alluvium
ATLAS-14M-D	46.0	38.5	40.0 – 46.0	Springbok Sandstone
ATLAS-14M-S	11.0	7.0	7.0 – 10.0	Alluvium
ATLAS-15M-D	36.0	27.0	29.0 – 35.0	Weathered Rock beneath alluvium**
ATLAS-15M-S	11.4	4.0	8.4 – 11.4	Alluvium

mbGL = metres below ground level.
*** Gubberamunda Sandstone or Westbourne Formation*
^ No water strike encountered

Additional construction detail for each bore is provided below.

ATLAS-13M

ATLAS-13M-D was drilled to investigate groundwater level in the Westbourne Formation and was constructed with a 6 m screen positioned where the main groundwater zone was encountered within that unit (30.5-36.5 mbGL). Minor perched groundwater was encountered above the main water strike at 19 mbGL. A 9 m sand filter pack was installed from the base of screen to 3 m above the top of screen (27.5-36.5 mbGL), and a 2 m bentonite seal installed above the filter pack. The bore was then backfilled (using drill cuttings) to 3 mbGL and grouted to surface using a bentonite/cement mixture (Appendix I).

ATLAS-13M-S was drilled to investigate groundwater level in the Quaternary Alluvium and was constructed with a 3 m screen at the base of that unit (6-9 mbGL). A 2 m bentonite plug was installed below the screen to isolate the base of alluvium from the Westbourne. A 4 m sand filter pack was installed from the base of screen to 1 m above the top of screen (5-9 mbGL). A 1 m bentonite seal was installed above the filter pack then the bore was grouted to surface using a bentonite/cement mixture (Appendix I).

ATLAS-14M

ATLAS-14M-D was drilled to investigate groundwater level in the Springbok Sandstone and was constructed with a 6 m screen positioned where the main groundwater zone was encountered within that unit (40-46 mbGL). Minor perched groundwater was encountered above the main water strike at 26 and 30 mbGL respectively, both within minor coal seams with dry rock immediately above and below. The main water strike was encountered at 38.5 mbGL beneath a confining clay layer: penetration of this confining layer released gas and pressurised groundwater which dissipated/settled overnight. The bore is not artesian as groundwater level settled at 14 mbGL. A 7 m sand filter pack was installed from the base of screen to 1 m above the top of screen (39-46 mbGL), and a 2 m bentonite seal installed above the filter pack. The bore was then backfilled (using drill cuttings) to 3 mbGL and grouted to surface using a bentonite/cement mixture (Appendix I).

ATLAS-14M-S was drilled to investigate groundwater level in the Quaternary Alluvium and was constructed with a 3 m screen at the base of that unit (7-10 mbGL). A 1 m bentonite plug was installed below the screen to isolate the base of alluvium from the underlying unit. A 4 m sand filter pack was installed from the base of screen to 1 m above the top of screen (6-10 mbGL). A 1 m bentonite seal was installed above the filter pack. The bore annulus was backfilled by allowing walls to collapse into the bore once the advanced casing was removed, which backfilled the bore to 3 mbGL. The remaining bore annulus was grouted to surface using a bentonite/cement mixture (Appendix I).

ATLAS-15M

ATLAS-15M-D was drilled to investigate groundwater level in the Weathered Rock unit beneath alluvium and was constructed with a 6 m screen where groundwater was encountered within that unit (29-35 mbGL). A 7 m sand filter pack was installed from the base of screen to 1 m above the top of screen (28-35 mbGL), and a 1 m bentonite seal installed above the filter pack. The bore annulus was backfilled by allowing walls to collapse into the bore once the advanced casing was

removed, which backfilled the bore to 3 mbGL. The remaining bore annulus was grouted to surface using a bentonite/cement mixture (Appendix I).

ATLAS-15M-S was drilled to investigate groundwater level in the Quaternary Alluvium and was constructed with a 3 m screen at the base of that unit (9-12 mbGL). A 1 m bentonite plug was installed below the screen to isolate the base of alluvium from the underlying unit. A 4 m sand filter pack was installed from the base of screen to 1 m above the top of screen (8-12 mbGL). A 1 m bentonite seal was installed above the filter pack. The bore annulus was then backfilled by allowing walls to collapse into the bore once the advanced casing was removed, which backfilled the bore to 3 mbGL. The remaining bore annulus was grouted to surface using a bentonite/cement mixture (Appendix I).

3.2 Airlift Development

Monitoring bores were developed using the airlift method. This approach involved delivery of compressed air into the screened interval of each bore using a HDPE hose which resulted in air/water being circulated to the surface and directed (and collected) away from the bore.

In-situ field physico-chemical parameters (pH, EC, temperature) of airlifted groundwater were recorded during bore development using a YSI Pro DSS handheld water quality meter. The water quality meter was calibrated every day to maintain accurate measurements. Development was determined to be complete once field physico-chemical parameter values had stabilised over at least three ten-minute intervals, and groundwater was sufficiently clear of fine/silt content (based on visual estimates). Bores were developed for a maximum of 90 minutes for low yield bores unless flow was too low to develop further.

A summary of final airlift yields and physico-chemical values from each bore is provided in Table 3.3. Full development records are provided in Appendix III.

Table 3.3 Monitoring bore airlift development data summary

Bore ID	Airlift Yield (L/s)	Physico-Chemical Parameters (Field)		
		pH	EC (µS/cm)	Temperature (°C)
ATLAS-13M-D	0.020	8.5	12,273	25.6
ATLAS-13M-S	No Data – Dry Bore			
ATLAS-14M-D	0.008	8.7	9,070	22.7
ATLAS-14M-S	No Data – Dry Bore			
ATLAS-15M-D	0.040	8.2	9,580	22.3
ATLAS-15M-S	0.020	8.0	13,900	23.6

µS/cm = Micro siemens per centimetre.
L/s = Litres per second.
°C = Degrees Celsius.

ALTAS-13M

ATLAS-13M-D was developed for 72 minutes; however, extremely low flow halted development prematurely. Air circulation was switched off after 43 minutes (for 20 minutes) to allow groundwater to recover (thus, to continue development), however, development was halted at 72 minutes due to extremely low groundwater flow from the bore and low fuel in the generator. It was not possible to collect a sample for laboratory analysis following development due to a lack of

groundwater in the bore, so the bore was sampled on February 4, 2023, following groundwater recovery.

ATLAS-13M-S was dry, therefore airlift development and groundwater sampling were not possible.

ATLAS-14M

ATLAS-14M-D was developed for 84 minutes, however, extremely low flow prevented full development. Air circulation was switched off after 35 minutes (for 15 minutes) to allow groundwater to recover (thus, to continue development). Samples were collected for laboratory analysis.

ATLAS-14M-S was dry, therefore airlift development and groundwater sampling were not possible.

ATLAS-15M

ATLAS-15M-D was developed for 59 minutes. Physico-chemical parameters stabilised relatively quickly (11 minutes); however, it took longer for water to clear in this bore. Once groundwater was mostly clear of silt and fines, samples were collected for laboratory analysis.

ATLAS-15M-S was developed for 28 minutes. Unexpected low flow was observed so air pressure was decreased to allow samples to be collected. Physico-chemical parameters stabilised relatively quickly, and once water became mostly clear, samples were collected for laboratory analysis.

3.3 Groundwater Chemistry

Groundwater samples were collected from monitoring bores following completion of airlift development in accordance with industry-accepted water sampling practice (AS/NZS 5667.11 2018).

The sample from Atlas-13M-D was collected separately due to low flow conditions in the bore during development which prevented sample collection. The bore was revisited on February 4, 2023, purged of three bore volumes using a bailer, and a sample collected for laboratory analysis.

Groundwater samples were dispatched under chain of custody protocol to a NATA accredited laboratory (ALS) for chemical analysis. Key laboratory groundwater quality data are summarised in Table 3.4, full laboratory reports/certificates of analyses are provided in Appendix IV.

Table 3.4 Groundwater quality data summary – key analytes (laboratory)

Bore ID	TDS	Total Alkalinity ($CaCO_3$)	Na	Ca	K	Mg	Cl	SO_4	F
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ATLAS-13M-D	5,470	263	1,670	34	6	5	2,780	2	0.9
ATLAS-13M-S	No Data – Dry Bore								
ATLAS-14M-D	6,240	232	1,890	28	10	4	3,220	6	1.4
ATLAS-14M-S	No Data – Dry Bore								
ATLAS-15M-D	6,150	122	1,890	74	6	5	3,420	27	0.6
ATLAS-15M-S	9,230	338	2,410	484	20	128	4,920	774	0.3

mg/L = Milligrams per litre.

3.4 Groundwater Levels

Groundwater level data were collected from monitoring bores approximately one day after development to allow groundwater level recovery in the bores. Depth to groundwater was measured from the top of casing (or stick-up), and the stick-up height was measured. Values were then converted to groundwater elevations (mAHD) later.

Shallow bores which were dry following installation (Atlas-13M-S and Atlas-14M-S) were revisited on February 4, 2023, to monitor groundwater levels. Both bores were dry during the revisit.

A Solinst Pressure Transducer Data Logger (PTDL) (3001 Levelogger 5, M30) was installed in each monitoring bore to record groundwater level at 12-hour intervals. Each PTDL was suspended within the bore using steel cable attached to the bore casing. The general location of the PTDLs within each bore was at the top of screened intervals for bores with groundwater and the bottom of screened intervals for dry bores.

A Solinst barologger (3001 Barologger 5) was installed within the surface casing of Atlas-13M-S to record barometric pressure at 12-hour intervals. Barologger data are used to correct levelogger data values for barometric pressure.

Recorded groundwater level data are summarised in Table 3.5.

Table 3.5 Groundwater level data summary

Bore ID	Water Strike (mbGL)	SWL (mbTOC)	SWL (mbGL)	GW Elevation (mAHD)
ATLAS-13M-D	19.0	10.7	10.3	245.4
ATLAS-13M-S	No data – dry Bore			
ATLAS-14M-D	38.5	14.6	14.0	239.1
ATLAS-14M-S	7.0 (moist)	No data – dry Bore		
ATLAS-15M-D	27.0	7.0	6.6	260.7
ATLAS-15M-S	4.0	4.8	4.2	263.2

mAHD = Metres above Australian height datum.
mbGL = Metres below ground level.
SWL = Static water level.
TOC = Top of casing.
GW = Groundwater.

3.5 Hydraulic Tests

Hydraulic tests (slug tests) were completed at each bore following airlift development and recovery of groundwater level to pre-development conditions. Slug tests were designed to displace the water level inside a bore, resulting in groundwater level recovery to pre-test conditions, which is measured and analysed to estimate hydraulic conductivity for the screened hydrostratigraphic unit adjacent to the bore.

A summary of the slug test methodology is provided below:

- Static Water Level (SWL) was recorded by measuring water level in mbTOC using a manual dipper, minus casing height (stick-up) to obtain the SWL in mbGL.

- A PTDL set to record water level at 1 s intervals, was installed in the bore to monitor changing groundwater level during the slug test. The PTDL was lowered to at least twice the length of the slug (to prevent interference).
- A calibrated Waterra three-part slug with a combined length of 1.93 m designed to displace 1 m of water inside the bore was placed into the bore suspended by a tagline. The PTDL recorded falling water levels following initial displacement (caused by the slug) as groundwater in the bore equalised to pre-test conditions. This process is known as a Falling Head Test (FHT). The rate of groundwater recovery is controlled by the hydraulic conductivity of the screened hydrostratigraphic unit.
- The slug was then quickly removed from the bore to create an instantaneous drop in water level inside the bore. The PTDL recorded rising water level in the bore as groundwater in the bore recovered to pre-test conditions. This is known as a Rising Head Test (RHT).
- Regular, manual groundwater level measurements were recorded until water levels either returned to pre-test conditions, or to within 5% of initial displacement.
- The PTDL was removed from the bore following groundwater recovery after the RHT. Data from the PTDL were downloaded for analysis.
- Raw data from each test were plotted as pressure head versus time and converted to deviation from static head (or displacement head) versus time.
- Hydraulic conductivity values were calculated using AQTESOLV v. 4.5 software (HydroSOLVE Inc 2007). Analytical solutions were selected based on hydrogeological conditions and aquifer response (Butler 1998).

Hydraulic conductivity estimates from all bores are summarised in Table 3.6. Individual analyses from each test are provided in Appendix V. Hydraulic conductivity estimates should be reviewed in conjunction with lithological descriptions provided in geological logs (Appendix I).

Table 3.6 Monitoring bore hydraulic conductivity estimates, analysis methods, and general notes

Bore ID	Formation	Aquifer Model	Test Type	Hydraulic Conductivity (m/day)	Solution Method	Notes
ATLAS-13M-D	Westbourne Formation	Confined	FHT	0.002	KGS	KGS Model (1994) is the appropriate solution for a slug test in a confined aquifer with partial penetration (Hyder et al. 1994).
		Confined	RHT	0.001	KGS	KGS Model (1994) is the appropriate solution for a slug test in a confined aquifer with partial penetration (Hyder et al. 1994).
ATLAS-13M-S	Alluvium					
ATLAS-14M-D	Springbok Sandstone	Confined	FHT	0.002	Hvorslev	Hvorslev (1951) is the appropriate solution for a slug test in a confined aquifer with partial penetration (Hvorslev 1951). A straight-line solution was selected due to a better curve fit.
		Confined	RHT	0.002	Hvorslev	Hvorslev (1951) is the appropriate solution for a slug test in a confined aquifer with partial penetration (Hvorslev 1951). A straight-line solution was selected due to a better curve fit. The screened Springbok zone was highly interbedded with siltstones and mudstones which resulted in an overall anomalous low K for the screened interval.
ATLAS-14M-S	Alluvium					
ATLAS-15M-D	Weathered Rock beneath alluvium	Confined	FHT	0.03	KGS	KGS Model (1994) is the appropriate solution for a slug test in a confined aquifer with partial penetration (Hyder et al. 1994).
		Confined	RHT	0.05	KGS	KGS Model (1994) is the appropriate solution for a slug test in a confined aquifer with partial penetration (Hyder et al. 1994).
ATLAS-15M-S	Alluvium	Unconfined	FHT	0.16	KGS	KGS Model (1994) is the appropriate solution for a slug test in an unconfined aquifer with partial penetration (Hyder et al. 1994).
		Unconfined	RHT	0.12	KGS	KGS Model (1994) is the appropriate solution for a slug test in an unconfined aquifer with partial penetration (Hyder et al. 1994).

FHT = Falling Head Test.
RHT = Rising Head Test.
m/sec = Metres per second.
m/day = Metres per day.

4 CLOSING

We would like to thank Senex Energy Pty Ltd for the opportunity to work on this assignment. Please do not hesitate to contact the undersigned should you have any questions.

KCB AUSTRALIA PTY LTD.

Marc Addison, Ph.D.
Hydrogeologist

Carly Waterhouse, MSc, RPGeo
Senior Hydrogeologist, Project Manager

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APPENDIX I

Geological Logs and Bore Construction Details

Klohn Crippen Berger

Borehole No.	**ATLAS-13M-D**
Page	**1 of 1**
Project No.	**DX10171A12**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started:	**09/12/22**
Date Completed:	**10/12/22**
Logged by:	**M. Addison**
Checked by:	**C. Strachotta**

Contractor:	**Easternwell**	Northing:	**7101921N**	Hole Depth (mbgl):	**36.5**
Hole Location:	**Demvale 1RP123884**	Easting:	**782185E**	Stick Up (m):	**0.42**
Hole Diameter (mm):	**125**	Elevation (m):	**255.68 m**	Static Water Level (mbgl):	**10.3**
Rig Details:	**Edson 3000WB**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drlling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
255	0	0.50 m 255.18 mRL RESIDUAL SOIL: Organic CLAY (OL): non plastic, Grey.				
254	1	RESIDUAL SOIL: CLAY (CL-CI): grey, firm becoming stiff medium dense to dense dry moderately cemented.				
253	2	2.00 m 253.68 mRL ALLUVIUM: Silty Siliceous CLAY (CL): low plasticity, pale brown, friable loose to medium dense dry weakly cemented.				
252	3					
251	4					
250	5					Grouted to surface (bentonite/cement mixture). Lockable monument installed.
249	6	6.00 m 249.68 mRL ALLUVIUM: Silty Siliceous SAND (SM): fine and medium grained, 0.5 mm maximum particle size, poorly graded, sub-rounded and sub-angular, pale brown and pale orange, friable very loose dry uncemented; sub-angular.				
248	7					
247	8					
246	9	9.00 m 246.68 mRL SILTSTONE: fine grained, pale orange, dry.		▼		
245	10					
244	11	11.00 m 244.68 mRL SILTSTONE: fine grained, pale grey, dry.				
243	12	12.00 m 243.68 mRL SANDSTONE: fine grained, off white to pale grey, dry.				
242	13					
241	14					
240	15					Backfilled using drill cuttings. uPVC blank casing 50 mm.
239	16					
238	17					
237	18	19.00 m 236.68 mRL SILTSTONE: fine grained, dark grey, wet.				
236	19					
235	20		▶			
234	21					
233	22	22.00 m 233.68 mRL COAL: Black, wet.				
232	23	23.00 m 232.68 mRL Silty MUDSTONE: fine grained, black, dry.				
231	24					
230	25					Bentonite seal
229	26					
228	27					
227	28					
226	29					
225	30					3 mm sand filter pack
224	31		▶			
223	32					6 m uPVC 50 mm slotted screen, 0.5 mm aperture
222	33					
221	34					
220	35					
219	36	36.50 m 219.18 mRL ATLAS-13M-D terminated at 36.50 m.				

Notes

Well-sorted, fine-grained sandstone encountered beneath alluvium, bounded above and below by siltstones. Perched groundwater encountered at 20-23 m, dry thereafter. Polycrystalline Diamond (PCD) drill bit pulverised rock making logging difficult. 6 m screen installed in Westbourne.

Klohn Crippen Berger

Borehole No.	**ATLAS-13M-S**
Page	**1 of 1**
Project No.	**DX10171A12**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started:	**10/12/22**
Date Completed:	**10/12/22**
Logged by:	**M Addison**
Checked by:	**C. Strachotta**

Contractor:	**Easternwell**	Northing:	**7101917N**	Hole Depth (mbgl):	**11.0**
Hole Location:	**Demvale 1RP123884**	Easting:	**782184E**	Stick Up (m):	**0.95**
Hole Diameter (mm):	**125**	Elevation (m):	**255.59 m**	Static Water Level (mbgl):	**Dry**
Rig Details:	**Edson 3000WB**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drlling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
255	0	RESIDUAL SOIL: SILT (OL): non plastic, brown, soft loose dry uncemented.				
	1.00 m 254.59 mRL					
	1	RESIDUAL SOIL: Clayey CLAY (CL-CI): low to medium plasticity, dark grey, firm becoming friable dense moist weakly cemented.				
254	2.00 m 253.59 mRL					
	2	ALLUVIUM: Clayey Siliceous CLAY (CL): low to medium plasticity, pale orange, firm becoming friable loose becoming medium dense dry very weakly cemented.				
253	3.00 m 252.59 mRL					
	3	ALLUVIUM: Silty Siliceous SILT (CL): low plasticity, brown, friable becoming soft loose dry very weakly cemented.				
252	4					
251	5.00 m 250.59 mRL					
	5	ALLUVIUM: Siliceous SAND (SM): fine and medium grained, 0.4 mm maximum particle size, poorly graded, sub-rounded, brown and pale orange, hard and soft loose becoming very loose dry uncemented.				
250	6					
249	7					
248	8					
247	9.00 m 246.59 mRL					
	9	SILTSTONE: fine grained, dark red, dry.				
246	10.00 m 245.59 mRL					
	10	SILTSTONE: fine grained, pale grey.				
245	11.00 m 244.59 mRL					
	11	ATLAS-13M-S terminated at 11.00 m.				
244						

Grouted to surface (bentonite/cement mixture). Lockable monument installed.

uPVC blank casing 50 mm.

Bentonite seal

3 mm sand filter pack installed (4 m)

3 m uPVC 50 mm slotted screen, 0.5 mm aperture

Bentonite plug installed below screen to isolate alluvium base

Notes

Base of alluvium encountered at 9 m. Alluvium dry to full depth. 3 m screen installed (6-9 m) in alluvium.

Klohn Crippen Berger

Borehole No. **ATLAS-14M-D**

Page **1 of 1**

Project No. **DX10171A12**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started: **23/01/23**

Date Completed: **24/01/23**

Logged by: **M Addison**

Checked by: **C. Strachotta**

Contractor:	**Numac**	Northing:	**7102910N**	Hole Depth (mbgl):	**46.0**
Hole Location:	**Peco's Valley 10FT949**	Easting:	**783221E**	Stick Up (m):	**0.73**
Hole Diameter (mm):	**100**	Elevation (m):	**253.12 m**	Static Water Level (mbgl):	**13.98**
Rig Details:	**Boart DB520**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drlling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Graphic Log	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
252	1		1.00 m 252.12 mRL RESIDUAL SOIL: Organic CLAY (OL), non plastic, dark brown.				
251	2		ALLUVIUM: Moderately-sorted, fine - medium-grained sand. Light brown, dry.				Grouted to surface (bentonite/cement mixture). Lockable monument installed.
250	3						
249	4						
248	5						
247	6						
246	7		7.00 m 246.12 mRL ALLUVIUM: Poorly-sorted, fine - medium-grained sand with medium gravel and some large rounded cobbles (10%), light brown, dry 7-9 m, moist 9-10 m.				
245	8						
244	9						
243	10		10.00 m 243.12 mRL Sandy CLAY (CL): low plasticity, stiff to friable, pale brown, dry, cemented				
242	11						
241	12						
240	13		13.00 m 240.12 mRL SANDSTONE: medium-grained, off white to pale grey, dry, extremely weathered.		▼		
239	14						
238	15		15.00 m 238.12 mRL SILTSTONE: pale grey, dry, weak, extremely weathered.				
237	16						
236	17						
235	18		18.00 m 235.12 mRL MUDSTONE: grey, dry, weak, extremely weathered.				
234	19		19.00 m 234.12 mRL SILTSTONE & SANDSTONE: Interbedded, pale grey and dark grey, clayey, weak, dry, sandstone fine to medium-grained, extremely weathered.				Backfilled using drill cuttings. uPVC blank casing 50 mm.
233	20						
232	21						
231	22						
230	23						
229	24						
228	25						
227	26		26.00 m 227.12 mRL COAL: Black, weak, wet, highly weathered.	▶			
226	27		27.00 m 226.12 mRL SILTSTONE: pale grey, dry, weak, extremely weathered.				
225	28						
224	29		30.00 m 223.12 mRL				
223	30		COAL: Black, weak, wet, highly weathered.	▶			
222	31		31.00 m 222.12 mRL SILTSTONE & SANDSTONE: Interbedded, pale grey and dark grey, clayey, weak, dry, sandstone fine to medium-grained, extremely weathered.				
221	32						
220	33						
219	34						
218	35						
217	36						
216	37		37.00 m 216.12 mRL MUDSTONE: grey, dry, weak, highly weathered.				
215	38		38.00 m 215.12 mRL 38.50 m 214.62 mRL CLAY: Low plasticity, dark grey/black, firm to stiff, wet.	▶			Bentonite seal
214	39		39.00 m 214.12 mRL MUDSTONE: grey, wet, weak, highly weathered. [Gas and pressurised groundwater encountered beneath confining clay layer].				
213	40		SANDSTONE & MUDSTONE: interbedded, sandstone fine to medium-grained, pale grey and dark grey, wet, highly weathered.				
212	41						
211	42						
210	43						3 mm sand filter pack 6 m uPVC 50 mm slotted screen, 0.5 mm aperture
209	44						
208	45						
207	46		46.00 m 207.12 mRL ATLAS-14M-D terminated at 46.00 m.				

Notes

Advanced casing used to retain hole wall integrity to 12 m, PCD then used to end of hole at 46 m. Gas bubbles and pressurised groundwater encountered beneath confining clay layer at 38.5 m; gas bubbles dissipated overnight, groundwater level settled at 13.98 mbGL. Perched groundwater in minor coal seams at 26-27 m; and 30-31 m.

Klohn Crippen Berger

Borehole No.	**ATLAS-14M-S**
Page	**1 of 1**
Project No.	**DX10171A12**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started:	**24/01/23**
Date Completed:	**24/01/23**
Logged by:	**M Addison**
Checked by:	**C. Strachotta**

Contractor:	**Numac**	Northing:	**7102907N**	Hole Depth (mbgl):	**11.0**
Hole Location:	**Peco's Valley 10FT949**	Easting:	**783217E**	Stick Up (m):	**0.77**
Hole Diameter (mm):	**100**	Elevation (m):	**253.14 m**	Static Water Level (mbgl):	**Dry**
Rig Details:	**Boart DB520**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drlling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Graphic Log	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
253	0		RESIDUAL SOIL: Organic CLAY (OL), non plastic, dark brown.				
252	1						Grouted to surface (bentonite/cement mixture). Lockable monument installed.
	2		2.00 m 251.14 mRL				
251			ALLUVIUM: Moderately-sorted, fine - medium-grained sand. Light brown, dry.				
250	3						uPVC blank casing 50 mm.
249	4						Backfilled using drill cuttings.
248	5						Bentonite seal
247	6						
	7		7.00 m 246.14 mRL				
246			ALLUVIUM: Poorly-sorted, fine - medium-grained sand with medium gravel and some large rounded cobbles (10%), light brown, dry 7-9 m, moist 9-10 m.	▶			
245	8						3 mm sand filter pack
244	9						3 m uPVC 50 mm slotted screen, 0.5 mm aperture
	10		10.00 m 243.14 mRL				
243			Sandy CLAY (CL): low plasticity, stiff to friable, pale brown, dry, cemented				Bentonite plug
	11		11.00 m 242.14 mRL				
242			ATLAS-14M-S terminated at 11.00 m.				

Notes

Auger used to full depth, moist sand encountered at 7-10 m (base of alluvium).

Klohn Crippen Berger

Borehole No.	**ATLAS-15M-D**
Page	**1 of 1**
Project No.	**DX10171A12**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started:	**19/01/23**
Date Completed:	**20/01/23**
Logged by:	**M Addison**
Checked by:	**C. Strachotta**

Contractor:	**Numac**	Northing:	**7096028N**	Hole Depth (mbgl):	**36.0**
Hole Location:	**Lara 222RP868424**	Easting:	**783871E**	Stick Up (m):	**0.61**
Hole Diameter (mm):	**100**	Elevation (m):	**267.29 m**	Static Water Level (mbgl):	**6.56**
Rig Details:	**Boart DB520**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drilling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
267	0					
266	1	RESIDUAL SOIL: Organic CLAY (OL), non plastic, dark brown.				
		2.00 m 265.29 mRL				Grouted to surface (bentonite/cement mixture). Lockable monument installed.
265	2	ALLUVIUM: Well-sorted, well-rounded, fine - medium-grained sand. Light brown, moist (wet below 9m). 20% fines (clay/silt) content below 10 m.				
264	3					
263	4					
262	5					
261	6			▼		
260	7					
259	8					
258	9		►			
257	10					
256	11					
255	12					
		13.00 m 254.29 mRL				
254	13	MUDSTONE & SILTSTONE: Extremely weathered, interbedded, clayey (clay content decreasing downward), moisture content unknown (ingress from alluvium), grey to pale grey, weak.				
253	14					
252	15					uPVC blank casing 50 mm. Backfilled using drill cuttings (bore walls collapsed onto casing once advanced casing was removed).
251	16					
250	17					
249	18					
248	19					
247	20					
246	21					
		22.00 m 245.29 mRL				
245	22	CLAYSTONE: Extremely weathered, dry, light grey to grey, pulverised to dust with PCD drill bit, slowed rotation to return chips of weak claystone				
244	23					
243	24					
242	25					
241	26					
		27.00 m 240.29 mRL				
240	27	SILTSTONE: Highly weathered, wet, dark grey at the top to light grey at the base, weak.	►			Bentonite seal
239	28					
238	29					
237	30					
236	31					3 mm sand filter pack installed (4 m) 6 m uPVC 50 mm slotted screen, 0.5 mm aperture
		32.00 m 235.29 mRL				
235	32	CLAYSTONE: Highly weathered, dry, dark grey/black, weak.				
		33.00 m 234.29 mRL				
234	33	SILTSTONE: Highly weathered, wet, grey, weak.				
233	34					
		35.00 m 232.29 mRL				
232	35	CLAY: Low plasticity, dark grey/black, firm to stiff, moist, cemented.				Bentonite seal
		36.00 m 231.29 mRL				
231	36	ATLAS-15M-D terminated at 36.00 m.				

Notes

Bore was drilled using air rotary to 21 m, then advanced casing reamed to 21 m to retain hole wall integrity, then air rotary continued past 21 m to end of hole at 36 m.

Klohn Crippen Berger

Borehole No.	**ATLAS-15M-S**
Page	**1 of 1**
Project No.	**DX10171A12**

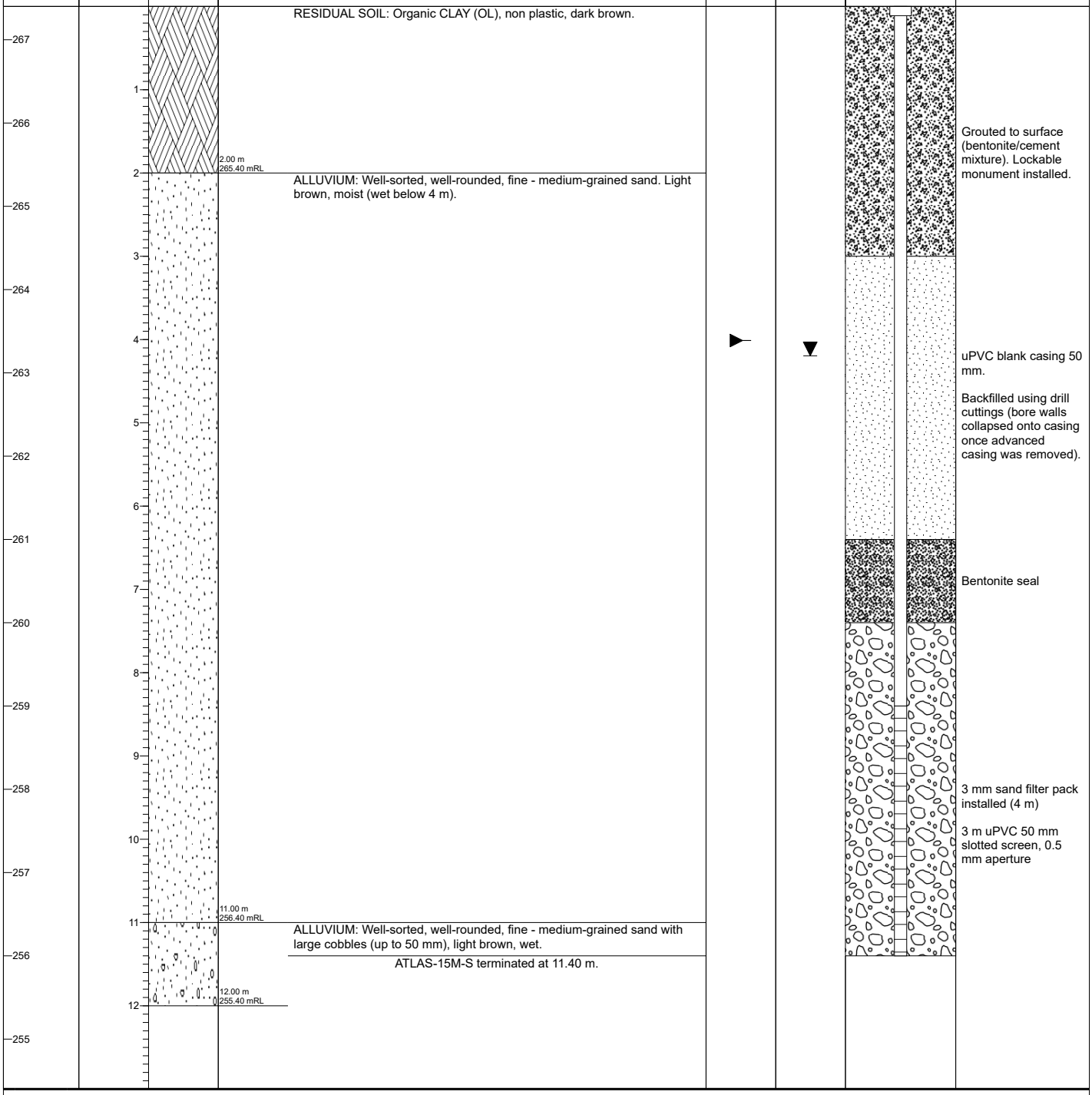
Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started:	**17/01/23**
Date Completed:	**19/01/23**
Logged by:	**M Addison**
Checked by:	**C. Strachotta**

Contractor:	**Numac**	Northing:	**7096012N**	Hole Depth (mbgl):	**11.4**
Hole Location:	**Lara 222RP868424**	Easting:	**783869E**	Stick Up (m):	**0.58**
Hole Diameter (mm):	**100**	Elevation (m):	**267.40 m**	Static Water Level (mbgl):	**4.2**
Rig Details:	**Boart DB520**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drilling Method:	**RCG**	Datum:	**AHD**		



Notes

Geological data from nearby drill hole (15 m NW) as samples were not possible from this hole due to wet soft sediment mixing during drilling. Advanced casing used post-drilling to prevent hole wall collapse. Hydrostatic barrier encountered at 11.4 mbGL.

APPENDIX II

Drill Cutting Photographs

II-1 ATLAS-13M-D

Figure II-1.1 Drill recovery chips; 1 – 5 m depth

Figure II-1.2 Drill recovery chips; 5-10 m depth

Figure II-1.3 Drill recovery chips; 10 – 15 m depth

Figure II-1.4 Drill recovery chips; 15 – 20 m depth

Figure II-1.5 Drill recovery chips; 20 – 25 m depth

Figure II-1.6 Drill recovery chips; 25 – 30 m depth

Figure II-1.7 Drill recovery chips; 30 – 35 m depth

Figure II-1.8 Drill recovery chips; 35 – 36.5 m depth

II-2 ATLAS-13M-S

Figure II-2.1 Drill recovery chips; 1 – 5 m depth

Figure II-2.2 Drill recovery chips; 5 – 10 m depth

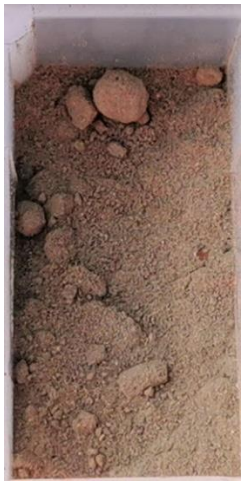


Figure II-2.3 Drill recovery chips; 10 – 11 m depth

II-3 ATLAS-14M-D

Figure II-3.1 Drill recovery chips; 1 – 5 m depth

Figure II-3.2 Drill recovery chips; 5-10 m depth

Figure II-3.3 Drill recovery chips; 10 – 15 m depth

Figure II-3.4 Drill recovery chips; 15 – 20 m depth

Figure II-3.5 Drill recovery chips; 20 – 25 m depth

Figure II-3.6 Drill recovery chips; 25 – 30 m depth

Figure II-3.7 Drill recovery chips; 30 – 35 m depth

Figure II-3.8 Drill recovery chips; 35 – 40 m depth

Figure II-3.9 Drill recovery chips; 40 – 45 m depth

Figure II-3.10 Drill recovery chips; 45 – 46 m depth

II-4 ATLAS-14M-S

Figure II-4.1 Drill recovery chips; 1 – 5 m depth

Figure II-4.2 Drill recovery chips; 5-10 m depth

Figure II-4.3 Drill recovery chips; 10 – ? m depth

II-5 ATLAS-15M-D

Figure II-5.1 Drill recovery chips; 1 – 5 m depth

Figure II-5.2 Drill recovery chips; 5-10 m depth

Figure II-5.3 Drill recovery chips; 10 – 15 m depth

Figure II-5.4 Drill recovery chips; 15 – 20 m depth

Figure II-5.5 Drill recovery chips; 20 – 25 m depth

Figure II-5.6 Drill recovery chips; 25 – 30 m depth

Figure II-5.7 Drill recovery chips; 30 – 35 m depth

Figure II-5.8 Drill recovery chips; 35 – 36 m depth

II-6 ATLAS-15M-S

Figure II-6.1 Drill recovery chips; 1 – 5 m depth

Figure II-6.2 Drill recovery chips; 5-10 m depth

Figure II-6.3 Drill recovery chips; 10 – 12 m depth (large clast at 12 m is a cobble)

Figure II-6.4 Creek bank (looking north from ATLAS-13M-S)

APPENDIX III

Development Records

Appendix III
Development Records

III-1 ATLAS-13M

Table III-1.1 Development Record for ATLAS-13M-D

Time	Purge Time (mins)	pH	EC (µS/cm)	Temperature (°C)	Flow Rate (L/s)	Description
09:42	0	7.62	15,987	26.1		Very silty and brown
09:52	10	8.30	15,593	25.2	0.02	0.02 L/s, silty and brown
10:01	19	8.36	14,888	26.1		Silty, beginning to clear
10:25	43	8.52	11,432	25.3		Extremely low flow, pump switched off and allowed to recover
10:54	72	8.47	12,273	25.6		Mostly clear. Had to stop development as almost no flow and rig running out of diesel

III-2 ATLAS-14M

Table III-2.1 Development Record for ATLAS-14M-D

Time	Purge Time (mins)	pH	EC (µS/cm)	Temperature (°C)	Flow Rate (L/s)	Description
07:15	0	8.49	9,150	22.0		Very silty and brown
07:22	7	8.68	12,200	22.0	0.050	Very silty and brown
07:38	23	8.73	9,170	22.2		Very silty and brown
07:51	35	8.70	9,250	21.9	0.015	Switched compressor off and allowed groundwater in bore to recover due to extremely low flow
08:07	52	8.73	8,830	22.2	0.019	Beginning to clear
08:19	64	8.70	9,070	22.7	0.008	Clearer, still some silt
08:39	84	8,72	9,083	22.5	0.008	Sample taken

III-3 ATLAS-15M

Table III-3.1 Development Record for ATLAS-15M-D

Time	Purge Time (mins)	pH	EC (µS/cm)	Temperature (°C)	Flow Rate (L/s)	Description
13:14	0	7.97	11,300	26.9		Cloudy, silty, salt crystals
13:19	5				0.053	Flow rate likely an underestimate due to water loss at the bore head
13:25	11	8.22	10,200	24.5		Silty and brown, low flow
13:34	20	8.22	9,900	23.2		Becoming clear, some silt
13:38	24	8.20	10,000	22.2	0.038	Becoming clear, less silty, flow rate is likely an underestimate due to water loss at the bore head
13:46	32	8.14	10,200	21.6		Some silt
13:56	42	8.20	9,790	21.0	0.035	Still some silt
14:09	59	8.24	9,580	22.3		Mostly clear, sample taken

Table III-3.2 Development Record for ATLAS-15M-S

Time	Purge Time (mins)	pH	EC (µS/cm)	Temperature (°C)	Flow Rate (L/s)	Description
14:21	0	7.95	12,800	25.9		Silty and brown
14:30	9	8.06	13,000	23.6	0.021	Very silty and brown, low flow
14:39	18	8.03	13,400	23.5		Almost clear, some silt
14:49	28	8.03	13,900	23.6	0.018	Flow rate more reliable than deep bore due to a good seal on the bore head – no visible water loss Mostly clear, sample taken

APPENDIX IV

Laboratory Analysis Certificates

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2302328**	Page	: 1 of 5
Client	: **KCB AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MARC ADDISON	Contact	: Customer Services EB
Address	: LEVEL 1 154 MELBOURNE STREET SOUTH BRISBANE 4101	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3518 0915	Telephone	: +61-7-3243 7222
Project	: ATLAS	Date Samples Received	: 27-Jan-2023 16:40
Order number	: DX2023PO-46	Date Analysis Commenced	: 02-Jan-2023
C-O-C number	: ----	Issue Date	: 02-Feb-2023 21:49
Sampler	: MARC ADDISON, MARC ADDISON		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Beatriz Llarinas	Senior Chemist - Inorganics	WB Water Lab Brisbane, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- It is recognised that EG020T (Total Metals by ICP-MS) is less than EG020F (Dissolved Metals by ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-14M-D	Atlas-15M-D	Atlas-15M-S	----	----
				Sampling date / time	25-Jan-2023 08:30	21-Jan-2023 14:10	21-Jan-2023 15:00	----	----
Compound	CAS Number	LOR	Unit		EB2302328-001	EB2302328-002	EB2302328-003	--------	--------
					Result	Result	Result	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.88**	**8.12**	**7.64**	----	----
EA006: Sodium Adsorption Ratio (SAR)									
^ Sodium Adsorption Ratio	----	0.01	-		**88.4**	**57.4**	**25.2**	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**9600**	**9460**	**14200**	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	1	mg/L		**6240**	**6150**	**9230**	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		**86**	**205**	**1740**	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**232**	**122**	**338**	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**232**	**122**	**338**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**6**	**27**	**774**	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**3220**	**3420**	**4920**	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**28**	**74**	**484**	----	----
Magnesium	7439-95-4	1	mg/L		**4**	**5**	**128**	----	----
Sodium	7440-23-5	1	mg/L		**1890**	**1890**	**2410**	----	----
Potassium	7440-09-7	1	mg/L		**10**	**6**	**20**	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.005**	**0.001**	<0.001	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Barium	7440-39-3	0.001	mg/L		**1.04**	**0.966**	**0.414**	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	**0.015**	----	----
Copper	7440-50-8	0.001	mg/L		**0.006**	<0.001	**0.003**	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L		**0.005**	**0.058**	**2.84**	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-14M-D	Atlas-15M-D	Atlas-15M-S	----	----
				Sampling date / time	25-Jan-2023 08:30	21-Jan-2023 14:10	21-Jan-2023 15:00	----	----
Compound	CAS Number	LOR	Unit		EB2302328-001	EB2302328-002	EB2302328-003	--------	--------
					Result	Result	Result	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Molybdenum	7439-98-7	0.001	mg/L		**0.039**	**0.005**	**0.012**	----	----
Nickel	7440-02-0	0.001	mg/L		**0.005**	<0.001	**0.035**	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L		**2.11**	**2.37**	**12.2**	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	----	----
Boron	7440-42-8	0.05	mg/L		**0.19**	**0.49**	**0.31**	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.63**	**5.95**	**2.20**	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.005**	**0.002**	**0.002**	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Barium	7440-39-3	0.001	mg/L		**0.983**	**0.981**	**0.453**	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	**0.0003**	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	**0.002**	**0.005**	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	**0.002**	**0.020**	----	----
Copper	7440-50-8	0.001	mg/L		**0.008**	**0.004**	**0.036**	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	**0.004**	**0.001**	----	----
Manganese	7439-96-5	0.001	mg/L		**0.005**	**0.093**	**4.61**	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.051**	**0.005**	**0.016**	----	----
Nickel	7440-02-0	0.001	mg/L		**0.006**	**0.002**	**0.039**	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L		**1.92**	**2.29**	**11.4**	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.017**	**0.025**	----	----
Boron	7440-42-8	0.05	mg/L		**0.22**	**0.64**	**0.40**	----	----
Iron	7439-89-6	0.05	mg/L		**0.24**	**2.90**	**4.63**	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EG052F: Dissolved Silica by ICPAES									
Silicon as SiO2	14464-46-1	0.1	mg/L		**7.0**	**11.2**	**38.6**	----	----
EK040P: Fluoride by PC Titrator									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-14M-D	Atlas-15M-D	Atlas-15M-S	----	----
				Sampling date / time	25-Jan-2023 08:30	21-Jan-2023 14:10	21-Jan-2023 15:00	----	----
Compound	CAS Number	LOR	Unit		EB2302328-001	EB2302328-002	EB2302328-003	--------	--------
					Result	Result	Result	----	----
EK040P: Fluoride by PC Titrator - Continued									
Fluoride	16984-48-8	0.1	mg/L		**1.4**	**0.6**	**0.3**	**----**	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**95.6**	**99.5**	**162**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**84.2**	**86.5**	**140**	**----**	**----**
ø Ionic Balance	----	0.01	%		**6.34**	**6.99**	**7.17**	**----**	**----**
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**6.00**	**5.30**	**9.10**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2302328**	Page	: 1 of 9
Client	: **KCB AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MARC ADDISON	Contact	: Customer Services EB
Address	: LEVEL 1 154 MELBOURNE STREET SOUTH BRISBANE 4101	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3518 0915	Telephone	: +61-7-3243 7222
Project	: ATLAS	Date Samples Received	: 27-Jan-2023
Order number	: DX2023PO-46	Date Analysis Commenced	: 02-Jan-2023
C-O-C number	: ----	Issue Date	: 02-Feb-2023
Sampler	: MARC ADDISON, MARC ADDISON		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	*Position*	*Accreditation Category*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Beatriz Llarinas	Senior Chemist - Inorganics	WB Water Lab Brisbane, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED009: Anions (QC Lot: 4841878)									
EB2302328-001	Atlas-14M-D	ED009-X: Bromide	24959-67-9	0.01	mg/L	6.00	5.85	2.5	0% - 50%
EB2302363-008	Anonymous	ED009-X: Bromide	24959-67-9	0.01	mg/L	0.580	0.570	1.7	No Limit
EA005P: pH by PC Titrator (QC Lot: 4841481)									
EB2302309-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.72	7.80	1.0	0% - 20%
EB2302389-002	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.98	7.99	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4841484)									
EB2302309-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1930	1980	2.6	0% - 20%
EB2302389-002	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	8600	8620	0.3	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4841483)									
EB2302309-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	252	254	0.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	252	254	0.9	0% - 20%
EB2302389-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	456	443	2.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	456	443	2.9	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4842631)									
EB2302313-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	203	205	1.0	0% - 20%
EB2302389-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	272	270	0.7	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4842630)									
EB2302313-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	226	228	1.2	0% - 20%
EB2302389-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2560	2570	0.2	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED093F: Dissolved Major Cations (QC Lot: 4844048)									
EB2302416-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	89	92	3.4	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	112	115	2.8	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	298	302	1.3	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	20	21	0.0	0% - 20%
EB2302202-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	192	215	11.6	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8	7	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	16500	15800	4.2	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	37	36	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4844049)									
EB2302416-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.034	0.034	0.0	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.003	0.004	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.006	0.007	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.01	0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.28	0.27	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2302202-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0005	0.0007	34.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.009	0.014	44.6	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.005	0.006	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	27.1	27.6	1.9	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.005	0.007	27.9	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.007	0.008	21.5	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.005	0.008	48.1	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.010	0.012	11.6	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.005	<0.005	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.006	0.008	27.5	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.116	0.118	1.9	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	121	118	1.9	0% - 20%
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4844049) - continued									
EB2302202-001	Anonymous	EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.38	0.35	7.5	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.62	0.59	3.7	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4844051)									
EB2302202-001	Anonymous	EG020B-F: Strontium	7440-24-6	0.001	mg/L	24.3	26.3	7.7	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 4845097)									
EB2301543-003	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.20	0.20	0.0	0% - 50%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2302210-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0004	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.176	0.177	0.0	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.020	0.021	0.0	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.022	0.022	0.0	0% - 20%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.018	0.018	0.0	0% - 50%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.114	0.115	1.2	0% - 20%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.02	0.0	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.11	0.11	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 4845099)									
EB2301543-003	Anonymous	EG020B-T: Strontium	7440-24-6	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EB2302210-001	Anonymous	EG020B-T: Strontium	7440-24-6	0.001	mg/L	1.53	1.51	1.4	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 4844050)									
EB2302416-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB2302202-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4844750)									
EB2302159-010	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB2302305-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4841486)									
EB2302309-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED009: Anions (QCLot: 4841878)								
ED009-X: Bromide	24959-67-9	0.01	mg/L	<0.010	2 mg/L	97.6	80.0	115
EA005P: pH by PC Titrator (QCLot: 4841481)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.0	102
				----	7 pH Unit	99.8	98.0	102
EA010P: Conductivity by PC Titrator (QCLot: 4841484)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	4000 µS/cm	98.9	90.0	106
				<1	12890 µS/cm	93.7	90.0	106
ED037P: Alkalinity by PC Titrator (QCLot: 4841483)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	50 mg/L	97.0	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4842631)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	106	85.0	118
				<1	100 mg/L	97.5	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 4842630)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	99.5	90.0	115
				<1	1000 mg/L	105	90.0	115
ED093F: Dissolved Major Cations (QCLot: 4844048)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	102	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	98.7	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	97.2	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4844049)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	103	79.0	118
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	103	88.0	116
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	103	81.0	117
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	99.8	70.0	130
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	100	88.0	108
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87.0	113
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	98.9	86.0	112
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	103	88.0	114
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	90.4	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	102	89.0	120
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	101	89.0	112
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	101	89.0	113
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	99.0	83.0	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4844049) - continued								
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	102	88.0	114
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	102	87.0	113
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	104	81.0	125
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	103	82.0	114
EG020F: Dissolved Metals by ICP-MS (QCLot: 4844051)								
EG020B-F: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	101	86.0	111
EG020T: Total Metals by ICP-MS (QCLot: 4845097)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	105	80.0	114
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	102	88.0	112
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	103	81.0	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	99.0	70.0	130
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	99.6	88.0	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	102	89.0	115
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	101	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	102	88.0	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	89.0	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	88.0	114
EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	106	90.0	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	101	88.0	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	100	79.0	111
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	103	87.0	114
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	103	84.0	114
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	116	82.0	128
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	106	82.0	118
EG020T: Total Metals by ICP-MS (QCLot: 4845099)								
EG020B-T: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	100	86.0	112
EG035F: Dissolved Mercury by FIMS (QCLot: 4844050)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	98.7	84.0	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4844750)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	108	84.0	118
EK040P: Fluoride by PC Titrator (QCLot: 4841486)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	100	80.0	117

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Matrix Spike (MS) Report

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED009: Anions (QCLot: 4841878)							
EB2302328-002	Atlas-15M-D	ED009-X: Bromide	24959-67-9	25 mg/L	97.2	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4842631)							
EB2302313-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4842630)							
EB2302313-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	99.0	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4844049)							
EB2302202-003	Anonymous	EG020A-F: Arsenic	7440-38-2	5 mg/L	104	70.0	130
		EG020A-F: Beryllium	7440-41-7	5 mg/L	91.1	70.0	130
		EG020A-F: Barium	7440-39-3	5 mg/L	97.5	70.0	130
		EG020A-F: Cadmium	7440-43-9	1.25 mg/L	98.1	70.0	130
		EG020A-F: Chromium	7440-47-3	5 mg/L	96.6	70.0	130
		EG020A-F: Cobalt	7440-48-4	5 mg/L	95.4	70.0	130
		EG020A-F: Copper	7440-50-8	5 mg/L	97.2	70.0	130
		EG020A-F: Lead	7439-92-1	5 mg/L	97.8	70.0	130
		EG020A-F: Manganese	7439-96-5	5 mg/L	100	70.0	130
		EG020A-F: Nickel	7440-02-0	5 mg/L	97.3	70.0	130
		EG020A-F: Vanadium	7440-62-2	5 mg/L	101	70.0	130
		EG020A-F: Zinc	7440-66-6	5 mg/L	97.5	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 4845097)							
EB2301543-005	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG020A-T: Beryllium	7440-41-7	1 mg/L	114	70.0	130
		EG020A-T: Barium	7440-39-3	1 mg/L	103	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	105	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	107	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	108	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	110	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	105	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	107	70.0	130
		EG020A-T: Vanadium	7440-62-2	1 mg/L	108	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	106	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4844050)							
EB2302202-004	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	94.2	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4844750)							
EB2302159-011	Anonymous	EG035T: Mercury	7439-97-6	0.013 mg/L	95.3	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4841486)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK040P: Fluoride by PC Titrator (QCLot: 4841486) - continued							
EB2301985-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	91.3	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2302328**	Page	: 1 of 8
Client	: **KCB AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MARC ADDISON	Telephone	: +61-7-3243 7222
Project	: ATLAS	Date Samples Received	: 27-Jan-2023
Site	: ----	Issue Date	: 02-Feb-2023
Sampler	: MARC ADDISON, MARC ADDISON	No. of samples received	: 3
Order number	: DX2023PO-46	No. of samples analysed	: 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB2302313--002	Anonymous	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
Atlas-15M-D, Atlas-15M-S	----	----	----	31-Jan-2023	21-Jan-2023	**10**
Clear Plastic Bottle - Natural						
Atlas-14M-D	----	----	----	31-Jan-2023	25-Jan-2023	**6**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
Atlas-15M-D, Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**31-Jan-2023**	21-Jan-2023	×
Clear Plastic Bottle - Natural (EA005-P)							
Atlas-14M-D	**25-Jan-2023**	**----**	----	----	**31-Jan-2023**	25-Jan-2023	×
EA006: Sodium Adsorption Ratio (SAR)							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)							
Atlas-15M-D, Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Jan-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)							
Atlas-14M-D	**25-Jan-2023**	**----**	----	----	**02-Jan-2023**	22-Feb-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**31-Jan-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Natural (EA010-P)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**31-Jan-2023**	22-Feb-2023	✓
EA065: Total Hardness as CaCO3								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Jan-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**02-Jan-2023**	22-Feb-2023	✓
ED009: Anions								
Clear Plastic Bottle - Natural (ED009-X)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**01-Feb-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Natural (ED009-X)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**01-Feb-2023**	22-Feb-2023	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**31-Jan-2023**	04-Feb-2023	✓
Clear Plastic Bottle - Natural (ED037-P)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**31-Jan-2023**	08-Feb-2023	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Feb-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Natural (ED041G)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**02-Feb-2023**	22-Feb-2023	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Feb-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Natural (ED045G)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**02-Feb-2023**	22-Feb-2023	✓
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Jan-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**02-Jan-2023**	22-Feb-2023	✓
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)								
Atlas-15M-D,	Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Jan-2023**	20-Jul-2023	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)								
Atlas-14M-D		**25-Jan-2023**	**----**	----	----	**02-Jan-2023**	24-Jul-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020B-T)							
Atlas-15M-D, Atlas-15M-S	**21-Jan-2023**	**01-Feb-2023**	20-Jul-2023	✓	**02-Feb-2023**	20-Jul-2023	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020B-T)							
Atlas-14M-D	**25-Jan-2023**	**01-Feb-2023**	24-Jul-2023	✓	**02-Feb-2023**	24-Jul-2023	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
Atlas-15M-D, Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Feb-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
Atlas-14M-D	**25-Jan-2023**	**----**	----	----	**02-Feb-2023**	22-Feb-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
Atlas-15M-D, Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**02-Feb-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
Atlas-14M-D	**25-Jan-2023**	**----**	----	----	**02-Feb-2023**	22-Feb-2023	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
Atlas-15M-D, Atlas-15M-S	**21-Jan-2023**	**----**	----	----	**31-Jan-2023**	18-Feb-2023	✓
Clear Plastic Bottle - Natural (EK040P)							
Atlas-14M-D	**25-Jan-2023**	**----**	----	----	**31-Jan-2023**	22-Feb-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	2	4	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Major Cations - Dissolved	ED093F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by Auto Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Standard Anions -by IC (Extended Method)	ED009-X	WATER	In house: Referenced to APHA 4110B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Metals by ICP-MS - Suite B	EG020B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Total Metals by ICP-MS - Suite B	EG020B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Silica (Total Dissolved) by ICPAES	EG052F	WATER	In house: Referenced to APHA 4500-SiO2. Silica (Total) determined by calculation from Silicon by ICPAES.
Fluoride by Auto Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Gladstone QLD 4680 Ph: 07 4976 7944 E: ALSEnviro.Gladstone@alsglobal.com
MACKAY Unit 2/20 Caterpillar Drive Paget QLD 4740 Ph: 07 4952 5795 E: ALSEnviro.Mackay@alsglobal.com
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TOWNSVILLE 13 Carlton Street Kirwan QLD 4817 Ph: 07 4773 0000 E: ALSEnviro.Townsville@alsglobal.com
WOLLONGONG P

CLIENT: SENEX ENERGY / KCB	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LAB
OFFICE: BRISBANE		☐ Non Standard or urgent TAT (List due date):	Custody Se N/A
PROJECT: ATLAS PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	Free ice / fr N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	OF: 1 2 3 4 5 6 7	Random Sar
PROJECT MANAGER: MARC ADDISON CONTACT PH: 0435 352 218			Other comme
SAMPLER: MARC ADDISON SAMPLER MOBILE: 0435 352 218	RELINQUISHED BY: MARC ADDISON	RECEIVED BY:	RELINQUISHED
COC Emailed to ALS? (YES (NO) EDD FORMAT (or default):	DATE/TIME: 27/1/23, 16:30	DATE/TIME: 27/1/23 16:40	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): Maddison@klohn.com			
Email Invoice to (will default to PM if no other addresses are listed): Maddison@klohn.com			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Environmental Division
Brisbane
Work Order Reference
EB2302328

Telephone : +61-7-3243 7222

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	Atlas - 14M - D	25/1/23, 08:30			3	CSG-2								
2	Atlas - 15M - D	21/1/23, 14:10			3	CSG-2								
3	Atlas - 15M - S	21/1/23, 15:00			3	CSG-2								
				TOTAL	9									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2303416**	Page	: 1 of 5
Client	: **KCB AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CARLY WATERHOUSE	Contact	: Customer Services EB
Address	: LEVEL 1 154 MELBOURNE STREET SOUTH BRISBANE 4101	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3004 0240	Telephone	: +61-7-3243 7222
Project	: ATLAS	Date Samples Received	: 08-Feb-2023 03:00
Order number	: DX2023PO-49	Date Analysis Commenced	: 09-Feb-2023
C-O-C number	: ----	Issue Date	: 16-Feb-2023 11:38
Sampler	: MARC ADDISON		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Beatriz Llarinas	Senior Chemist - Inorganics	WB Water Lab Brisbane, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- It is recognised that EG020T (Total Metals by ICP-MS) is less than EG020F (Dissolved Metals by ICP-MS) for 'ATLAS-13M-D' (EB2303416-001). However, the difference is within experimental variation of the methods.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	ATLAS-13M-D	----	----	----	----
				Sampling date / time	04-Feb-2023 08:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2303416-001	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**8.56**	----	----	----	----
EA006: Sodium Adsorption Ratio (SAR)									
^ Sodium Adsorption Ratio	----	0.01	-		**70.7**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**8410**	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	1	mg/L		**5470**	----	----	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		**105**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		**26**	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**237**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**263**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**2**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**2780**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**34**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**5**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**1670**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**6**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.001**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.654**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.004**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.070**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	ATLAS-13M-D	----	----	----	----
				Sampling date / time	04-Feb-2023 08:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2303416-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Molybdenum	7439-98-7	0.001	mg/L		**0.009**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.022**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L		**1.54**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.006**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.41**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.14**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.002**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.661**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		**0.006**	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		**0.001**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.034**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.083**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.010**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.028**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L		**1.58**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.026**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.38**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.49**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG052F: Dissolved Silica by ICPAES									
Silicon as SiO2	14464-46-1	0.1	mg/L		**12.5**	----	----	----	----
EK040P: Fluoride by PC Titrator									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	ATLAS-13M-D	----	----	----	----
				Sampling date / time	04-Feb-2023 08:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2303416-001	--------	--------	--------	--------
					Result	----	----	----	----
EK040P: Fluoride by PC Titrator - Continued									
Fluoride	16984-48-8	0.1	mg/L		**0.9**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**83.7**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**74.9**	----	----	----	----
ø Ionic Balance	----	0.01	%		**5.56**	----	----	----	----
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**4.85**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2303416**	Page	: 1 of 9
Client	: **KCB AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CARLY WATERHOUSE	Contact	: Customer Services EB
Address	: LEVEL 1 154 MELBOURNE STREET SOUTH BRISBANE 4101	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3004 0240	Telephone	: +61-7-3243 7222
Project	: ATLAS	Date Samples Received	: 08-Feb-2023
Order number	: DX2023PO-49	Date Analysis Commenced	: 09-Feb-2023
C-O-C number	: ----	Issue Date	: 16-Feb-2023
Sampler	: MARC ADDISON		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	*Position*	*Accreditation Category*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Beatriz Llarinas	Senior Chemist - Inorganics	WB Water Lab Brisbane, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED009: Anions (QC Lot: 4861062)									
EB2302849-001	Anonymous	ED009-X: Bromide	24959-67-9	0.01	mg/L	10.4	10.2	1.7	0% - 20%
EB2303408-002	Anonymous	ED009-X: Bromide	24959-67-9	0.01	mg/L	440	456	3.6	0% - 20%
EA005P: pH by PC Titrator (QC Lot: 4868162)									
EB2303401-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	9.03	9.04	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4868160)									
EB2303401-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	6800	6570	3.4	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4868161)									
EB2303401-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	269	264	1.9	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	898	896	0.2	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	1170	1160	0.6	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4863220)									
EB2303222-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3	2	43.7	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 4863221)									
EB2303222-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	13	14	0.0	0% - 50%
ED093F: Dissolved Major Cations (QC Lot: 4863816)									
EB2303412-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	106	108	1.7	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	15	15	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	40	41	2.7	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	6	7	0.0	No Limit
EB2303412-005	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	80	77	4.3	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	19	19	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	5	5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 4863816) - continued									
EB2303412-005	Anonymous	ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4863817)									
EB2303412-005	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0005	0.0005	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.024	0.024	0.0	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.004	0.005	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	2.98	2.97	0.4	0% - 20%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.027	0.027	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.04	0.04	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2303542-005	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0002	0.0002	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.418	0.401	4.0	0% - 20%
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.010	0.009	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.027	0.025	6.5	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.885	0.848	4.4	0% - 20%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.014	0.014	0.0	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.052	0.050	5.2	0% - 50%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.24	0.23	5.7	0% - 20%
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4863818)									
EB2303412-005	Anonymous	EG020B-F: Strontium	7440-24-6	0.001	mg/L	0.710	0.711	0.2	0% - 20%
EB2303542-005	Anonymous	EG020B-F: Strontium	7440-24-6	0.001	mg/L	0.046	0.044	5.5	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 4862250)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 4862250) - continued									
EB2303170-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	1.32	1.37	3.8	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.057	0.058	0.0	0% - 20%
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.014	0.016	18.2	0% - 50%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.005	0.004	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.084	0.086	1.7	0% - 20%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.010	0.010	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.25	0.25	0.0	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	4.26	4.26	0.0	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	6.60	6.71	1.7	0% - 20%
ET2300651-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0015	0.0015	0.0	0% - 50%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.008	0.009	0.0	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.124	0.119	3.7	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.013	0.013	0.0	0% - 50%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.125	0.123	1.7	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.340	0.336	1.0	0% - 20%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.007	0.007	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.563	0.552	2.0	0% - 20%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	2.80	2.74	2.1	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.06	<0.05	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	4.08	3.98	2.5	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 4862252)									
EB2303170-001	Anonymous	EG020B-T: Strontium	7440-24-6	0.001	mg/L	2.47	2.56	3.8	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 4863815)									
EB2302438-010	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB2302438-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4862372)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4862372) - continued									
EB2303235-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB2303416-001	ATLAS-13M-D	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4868159)									
EB2303401-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	2.0	2.0	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED009: Anions (QCLot: 4861062)								
ED009-X: Bromide	24959-67-9	0.01	mg/L	<0.010	2 mg/L	105	80.0	115
EA005P: pH by PC Titrator (QCLot: 4868162)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.0	102
				----	7 pH Unit	99.7	98.0	102
EA010P: Conductivity by PC Titrator (QCLot: 4868160)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	101	90.0	106
				<1	24800 µS/cm	94.5	90.0	106
ED037P: Alkalinity by PC Titrator (QCLot: 4868161)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.8	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4863220)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	107	85.0	118
				<1	100 mg/L	94.7	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 4863221)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	90.0	115
				<1	1000 mg/L	103	90.0	115
ED093F: Dissolved Major Cations (QCLot: 4863816)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	110	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	97.6	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	92.8	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	97.9	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4863817)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	99.5	79.0	118
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.7	88.0	116
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	98.7	81.0	117
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	102	70.0	130
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	97.3	88.0	108
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	96.5	87.0	113
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	99.0	86.0	112
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	93.2	88.0	114
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.2	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	97.5	89.0	120
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	99.5	89.0	112
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	96.7	89.0	113
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	100	83.0	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4863817) - continued								
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	99.9	88.0	114
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	96.0	87.0	113
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	101	81.0	125
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	97.2	82.0	114
EG020F: Dissolved Metals by ICP-MS (QCLot: 4863818)								
EG020B-F: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	97.8	86.0	111
EG020T: Total Metals by ICP-MS (QCLot: 4862250)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	102	80.0	114
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	103	88.0	112
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	105	81.0	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	102	70.0	130
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	100	88.0	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	103	89.0	115
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	101	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	108	88.0	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	108	89.0	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	100	88.0	114
EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	107	90.0	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	102	88.0	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	110	79.0	111
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	106	87.0	114
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	100	84.0	114
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	108	82.0	128
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100.0	82.0	118
EG020T: Total Metals by ICP-MS (QCLot: 4862252)								
EG020B-T: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	103	86.0	112
EG035F: Dissolved Mercury by FIMS (QCLot: 4863815)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	84.2	84.0	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4862372)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	98.1	84.0	118
EK040P: Fluoride by PC Titrator (QCLot: 4868159)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	93.2	80.0	117

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Matrix Spike (MS) Report

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED009: Anions (QCLot: 4861062)							
EB2302849-002	Anonymous	ED009-X: Bromide	24959-67-9	5 mg/L	116	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4863220)							
EB2303092-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	127	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4863221)							
EB2303092-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4863817)							
EB2303412-006	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG020A-F: Beryllium	7440-41-7	1 mg/L	103	70.0	130
		EG020A-F: Barium	7440-39-3	1 mg/L	105	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	103	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	98.7	70.0	130
		EG020A-F: Cobalt	7440-48-4	1 mg/L	100	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	100.0	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	101	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	101	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	101	70.0	130
		EG020A-F: Vanadium	7440-62-2	1 mg/L	99.7	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	104	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 4862250)							
EB2303332-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	108	70.0	130
		EG020A-T: Beryllium	7440-41-7	1 mg/L	100	70.0	130
		EG020A-T: Barium	7440-39-3	1 mg/L	105	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	103	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	99.5	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	102	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	99.6	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	108	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	103	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	101	70.0	130
		EG020A-T: Vanadium	7440-62-2	1 mg/L	105	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	101	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4863815)							
EB2302438-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	94.1	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4862372)							
EB2303151-001	Anonymous	EG035T: Mercury	7439-97-6	0.05 mg/L	83.1	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4868159)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK040P: Fluoride by PC Titrator (QCLot: 4868159) - continued							
EB2303402-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	94.6	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2303416**	Page	: 1 of 7
Client	: **KCB AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CARLY WATERHOUSE	Telephone	: +61-7-3243 7222
Project	: ATLAS	Date Samples Received	: 08-Feb-2023
Site	: ----	Issue Date	: 16-Feb-2023
Sampler	: MARC ADDISON	No. of samples received	: 1
Order number	: DX2023PO-49	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED045G: Chloride by Discrete Analyser	EB2303092--001	Anonymous	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
ATLAS-13M-D	----	----	----	13-Feb-2023	04-Feb-2023	**9**
EA006: Sodium Adsorption Ratio (SAR)						
Clear Plastic Bottle - Natural						
ATLAS-13M-D	----	----	----	14-Feb-2023	11-Feb-2023	**3**
EA065: Total Hardness as CaCO3						
Clear Plastic Bottle - Natural						
ATLAS-13M-D	----	----	----	14-Feb-2023	11-Feb-2023	**3**
ED093F: Dissolved Major Cations						
Clear Plastic Bottle - Natural						
ATLAS-13M-D	----	----	----	14-Feb-2023	11-Feb-2023	**3**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**13-Feb-2023**	04-Feb-2023	×
EA006: Sodium Adsorption Ratio (SAR)							
Clear Plastic Bottle - Natural (ED093F)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**14-Feb-2023**	11-Feb-2023	×

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**13-Feb-2023**	04-Mar-2023	✓
EA065: Total Hardness as CaCO3							
Clear Plastic Bottle - Natural (ED093F)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**14-Feb-2023**	11-Feb-2023	×
ED009: Anions							
Clear Plastic Bottle - Natural (ED009-X)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**10-Feb-2023**	04-Mar-2023	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**13-Feb-2023**	18-Feb-2023	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**10-Feb-2023**	04-Mar-2023	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**10-Feb-2023**	04-Mar-2023	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**14-Feb-2023**	11-Feb-2023	×
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Natural (EG020B-F)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**14-Feb-2023**	03-Aug-2023	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020B-T)							
ATLAS-13M-D	**04-Feb-2023**	**09-Feb-2023**	03-Aug-2023	✓	**10-Feb-2023**	03-Aug-2023	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Natural (EG035F)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**16-Feb-2023**	04-Mar-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**13-Feb-2023**	04-Mar-2023	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
ATLAS-13M-D	**04-Feb-2023**	**----**	----	----	**13-Feb-2023**	04-Mar-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite B	EG020B-F	2	1	**200.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by Auto Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Standard Anions -by IC (Extended Method)	ED009-X	WATER	In house: Referenced to APHA 4110B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Metals by ICP-MS - Suite B	EG020B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Total Metals by ICP-MS - Suite B	EG020B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Silica (Total Dissolved) by ICPAES	EG052F	WATER	In house: Referenced to APHA 4500-SiO2. Silica (Total) determined by calculation from Silicon by ICPAES.
Fluoride by Auto Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 3/1 Burma Road Pooraka SA 5095 Ph: 08 8162 5130 E: adelaide@alsglobal.com

☐BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 48 Callemondah Drive Gladstone QLD 4680 Ph: 07 4978 7944 E: ALSEnviro.Gladstone@alsglobal.com

☐MACKAY Unit 2/20 Caterpillar Drive Paget QLD 4740 Ph: 07 4952 5795 E: ALSEnviro.Mackay@alsglobal.com

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☐MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

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☐WOLLONG Ph: 02 4225 3

Environmental Division
Brisbane
Work Order Reference
EB2303416

Telephone : +61-7-3243 7222

CLIENT: Senex/KCB	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT **(List due date):**	**FOR LABORATO**
OFFICE: Brisbane		☐ Non Standard or urgent TAT **(List due date):**	Custody Seal Intact?
PROJECT: Atlas **PROJECT NO.:**	**ALS QUOTE NO.:**	**COC SEQUENCE NUMBER (Circle)**	Free Ice / frozen ice receipt?
ORDER NUMBER: **PURCHASE ORDER NO.:** DX2023PO-49	**COUNTRY OF ORIGIN:**	COC: 1 2 3 4 5 6 7	Random Sample Te
PROJECT MANAGER: Carly Waterhouse **CONTACT PH:**		OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Marc Addison **SAMPLER MOBILE:** 0435 352218	**RELINQUISHED BY:** Carly Waterhouse	**RECEIVED BY:**	**RELINQUISHED BY:**
COC Emailed to ALS? (YES / NO) **EDD FORMAT (or default):**	DATE/TIME:	DATE/TIME: 8/2/23 9:15	DATE/TIME:
Email Reports to: maddison@klohn.com			
Email Invoice to: maddison@klohn.com			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Small bottle which was ticked filtered, hasn't actually been filtered.

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	ATLAS-13M-D	04/02/2023, 08:00	W		3	CSG-2								The filtered metal bottle was not filtered in the field and will need filtering.
				TOTAL	3									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

APPENDIX V

Hydraulic Tests

Appendix V
Hydraulic Tests

V-1 ATLAS-13M

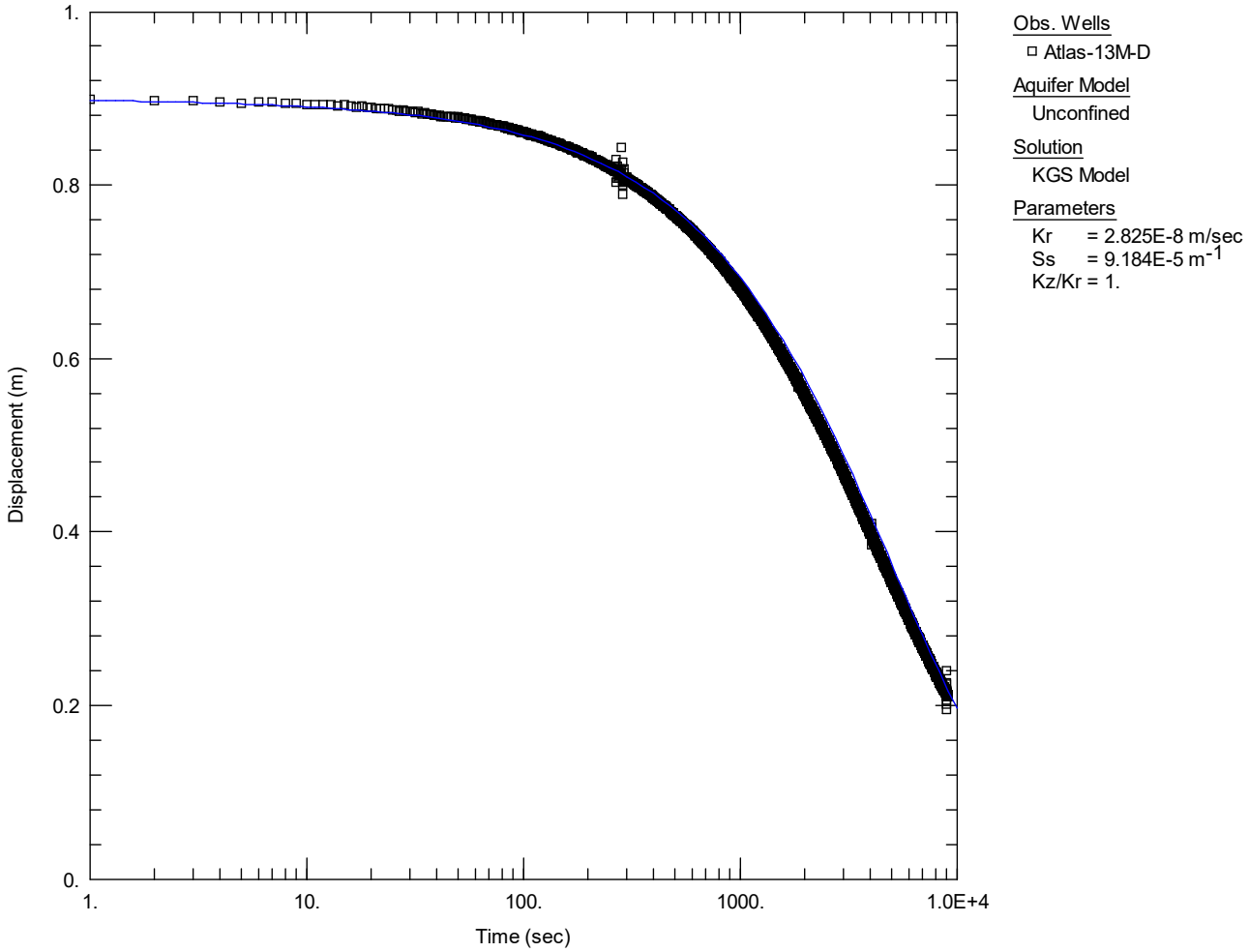

Figure V-1.1 Slug test analysis for Atlas-13M-D (falling head test)

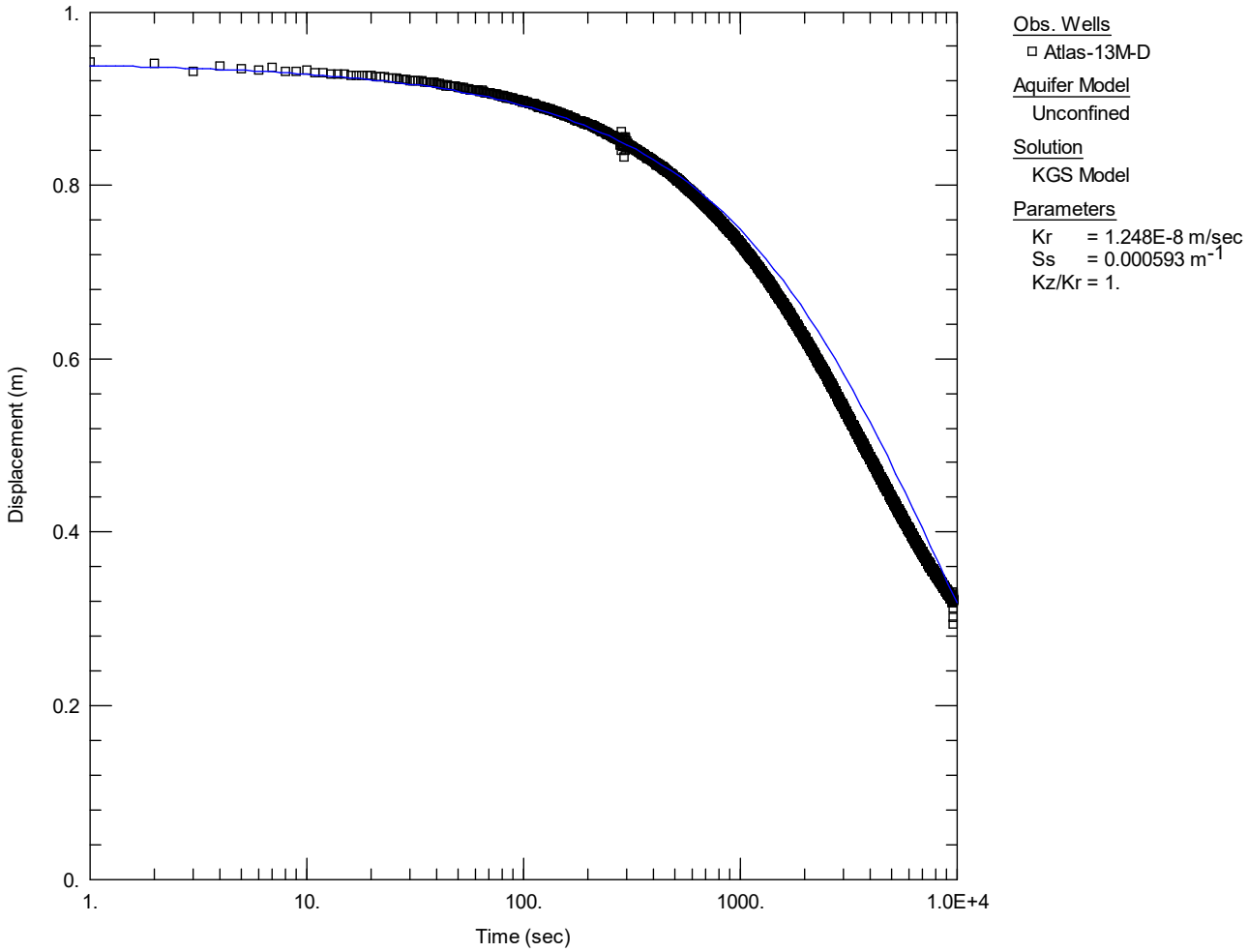

Figure V-1.2 Slug test analysis for Atlas-13M-D (rising head test)

V-2 ATLAS-14M

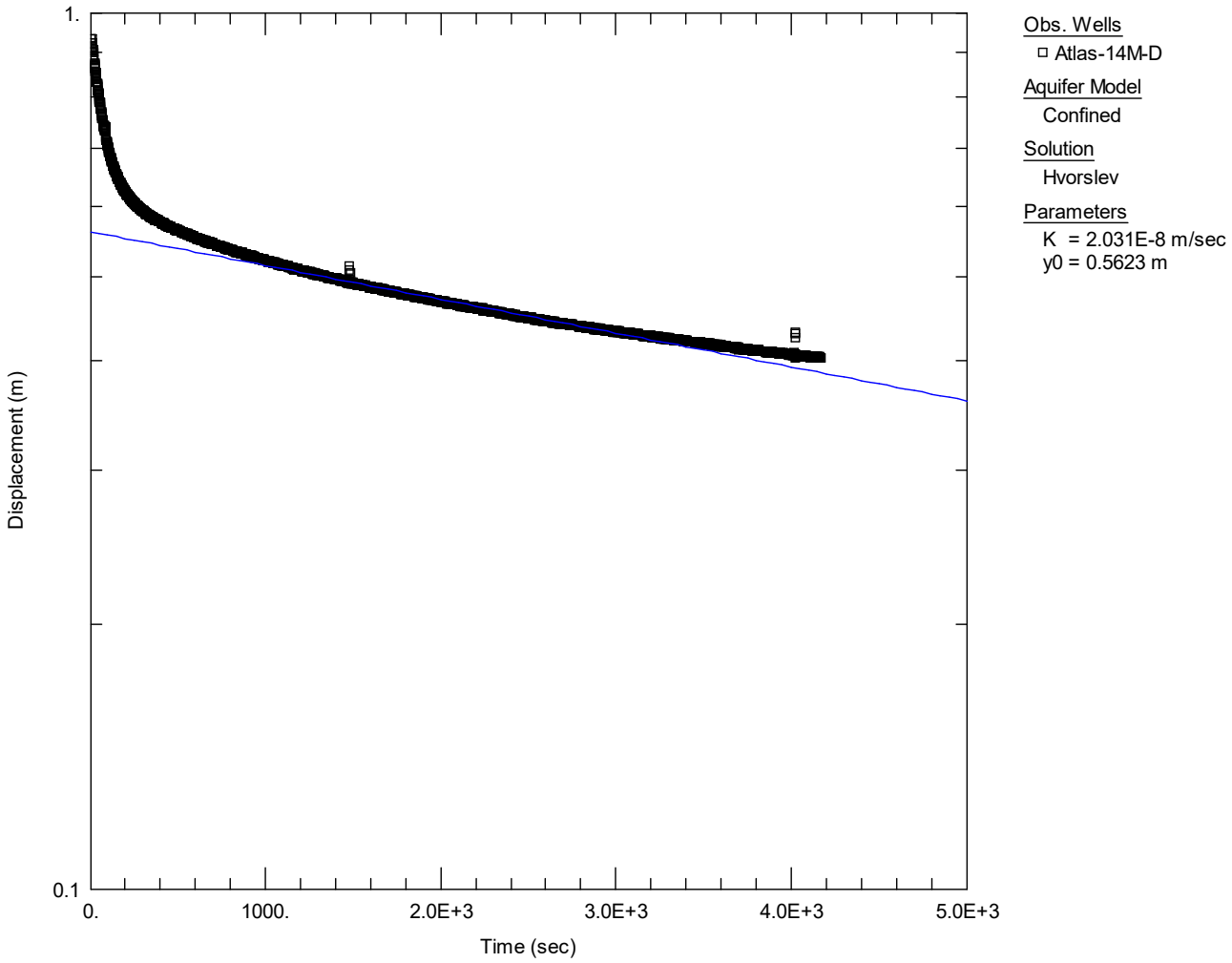

Figure V-2.1 Slug test analysis for Atlas-14M-D (falling head test)

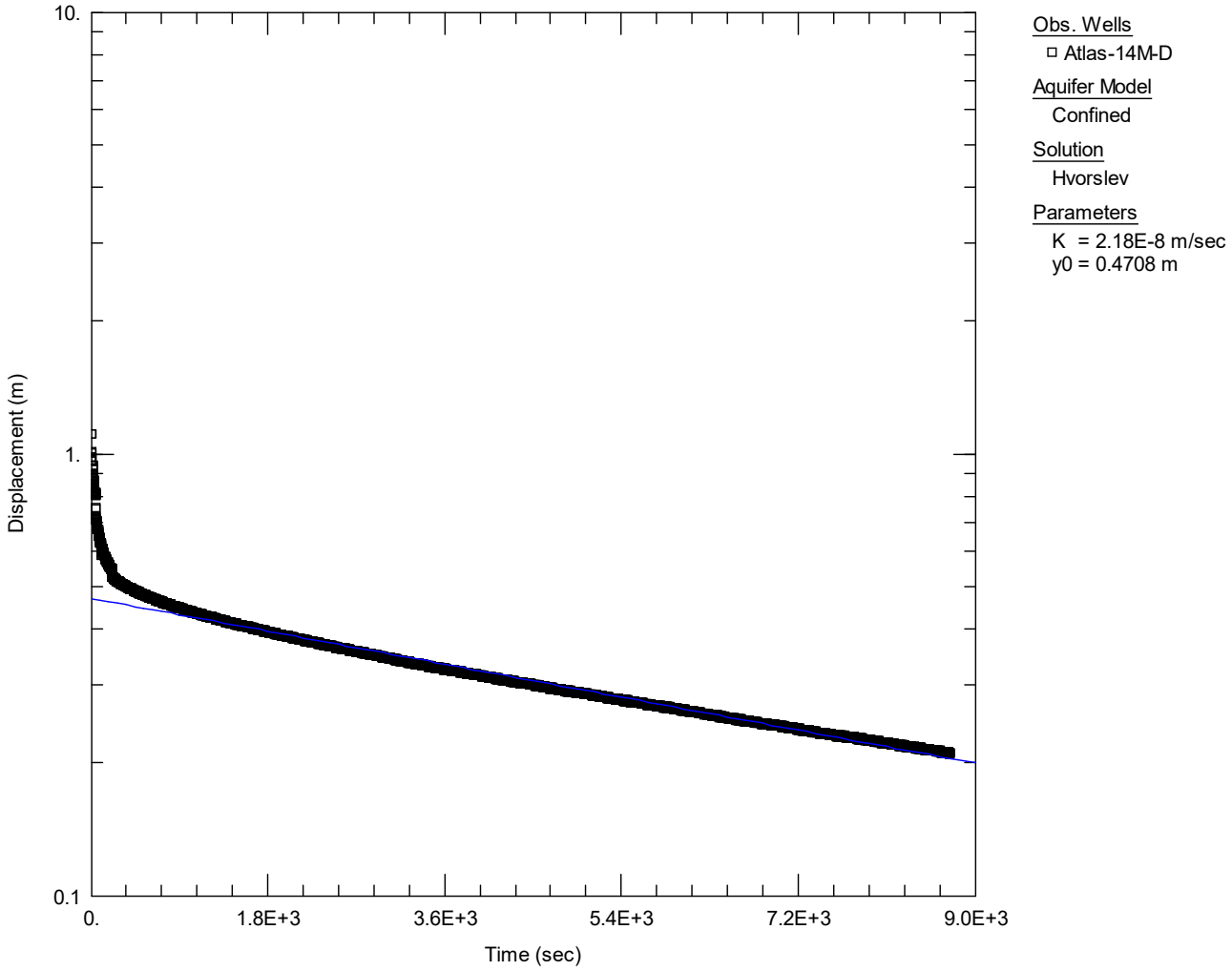

Figure V-2.2 Slug test analysis for Atlas-14M-D (rising head test)

V-3 ATLAS-15M

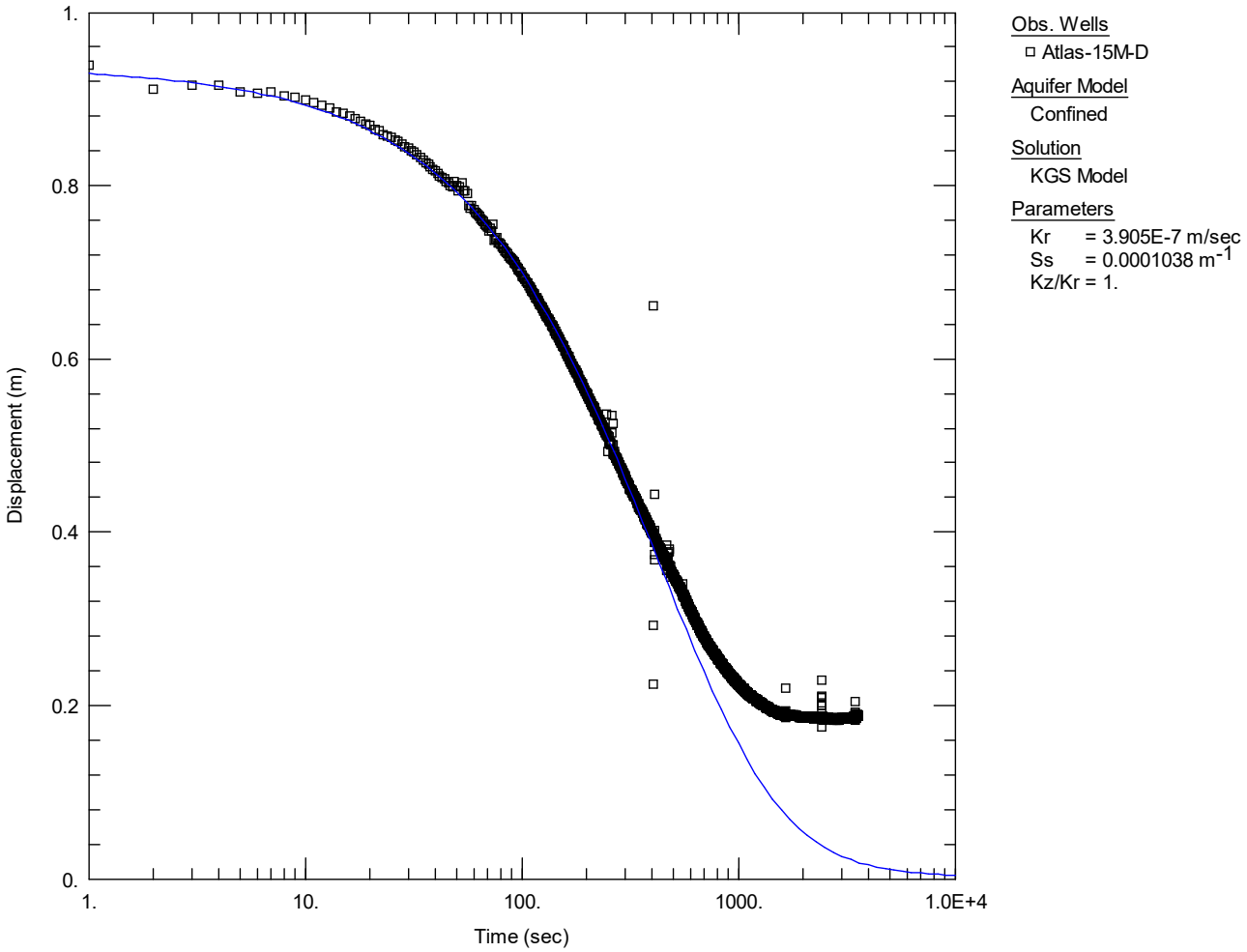

Figure V-3.1 Slug test analysis for Atlas-15M-D (falling head test)

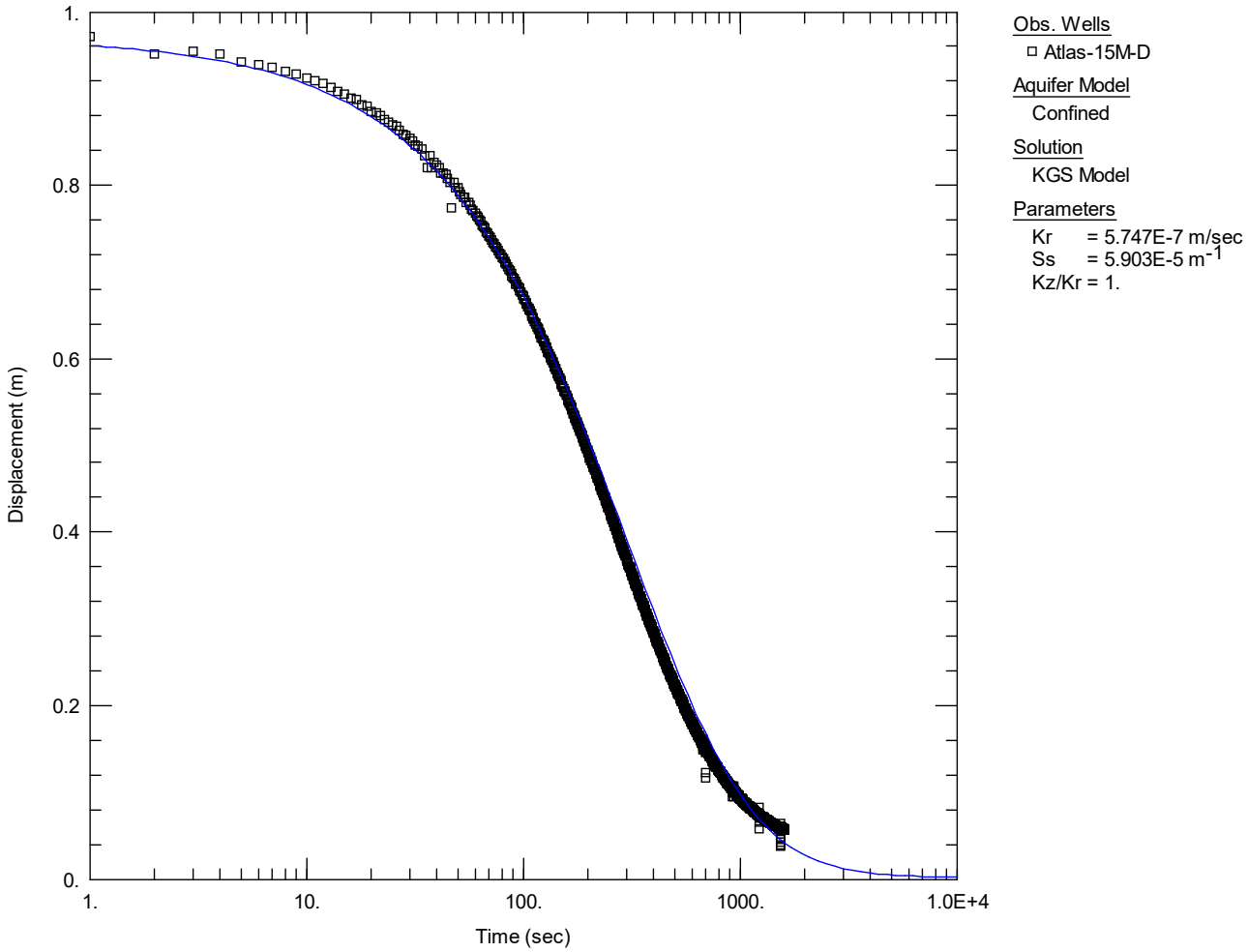

Figure V-3.2 Slug test analysis for Atlas-15M-D (rising head test)

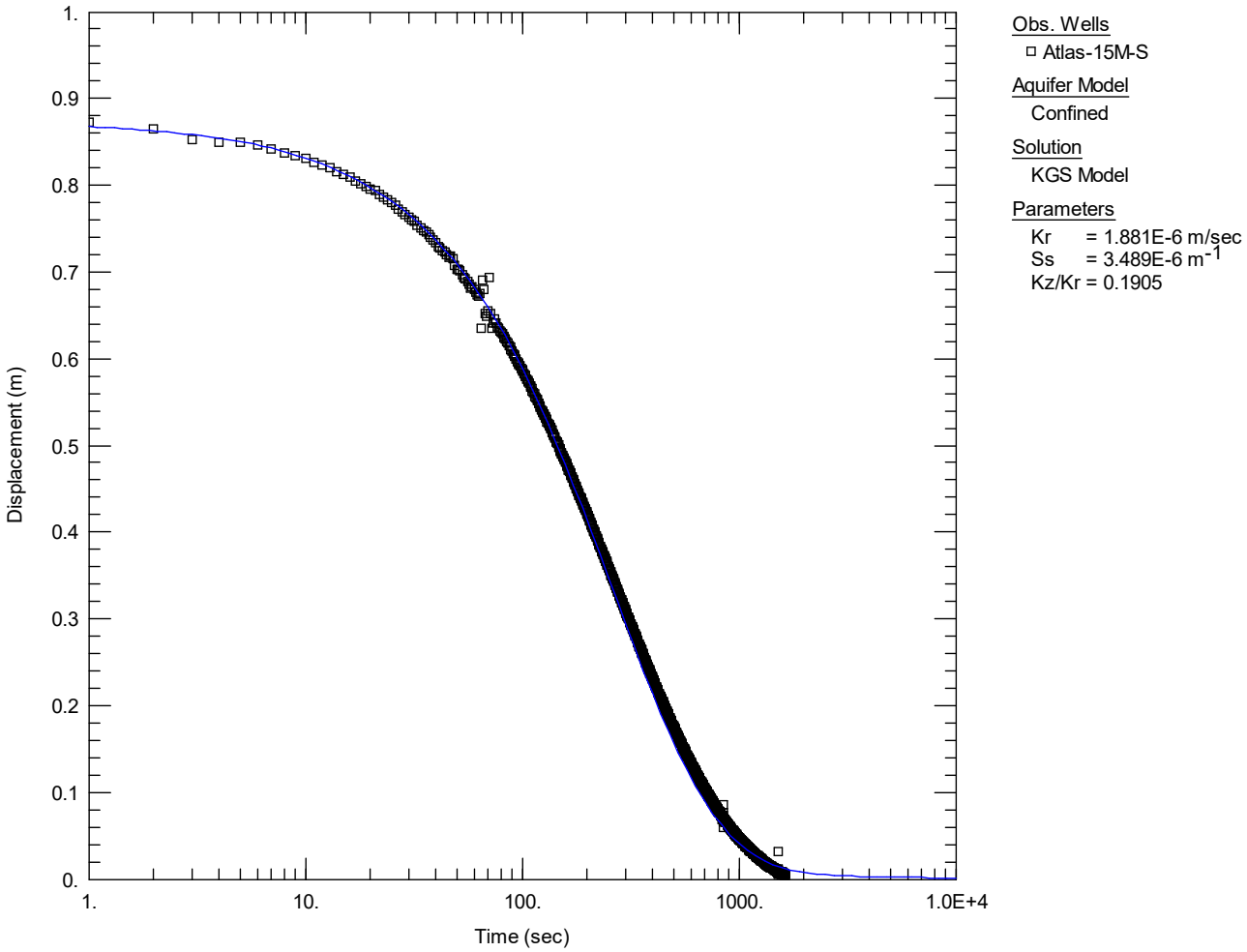

Figure V-3.3 Slug test analysis for Atlas-15M-S (falling head test)

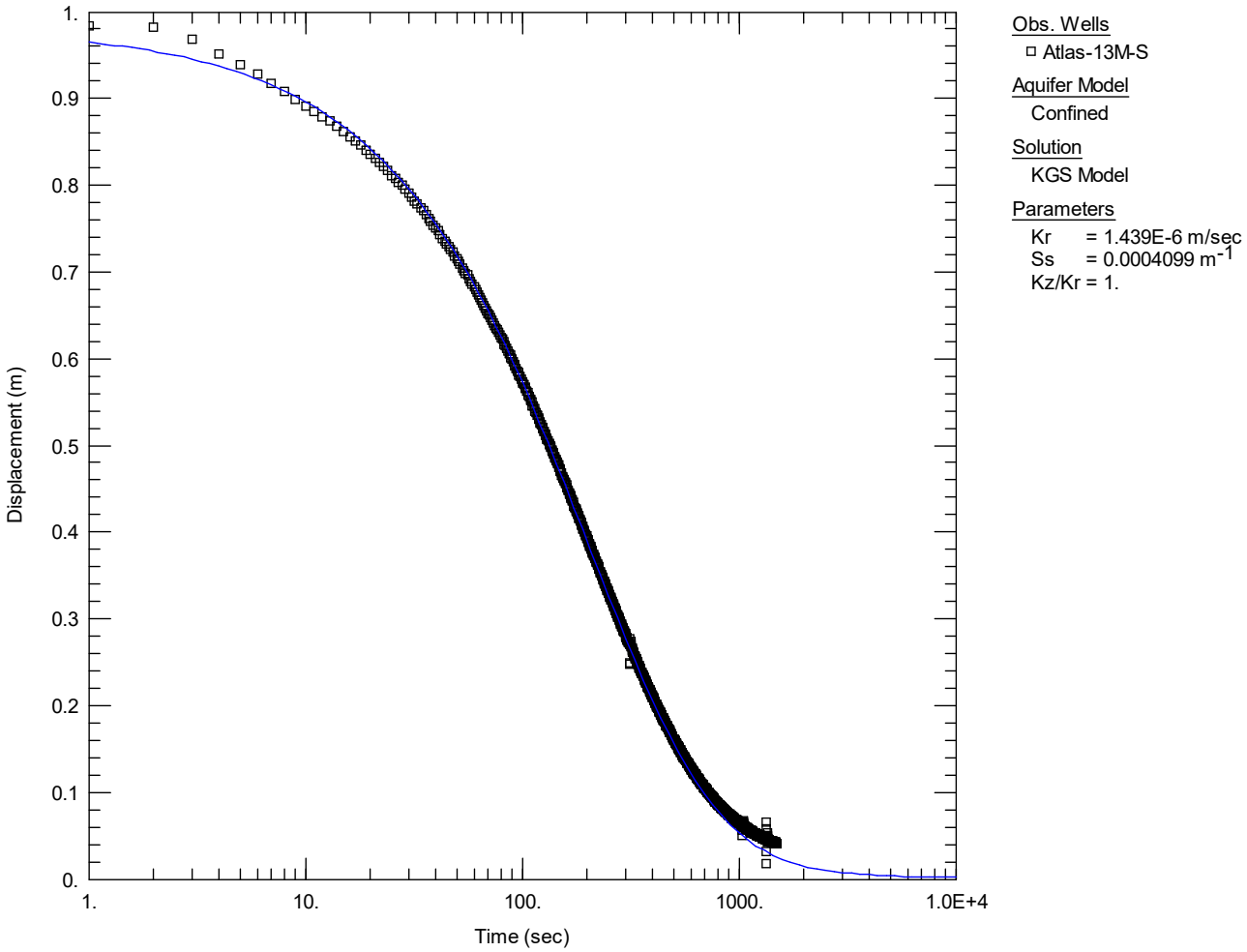

Figure V-3.4 Slug test analysis for Atlas-15M-S (rising head test)

APPENDIX XI

Site Investigation Report (Atlas-19M-D/S)

Klohn Crippen Berger

Senex Energy Pty Ltd

Atlas Stage 3 Drilling 2023

Site Investigation Report: Atlas-19M-D/S

Final

ISO 9001 14001 45001

DX10171A14

December 2023

8 December 2023

Senex Energy Pty Ltd
Level 30, 180 Ann Street
Brisbane
QLD 4001

Steve Fox
Atlas Approvals

Dear Mr. Fox:

Atlas Stage 3 Drilling 2023
Site Investigation Report: ATLAS-19M-D/S
Final

KCB Australia Pty Ltd (KCB) is pleased to provide Senex Energy Pty Ltd (Senex) with this final Site Investigation Report for the Atlas Stage 3 Gas Project.

Please do not hesitate to contact the undersigned at cwaterhouse@klohn.com or 07 3004 0244

Yours truly,

KCB AUSTRALIA PTY LTD.

Carly Waterhouse, MSc., RPGeo
Senior Hydrogeologist/Project Manager

CvS:JJ

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the use of Senex Energy Pty Ltd (the client) for the specific application to the Atlas Stage 3 Gas Project and may be published or disclosed by the Client to the Queensland Government, Department of Climate Change, Energy, The Environment and Water (DCCEEW).

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered; however, the use of this report will be at the user's sole risk absolutely and in all respects, and KCB makes no warranty, express or implied. This report may not be relied upon by any person other than the Client or DCCEEW without KCB's written consent.

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1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
2. Observations, findings, and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
3. The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
4. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
5. This report is electronically signed and sealed, and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

1 INTRODUCTION

KCB Australia Pty Ltd (KCB) was commissioned by Senex Energy Pty Ltd (Senex) to provide hydrogeological support for a bore drilling and installation program at the Atlas Stage 3 Project (the Project) near Wandoan, Queensland.

Senex, on behalf of its subsidiary, Senex Assets 2 Pty Ltd (ABN 50 008 942 827), is currently authorised to conduct petroleum exploration activities in accordance with its Environmental Authority (EA) (EA0002524) within Petroleum Leases (PL) 445 and 209. PL209 and PL445 are located 10 km southwest of Wandoan in southern Queensland. Senex proposes to develop, operate, decommission, and rehabilitate new coal seam gas (CSG) wells and associated infrastructure on PL445 and PL209.

The Office of Groundwater Impact Assessment (OGIA) have developed a numerical groundwater model to simulate impacts associated with CSG production by multiple operators in the Surat Cumulative Management Area (CMA). The OGIA model includes Senex's tenements and was used to simulate Senex's proposed CSG activities. The model predictions indicate a potential drawdown of 0.9 m in the Upper Springbok Sandstone, which is associated with the proposed development (OGIA 2021a). This potential drawdown was predicted in the vicinity of Woleebee Creek in areas of potential groundwater dependent ecosystems (GDEs). Predicted drawdown in the Upper Springbok Sandstone is greater than the Queensland *Water Act 2000* trigger threshold for springs and GDEs (0.2 m drawdown). Current understanding (pre-site investigation) suggests that those potential GDEs (associated with Woleebee Creek) may be intermittently supported by groundwater in alluvium (which is not predicted to experience drawdown), however, hydraulic connection between alluvium and the Upper Springbok Sandstone was not fully understood and required further investigation.

Senex have been investigating the potential for a groundwater connection between the shallow Quaternary alluvium and the underlying Upper Springbok Sandstone hydrostratigraphic units. A site investigation (SI) (KCB 2023) was undertaken in December 2022 and January 2023. Senex drilled and constructed three sets of shallow and deep bores in (ATLAS-13M-D/S, ATLAS-14M-D/S and ATLAS-15M-D/S). Atlas-14M-D/S was drilled into the Woleebee Creek alluvium and the Springbok Sandstone. The alluvium bore installed above the Springbok Sandstone (ATLAS-14M-S) was dry and has remained dry since installation, therefore potential connection between Woleebee Creek alluvium and the Springbok Sandstone is still uncertain. As a result, Senex decided to drill an additional set of bores closer to the Woleebee Creek watercourse to provide further information to understand the connection.

This factual report provides a summary of the SI completed at the Project from September 4 to 9, 2023. Geological and hydrogeological data collected as part of this SI were used to support the hydrogeological conceptual model of the area.

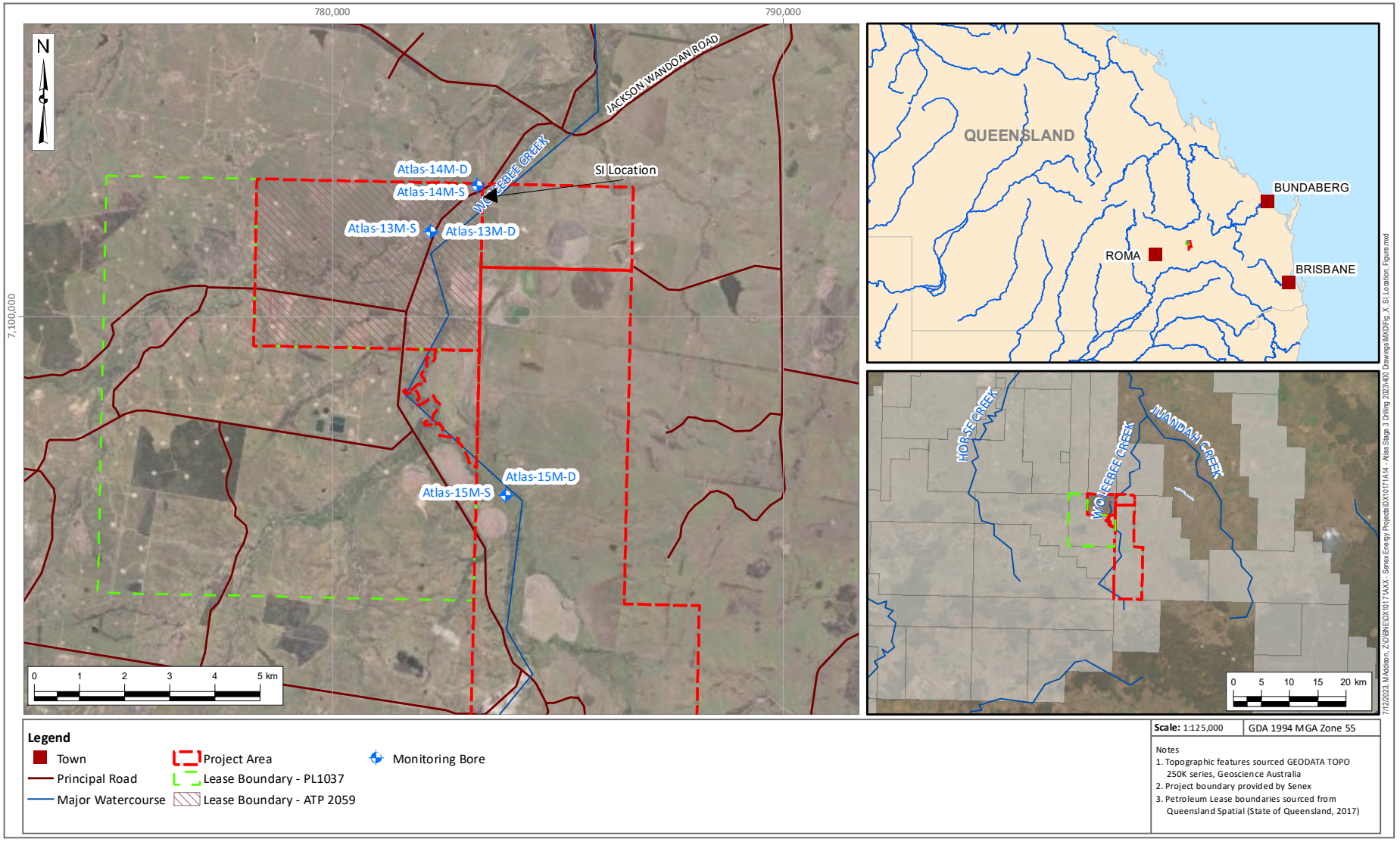

Figure 1.1 Location of Site Investigation

1.1 Site Investigation Overview

Key objectives of the SI included:

- Drill, construct and develop two monitoring bores (one deep (D) and one shallow (S)) at one location at the Project.
- Collect groundwater samples from the installed monitoring bores for laboratory water quality analyses.
- Collect and record hydrogeological data from each bore.
- Conduct hydraulic tests to derive estimates of hydraulic conductivity data for the screened hydrostratigraphic units.

1.2 Drilling Rationale

The drilling rationale for each bore is provided in Table 1.1. Two bores were drilled at the selected location, one deep (D) and one shallow (S), to monitor separate hydrostratigraphic units.

Table 1.1 Drilling Rationale for each Monitoring Bore

Bore ID	Property	Drilled Depth (mbGL)	Groundwater Unit	Rationale
ATLAS-19M-D	Pecos Valley	50.0	Springbok Sandstone	▪ Location selected to monitor groundwater within the Upper Springbok Sandstone close to Woleebee Creek. ▪ To gain a further understanding of hydraulic connectivity with shallow groundwater system in alluvium.
ATLAS-19M-S	Pecos Valley	8.0	Quaternary alluvium	▪ Location selected to monitor shallow groundwater in alluvium immediately overlying the Upper Springbok Sandstone close to Woleebee Creek. ▪ To gain a further understanding of hydraulic connectivity with deeper groundwater in the Upper Springbok Sandstone.

mbGL = metres below ground level

2 HYDROGEOLOGICAL CONTEXT

2.1 Geology

The Project is located within the Surat Basin, a basin of Jurassic-Cretaceous age, which is underlain by the Permo-Triassic Bowen Basin. Cenozoic-age formations are present overlying the Surat Basin formations.

Geological units present in the Project area include unconsolidated Quaternary alluvium, and Surat Basin units including the Gubberamunda Sandstone, the Westbourne Formation, and the Upper Springbok Sandstone (Figure 2.1). Summary descriptions of these units are provided below:

- **Quaternary alluvium** overlies Surat Basin units and comprises unconsolidated fluvial, flood wash, and lacustrine sediments deposited over land by creeks and flood events. Alluvium stratigraphy is locally variable.
- **Gubberamunda Sandstone** underlies the Westbourne Formation. Expected lithologies in this unit are "*Medium- to coarse-grained, largely quartzose, poorly sorted sandstone with minor conglomerates and siltstones*" (Geoscience Australia 2022).
- **Westbourne Formation** expected lithologies are "*Fluvial-lacustrine sediments: fine-grained sandstone interbedded with siltstone, claystone, minor coal*" (Geoscience Australia 2022).
- **Upper Springbok Sandstone** conformably underlies the Westbourne Formation. Expected lithologies in this unit are "*Clayey lithic sublabile to very lithic sandstone; calcareous in part; interbedded with carbonaceous mudstone and siltstone*" (Geoscience Australia 2022).

2.2 Groundwater

Hydrostratigraphic units targeted during the SI correspond to geological units described in Section 2.1. Encountered hydrostratigraphic units are summarised below.

- **Quaternary alluvium** can represent productive aquifers where they occur due to high porosity and permeability relative to competent rock, however, complex stratigraphy and variable grain size may result in local anisotropy. Alluvial systems within the Project area are generally associated with Wandoan and Woleebee Creeks. A previous site investigation found alluvium to be generally 7 to 10 m thick and dry (year round) where it occurs above the Upper Springbok Sandstone (KCB 2023).
- The **Upper Springbok Sandstone** is a regional 'tight aquifer' (OGIA 2021b) and is a productive sandstone unit. This unit contains interbedded lower hydraulic conductivity layers such as siltstone and mudstone (Geoscience Australia 2022). A previous site investigation found this unit to be lithologically variable with interbedded low permeability layers of mudstone and siltstone which confine groundwater where they occur. The main water strike at Atlas-14M-D was 38.5 mbGL[1] with a post-recovery standing water level of 14.0 mbGL. Water quality from this unit was brackish (KCB 2023).

[1] mbGL – metres below ground level

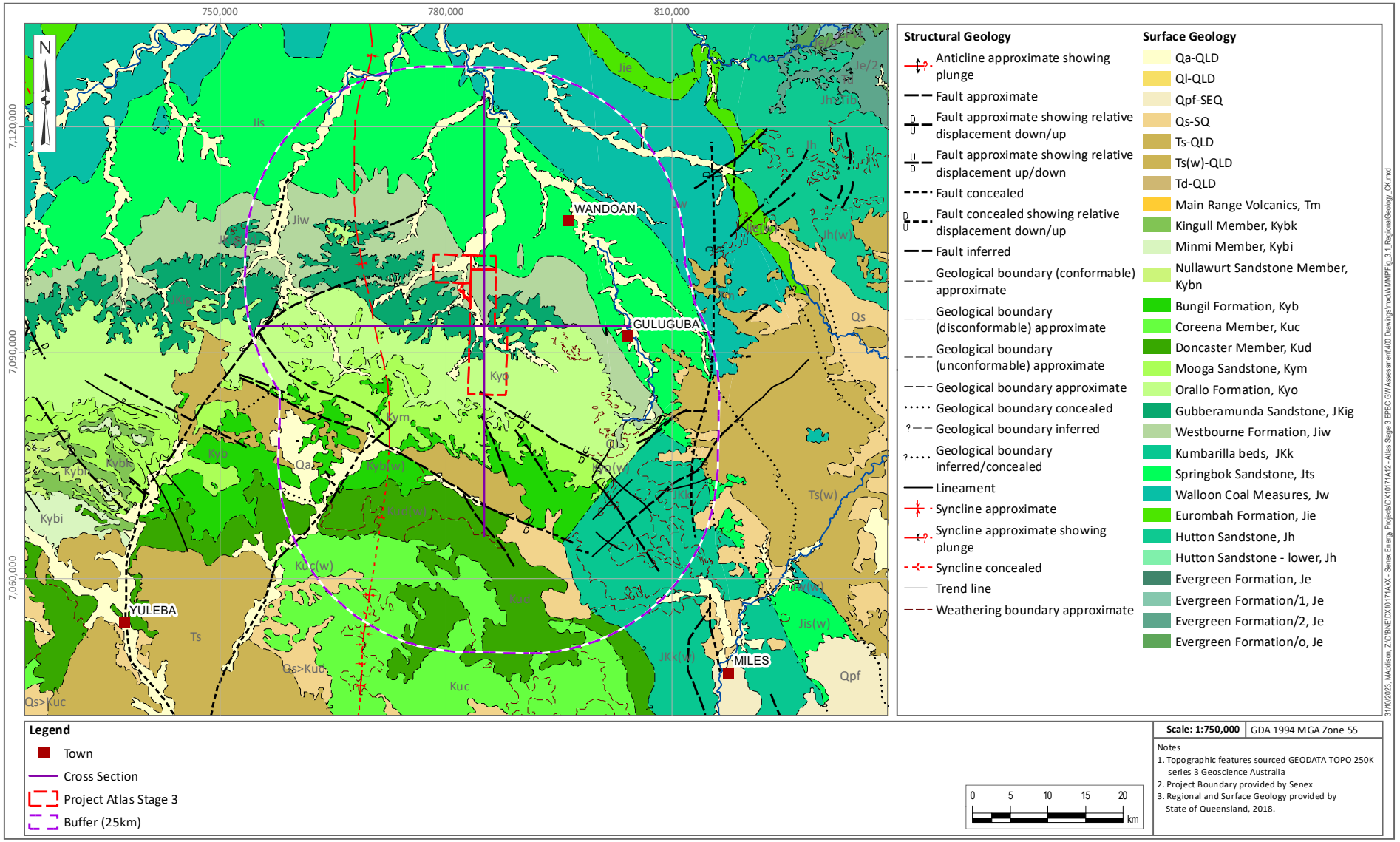

Figure 2.1 Regional Surface Geology

3 SITE INVESTIGATION

3.1 Drilling Program

3.1.1 Overview

The drilling and monitoring bore installation program was completed between 4 and 9 September 2023. A total of two monitoring bores (ATLAS-19M-D and ATLAS-19M-S) were drilled and completed as part of the drilling program.

Drilling, monitoring bore completion and development was undertaken by Legion Drilling. Hydrogeological observations to identify the lithostratigraphy, determine drilling depth and select depth of the screened intervals were completed by a KCB Hydrogeologist.

Bore locations were surveyed prior to drilling by Fyfe and are presented in Figure 3.1. A summary of the installed monitoring bores is provided in Table 3.1.

Table 3.1 Bore Location Summary

Bore ID	GDA94 Zone 56		Stick-up (m)	TOC Elevation (mAHD)	Ground Surface Elevation (mAHD)
	Easting (mE)	Northing (mN)			
ATLAS-19M-D	783359	7102620	0.75	254.57	253.82
ATLAS-19M-S	783356	7102616	0.70	254.45	253.75

Elevations and locations surveyed pre-construction by Fyfe.
'mAHD' = metres above Australian Height Datum.
'TOC' = top of casing.

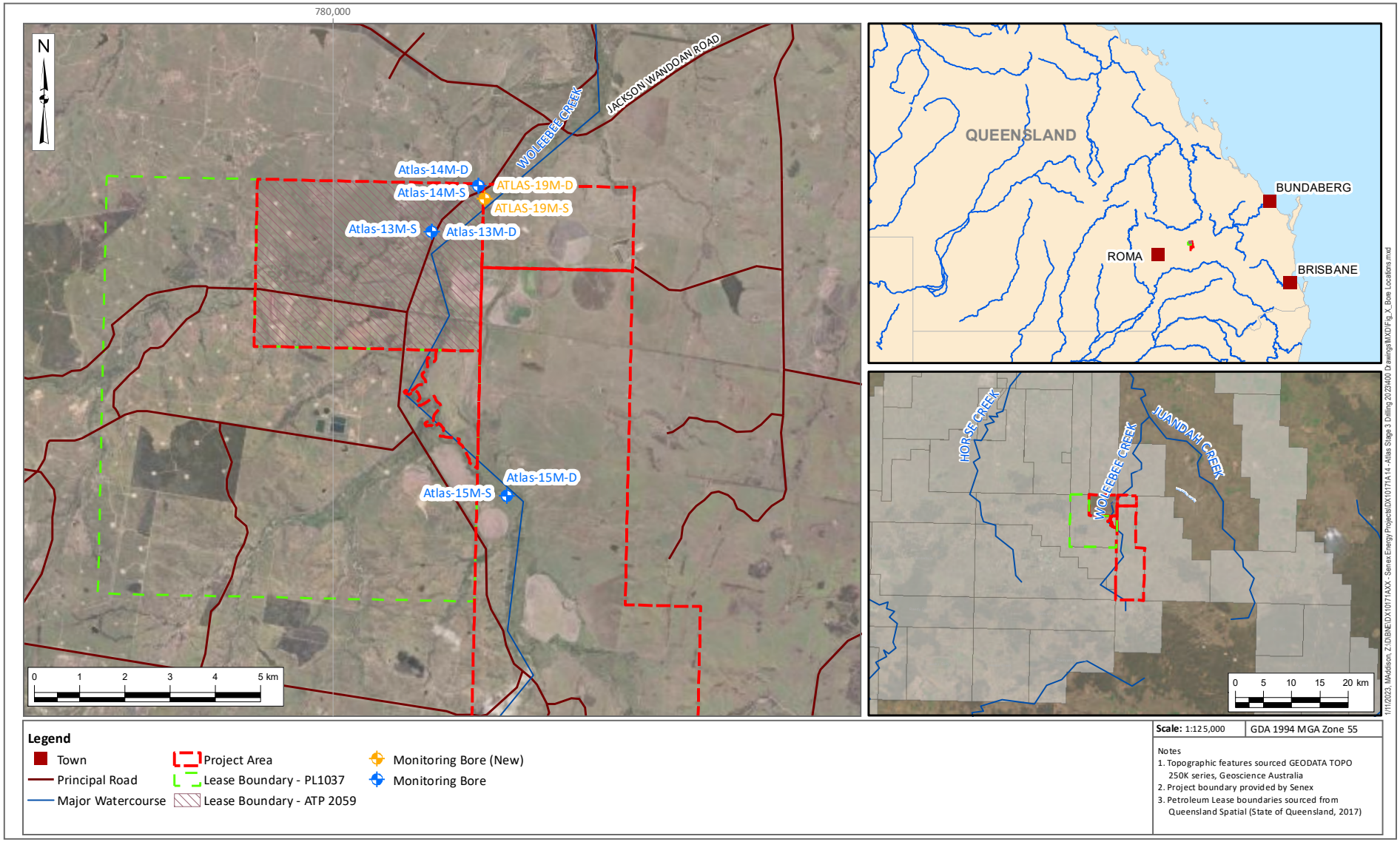

Figure 3.1 Installed Monitoring Bore Locations

3.1.2 Methodology

Drilling

The top section of each hole was drilled using an auger due to the loose, unconsolidated nature of the near-surface formation. The remainder of each hole was drilled using conventional air rotary circulation techniques. Final drill hole depth was determined by the on-site KCB hydrogeologist and was based on drilling observations and associated target hydrostratigraphic unit.

Both bores at this location were drilled using an LGN016 drilling rig equipped with a stepped blade bit. For ATLAS-19M-D, an auger was used initially to drill to 3 m, at which point a 175 mm PVC surface casing was installed to prevent potential collapse at the top of the hole. However, issues with unstable ground (loose sand) occurred between 4 m to 6 m at which point steel surface casing was installed hold back loose sediment whilst drilling continued using a 100 mm diameter hammer drill bit to 50 m.

For ATLAS-19M-S an auger was used for the first 3 m. Steel surface casing was also proactively installed during drilling, based on experience from the deeper bore.

Sampling

Drill cuttings were returned to the surface via air circulation during drilling. These were collected, and lithology logged at one-metre intervals for ATLAS-19M-D and 0.5 m intervals for ATLAS-19M-S. Changes to the drilling penetration rate (resistance), water / air return, moisture / water presence, airlifted groundwater flow rates, water quality, and weathering characteristics were observed. Geological logs are provided in Appendix I, and photographs of drill cuttings are provided in Appendix II.

Construction

Bores were drilled and constructed under the supervision of a Class II licensed water bore driller and in accordance with the '*Minimum Construction Requirements for Water Bores in Australia*' (NUDLC 2020).

Monitoring bores were constructed using 50 mm uPVC, Class 18 threaded casing with 0.5 mm aperture machine slotted uPVC screens. Screen length and zone selection were determined by the on-site KCB hydrogeologist, based on primary water-bearing zones encountered in the target hydrostratigraphic unit.

An end cap was installed on the casing at the base of each monitoring bore. A 3 mm sand filter pack was installed within the annular space adjacent to the screen, from the base of the screen to at least 1 m above the top of the screen. A 1 m thick bentonite seal was installed above the filter pack and in some cases below where drilling extended below target screen depth. The remaining annular space was grouted to the surface using a 3:2 bentonite-cement grout mix.

All bores were completed with a surface concrete plinth and a lockable, protective galvanised steel monument which was painted yellow. Steel lockable fences were installed around each bore.

Long-term Monitoring

A Solinst Pressure Transducer Data Logger (PTDL) (3001 Levelogger 5, M30) was installed in each monitoring bore to record groundwater level at 12-hour intervals. Each PTDL was suspended within the bore using steel cable attached to the bore cap.

3.1.3 Observations

Lithology

Alluvium encountered at ATLAS-19M comprised loose, well-sorted sand with a base layer of cobbles. Drill cuttings were mostly dry with some moisture at the base of alluvium.

Upper Springbok Sandstone lithologies encountered included fine-grained sandstone with interbedded layers of mudstone, shale, and minor coal.

Groundwater

The main water strike at Atlas-19M-D occurred at 12 mbGL and had a flow rate of 0.08 L/s. Increased flow was observed with depth. At 50 mbGL an estimated flow of 0.4 L/s was observed.

Construction

ATLAS-19M-D was drilled to investigate groundwater level and groundwater quality in the Springbok Sandstone and was constructed with two 6 m screens positioned where the main groundwater inflow zones were encountered. The first water strike was encountered at 12 mbGL after which the samples remained wet up to a depth of 50 m. A hard layer was encountered at 42.5 mbGL where gas was present which dissipated/settled within ~40 minutes. Two screens were installed: with the top screen located from 24 to 30 mbGL and the bottom screen located from 39 to 45 mbGL. A sand filter pack was installed from the bottom of the hole to 2 m above the top screen to target areas identified as having the highest potential hydraulic conductivity in the bore (sandstones with low mudstone content), and a 1 m bentonite seal installed above the filter pack. The bore was grouted from above the bentonite seal to the surface (Appendix I).

ATLAS-19M-S was drilled to investigate groundwater level and groundwater quality in the Quaternary alluvium and was constructed with a 3 m screen at the base of the unit at 4.5 to 7.5 mbGL. A 0.8 m bentonite plug was installed below the screen to isolate the base of alluvium from the underlying unit. A 4.2 m sand filter pack was installed from below the base of the screen to 1 m above the top of screen (4.5 to 7.7 mbGL). A 0.5 m bentonite seal was installed above the filter pack. The bore was then grouted to surface (Appendix I).

A monitoring bore installation summary is provided in Table 3.2. Detailed construction schematics for each bore are included in the borehole logs (Appendix I).

Table 3.2 Monitoring Bore Installation Summary

Bore ID	Drilled Depth (mbGL)	Water Strike (mbGL)	Screened Interval (mbGL)		Screened Unit
			Top	Bottom	
ATLAS-19M-D	50.0	12	24.0	30.0	Springbok Sandstone
			39.0	40.0	Springbok Sandstone
ATLAS-19M-S	8.0	ND	4.5	7.5	Alluvium

mbGL = metres below ground level.
ND = No data (dry bore)

3.2 Airlift Development

Monitoring bores were developed using the airlift method. This approach involved delivery of compressed air into the screened interval of each bore using a HDPE hose which resulted in air/water being circulated to the surface via the bore casing and directed (and collected) away from the bore.

In-situ field physico-chemical parameters (pH, electrical conductivity (EC), temperature) of the airlifted groundwater were recorded during bore development using a TPS WP-81 handheld water quality meter. The water quality meter was calibrated daily to maintain accurate measurements. Development was determined to be complete once field physico-chemical parameters had stabilised, and groundwater was sufficiently clear of fine/silt content (based on visual estimates).

A summary of final airlift yield and physico-chemical parameters is provided in Table 3.3. Full development records are provided in Appendix III. ATLAS-19M-S was not developed as the bore was dry.

Table 3.3 Monitoring Bore Airlift Development Data Summary

Bore ID	Airlift Yield (L/s)	Physico-Chemical Parameters (Field)	
		pH	EC (µS/cm)
ATLAS-19M-D	0.19	8.24	10,700
ATLAS-19M-S	ND	ND	ND

µS/cm = Micro siemens per centimetre.
L/s = Litres per second.
ND = No data (dry bore)

3.3 Groundwater Chemistry

Groundwater samples were collected from monitoring bores following completion of airlift development in accordance with industry-accepted water sampling practice (AS/NZS 5667.11 2018).

Groundwater samples were delivered under chain of custody protocol to a NATA-accredited laboratory (ALS) for chemical analysis. Key laboratory groundwater quality data are summarised in Table 3.4. Full laboratory reports/certificates of analyses are provided in Appendix IV.

Table 3.4 Groundwater Quality Data Summary – Key Analytes (Laboratory)

Bore ID	TDS	Total Alkalinity ($CaCO_3$)	Na	Ca	K	Mg	Cl	SO_4	F
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ATLAS-19M-D	7340	265	2220	41	7	5	3770	<1	0.8
ATLAS-19M-S	ND	ND	ND	ND	ND	ND	ND	ND	ND

mg/L = Milligrams per litre.
ND = No data (dry bore)

3.4 Groundwater Levels

Groundwater level data were collected from monitoring bores approximately one day after development to allow groundwater levels sufficiently to recover. Depth to groundwater was measured from the top of casing (or stick-up), and the stick-up height was measured.

Recorded groundwater level data are summarised in Table 3.5.

Table 3.5 Groundwater Level Data Summary

Bore ID	Water Strike (mbGL)	Stick-up (m)	SWL (mbTOC)	SWL (mbGL)	GW Elevation (mAHD)
ATLAS-19M-D	12.00	0.70	14.34	13.64	253.82
ATLAS-19M-S	ND	0.75	ND	ND	ND

mAHD = Metres above Australian height datum.
mbGL = Metres below ground level.
ND = No data (dry bore)
SWL = Static water level.
TOC = Top of casing.
GW = Groundwater.

3.5 Hydraulic Tests

Hydraulic tests (slug tests) were completed at ATLAS-19M-D the next day following airlift development. Slug tests are based on the displacement of the water level inside a bore, resulting in the recovery of the groundwater level to pre-test conditions. The rate of recovery of the groundwater level is a function of the hydraulic conductivity of the screened formation. A summary of the slug test methodology is provided below:

- Static water level (SWL) was recorded by measuring water level in mbTOC using a manual dipper, minus casing height (stick-up) to obtain the SWL in mbGL.
- A PTDL set to record the groundwater level at one-second intervals was installed in the bore at 44 mbGL to monitor the changing groundwater level during the test.
- A calibrated Waterra three-part slug, with a combined length of 1.93 m designed to displace 1 m of water inside the bore, was placed into the bore suspended by a steel cable. The PTDL recorded falling water levels following the initial displacement (caused by the slug) as groundwater in the bore recovered to pre-test conditions. This process is known as a Falling Head Test (FHT).

- Following the recovery of the water level to the pre-test conditions, the slug was removed from the bore to create an instantaneous drop in groundwater level inside the bore. The PTDL recorded rising water level in the bore as groundwater in the bore recovered to pre-test conditions. This is known as a Rising Head Test (RHT).
- Regular, manual groundwater level measurements were recorded until water levels either returned to pre-test conditions, or to within 5% of initial displacement.
- The PTDL was removed from the bore following groundwater recovery after the RHT. Data from the PTDL were downloaded for analysis.
- Raw data from each test were plotted as pressure head versus time and converted to deviation from static head (or displacement head) versus time.
- Hydraulic conductivity values were calculated using AQTESOLV v. 4.5 software (HydroSOLVE Inc 2007). Analytical solutions were selected based on hydrogeological conditions and aquifer response (Butler 1998).

Hydraulic conductivity estimates for ATLAS-19M-D are summarised in Table 3.6. Individual analyses from each test are provided in Appendix V. Hydraulic conductivity estimates should be reviewed in conjunction with lithological descriptions provided in geological logs (Appendix I). The KGS Model (1994) was used for analysis and is considered an appropriate solution for a slug test in an unconfined aquifer with partial penetration (Hyder et al. 1994).

Table 3.6 Monitoring Bore Hydraulic Conductivity Estimates, Analysis Methods, and General Notes

Bore ID	Formation	Aquifer Model	Test Type	Hydraulic Conductivity (m/day)	Solution Method
ATLAS-19M-D	Springbok Sandstone	Unconfined	FHT	0.31	KGS
		Unconfined	RHT	0.16	KGS
ATLAS-19M-S	Alluvium	ND	ND	ND	ND

FHT = Falling Head Test.
RHT = Rising Head Test.
m/day = Metres per day.
ND = No data (dry bore)

4 CLOSING

Atlas-19M-D and Atlas-19M-S will be added to the baseline monitoring network as part of ongoing monitoring in accordance with Senex Atlas Stage 3 Water Monitoring and Management Plan (WMMP).

We would like to thank Senex Energy Pty Ltd for the opportunity to work on this assignment. Please do not hesitate to contact the undersigned should you have any questions.

KCB AUSTRALIA PTY LTD.

Carly Waterhouse, MSc, RPGeo
Senior Hydrogeologist, Project Manager

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APPENDIX I

Geological Logs and Bore Construction Details

Klohn Crippen Berger

Borehole No. **ATLAS-19M-D**

Page **1 of 1**

Project No. **DX10171A14**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started: **06/09/23**

Date Completed: **08/09/23**

Logged by: **C van Staden**

Checked by: **C. Strachotta**

Contractor:	**Legion Drilling**	Northing:	**7102620N**	Hole Depth (mbgl):	**50.0**
Hole Location:	**Peco's Valley 10FT949**	Easting:	**783359E**	Stick Up (m):	**0.70**
Hole Diameter (mm):	**100**	Elevation (m):	**253.82 m**	Static Water Level (mbgl):	**13.64**
Rig Details:	**LGN016**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drlling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
253	1	RESIDUAL SOIL: organic CLAY (OL), intact, dark brown, slightly moist.				
252	2	1.00 m ALLUVIUM: fine to medium-grained sand. light brown, slightly moist (1.5-2 m), becoming more most (3 m onwards).				
251	3	3.00 m ALLUVIUM: fine to medium-grained sand, light brown to cream, dry.				
250	4					
249	5					
248	6					
247	7					
246	8	8.00 m SANDSTONE: fine-grained, light grey to dark grey, slightly moist, extremely weathered.				
245	9					
244	10					Grouted to surface (bentonite/cement mixture). Lockable monument installed. uPVC blank casing 50 mm.
243	11	11.00 m MUDSTONE: dark brown, dry.				
242	12	12.00 m COAL: black, weak, wet.	►			
241	13	13.00 m SILTSTONE & MUDSTONE: interbedded, grey to dark grey, wet.		▼		
240	14					
239	15					
238	16					
237	17					
236	18	18.00 m SHALE: dark grey to black, fine grained, wet.				
235	19					
234	20					Bentonite seal (hydrated)
233	21	21.00 m SANDSTONE: light grey and dark grey, coarse-grained, black grains (0.5-2 mm), wet.				
232	22					
231	23					
230	24					
229	25					
228	26					
227	27					
226	28					6 m uPVC 50 mm slotted screen, 0.5 mm aperture (24 - 30 m)
225	29	29.00 m SILTSTONE: dark grey, hard, wet.				
224	30					
223	31					
222	32					
221	33	33.00 m SILTSTONE & SANDSTONE: interbedded, light grey and dark grey, wet, fine to medium-grained sandstone.				
220	34					
219	35					
218	36					
217	37					
216	38					
215	39					uPVC blank casing 50 mm. 3 mm sand filter pack
214	40	40.00 m COAL: black, weak, wet.				
213	41	41.00 m SILTSTONE & SANDSTONE: interbedded, light grey and dark grey, wet, sandstone fine to medium-grained, [Gas encountered beneath confining hard layer at 42.5 m].				
212	42					
211	43	43.00 m COAL: black, weak, wet.				
210	44	44.00 m SILTSTONE: dark grey, hard, wet.	►			
209	45					
208	46					
207	47					
206	48					
205	49					
204	50	50.00 m ATLAS-19M-D terminated at 50.00 m.				6 m uPVC 50 mm slotted screen, 0.5 mm aperture (39 - 45 m)

Notes

Lost returns between 5 - 8 m then started using PWT to retain hole wall integrity to 9 m. Used blade bit to end of hole at 50 m. Gas encountered beneath hard layer at 42 m; goundwater level settled at 13.64 mbGL. Bore was developed until pH and EC stabilised and water became clear.

Klohn Crippen Berger

Borehole No. **ATLAS-19M-S**

Page **1 of 1**

Project No. **DX10171A14**

Client: **Senex Energy**

Status: **FINAL**

Project: **Project Atlas**

Date Started: **08/09/23**

Date Completed: **09/09/23**

Logged by: **C van Staden**

Checked by: **C. Strachotta**

Contractor:	**Legion Drilling**	Northing:	**7102616N**	Hole Depth (mbgl):	**8.0**
Hole Location:	**Peco's Valley 10FT949**	Easting:	**783356E**	Stick Up (m):	**0.75**
Hole Diameter (mm):	**100**	Elevation (m):	**253.75 m**	Static Water Level (mbgl):	**Dry**
Rig Details:	**LGN016**	Grid:	**GDA94 / MGA zone 55**	Sampling Method:	**Drill cuttings**
Drilling Method:	**RCG**	Datum:	**AHD**		

Elevation (m)	Depth (m)	Material Description	Water Strike	Static Water Level (mbgl)	Installation Diagram	Installation Details
253	0	TOP SOIL: organic CLAY (OL), intact, dark brown, slightly moist.				
	1.50 m	ALLUVIUM: sand, fine - medium-grained, light brown, slightly moist, becomes dry with depth.				Grouted to surface (bentonite/cement mixture). Lockable monument installed. uPVC blank casing 50 mm.
252	2					
251	3					
250	4					Bentonite seal (hydrated)
249	5					
248	6					3 mm sand filter pack 6 m uPVC 50 mm slotted screen, 0.5 mm aperture (4.5 - 7.5 m)
	6.50 m	ALLUVIUM: sand, fine - medium grained with some rounded gravel and cobbles (10%), light brown, dry 6.5-7.5 m.				
247	7					
	7.00 m	Clayey Pebbly SAND: Fine-medium grained sand with minor rounded pebbles (1-6 mm), low plasticity clay present (stiff to friable, pale brown, dry, cemented).				
	7.50 m	SANDSTONE: fine-grained, light grey to dark grey, slightly moist, extremely weathered.				
246	8					Bentonite seal
	8.00 m	ATLAS-19M-S terminated at 8.00 m.				
245						

Notes

Used PWT to retain hole wall integrity to 9 m. Used blade bit to blow out sand with slow rotation if resistance was encountered. Bore dry after construction. No development.

APPENDIX II

Drill Cutting Photographs

Appendix II
Drill Cutting Photographs

II-1 ATLAS-19M-D

Photograph II-1.1 Drill recovery chips; 1 – 5 m depth

Photograph II-1.2 Drill recovery chips; 6-10 m depth

Photograph II-1.3 Drill recovery chips; 10 – 15 m depth

Photograph II-1.4 Drill recovery chips; 15 – 20 m depth

Photograph II-1.5 Drill recovery chips; 20 – 25 m depth

Photograph II-1.6 Drill recovery chips; 25 – 30 m depth

Photograph II-1.7 Drill recovery chips; 30 – 35 m depth

Photograph II-1.8 Drill recovery chips; 35 – 40 m depth

Photograph II-1.9 Drill recovery chips; 40 – 45 m depth

Photograph II-1.10 Drill recovery chips; 45 – 50 m depth

II-2 ATLAS-19M-S

Photograph II-2.1 Drill recovery chips; 0 – 2 m depth

Photograph II-2.2 Drill recovery chips; 2.5 – 4.5 m depth

Photograph II-2.3 Drill recovery chips; 5 – 8 m depth

APPENDIX III

Development Records

Appendix III
Development Records

III-1 ATLAS-19M-D

Table III-1.1 Development Record for ATLAS-19M-D

Time	Purge Time (mins)	pH	EC (µS/cm)	Flow Rate (L/s)	Description
13:10	0				
13:15	5	7.88	2.46		Clear slightly turbid
13:25	15	6.24	8.32		Silty and grey
13:35	25	7.38	8.39	0.19	Silty and grey
13:45	35	8.34	8.77		Silty and light brown
13:55	45	8.33	9.07		Silty and light brown
14:05	55	8.32	9.5		Silty and cream
14:15	1:05	8.25	10.5		Silty and cream
14:25	1:15	8.29	10.8		Slightly silty
14:35	1:25	8.24	10.7		Clear

APPENDIX IV

Laboratory Analysis Certificates

CERTIFICATE OF ANALYSIS

Work Order	: **EB2328142**	Page	: 1 of 8
Client	: **SENEX ENERGY LIMITED**	Laboratory	: Environmental Division Brisbane
Contact	: LIDIA GOSSMANN	Contact	: Customer Services EB
Address	: GPO BOX 2233 BRISBANE QLD, AUSTRALIA 4001	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3335 9716	Telephone	: +61-7-3243 7222
Project	: GDE monitoring bores – Atlas Field	Date Samples Received	: 11-Sep-2023 10:20
Order number	: 18924	Date Analysis Commenced	: 12-Sep-2023
C-O-C number	: ----	Issue Date	: 19-Sep-2023 15:13
Sampler	: CHRISTEL VAN STADEN		
Site	: Wandoan		
Quote number	: EB23SENEXENE0003 V2		
No. of samples received	: 6		
No. of samples analysed	: 6		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Beatriz Llarinas	Senior Chemist - Inorganics	WB Water Lab Brisbane, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- It is recognised that EG020T (Total Metals by ICP-MS) is less than EG020F (Dissolved Metals by ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	Atlas-15m-D	Atlas-15m-S	Atlas-14m-D	Atlas-13m-D	Atlas-19m-D
			Sampling date / time	05-Sep-2023 00:00	05-Sep-2023 00:00	06-Sep-2023 00:00	06-Sep-2023 00:00	09-Sep-2023 00:00
Compound	CAS Number	LOR	Unit	EB2328142-001	EB2328142-002	EB2328142-003	EB2328142-004	EB2328142-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.04**	**7.05**	**7.98**	**7.86**	**8.23**
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	**28.9**	**30.4**	**93.7**	**84.0**	**87.1**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**14400**	**21800**	**8620**	**8220**	**11300**
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**9360**	**14200**	**5600**	**5340**	**7340**
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**1540**	**2750**	**62**	**75**	**123**
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**9.50**	**14.4**	**5.75**	**4.90**	**5.50**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**481**	**573**	**301**	**282**	**265**
Total Alkalinity as CaCO3	----	1	mg/L	**481**	**573**	**301**	**282**	**265**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**682**	**1080**	<1	**6**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**4790**	**7100**	**2760**	**2600**	**3770**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**450**	**723**	**20**	**25**	**41**
Magnesium	7439-95-4	1	mg/L	**100**	**229**	**3**	**3**	**5**
Sodium	7440-23-5	1	mg/L	**2600**	**3660**	**1700**	**1670**	**2220**
Potassium	7440-09-7	1	mg/L	**16**	**27**	**5**	**5**	**7**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	**0.01**	**0.02**	**0.01**
Arsenic	7440-38-2	0.001	mg/L	**0.002**	**0.001**	**0.005**	**0.002**	**0.002**
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L	**0.155**	**0.094**	**0.790**	**0.777**	**1.59**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**0.0001**	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	**0.004**	**0.005**	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-15m-D	Atlas-15m-S	Atlas-14m-D	Atlas-13m-D	Atlas-19m-D
				Sampling date / time	05-Sep-2023 00:00	05-Sep-2023 00:00	06-Sep-2023 00:00	06-Sep-2023 00:00	09-Sep-2023 00:00
Compound	CAS Number	LOR	Unit		EB2328142-001	EB2328142-002	EB2328142-003	EB2328142-004	EB2328142-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L		<0.001	**0.018**	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**1.70**	**2.63**	**0.018**	**0.112**	**0.014**
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	**0.004**	**0.006**	**0.006**	**0.002**
Nickel	7440-02-0	0.001	mg/L		**0.002**	**0.044**	**0.001**	**0.001**	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**11.0**	**19.1**	**1.44**	**1.39**	**2.63**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.021**	**0.022**	**0.012**	<0.005	<0.005
Boron	7440-42-8	0.05	mg/L		**0.43**	**0.39**	**0.21**	**0.36**	**0.25**
Iron	7439-89-6	0.05	mg/L		**3.20**	**0.55**	<0.05	**0.14**	<0.05
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.09**	**0.06**	**0.22**	**0.06**	**0.56**
Arsenic	7440-38-2	0.001	mg/L		**0.002**	**0.002**	**0.004**	**0.002**	**0.002**
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		**0.153**	**0.089**	**0.769**	**0.710**	**1.52**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	**0.0001**	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	**0.014**	**0.002**	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		**0.004**	**0.006**	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		**0.003**	**0.020**	**0.002**	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**1.53**	**2.35**	**0.017**	**0.100**	**0.017**
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	**0.004**	**0.006**	**0.006**	**0.002**
Nickel	7440-02-0	0.001	mg/L		**0.003**	**0.042**	**0.002**	**0.002**	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**9.93**	**17.2**	**1.31**	**1.28**	**2.36**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.020**	**0.010**	**0.019**	**0.009**	<0.005
Boron	7440-42-8	0.05	mg/L		**0.48**	**0.48**	**0.23**	**0.42**	**0.28**
Iron	7439-89-6	0.05	mg/L		**3.25**	**1.05**	**0.28**	**0.20**	**0.37**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-15m-D	Atlas-15m-S	Atlas-14m-D	Atlas-13m-D	Atlas-19m-D
				Sampling date / time	05-Sep-2023 00:00	05-Sep-2023 00:00	06-Sep-2023 00:00	06-Sep-2023 00:00	09-Sep-2023 00:00
Compound	CAS Number	LOR	Unit		EB2328142-001	EB2328142-002	EB2328142-003	EB2328142-004	EB2328142-005
					Result	Result	Result	Result	Result
EG052F: Dissolved Silica by ICPAES									
Silicon as SiO2	14464-46-1	0.1	mg/L		**25.3**	**51.4**	**12.6**	**16.0**	**12.1**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.4**	**1.1**	**0.9**	**0.8**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**159**	**234**	**83.9**	**79.1**	**112**
ø Total Cations	----	0.01	meq/L		**144**	**215**	**75.3**	**74.3**	**99.2**
ø Ionic Balance	----	0.01	%		**4.86**	**4.32**	**5.37**	**3.16**	**5.90**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-15m-S1	----	----	----	----
				Sampling date / time	05-Sep-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2328142-006	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.10**	----	----	----	----
EA006: Sodium Adsorption Ratio (SAR)									
^ Sodium Adsorption Ratio	----	0.01	-		**30.8**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**21700**	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	1	mg/L		**14100**	----	----	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		**2760**	----	----	----	----
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**14.4**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**572**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**572**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**1100**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**7100**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**725**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**232**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**3720**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**27**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.001**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.093**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		**0.0001**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		**0.005**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-15m-S1	----	----	----	----
				Sampling date / time	05-Sep-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2328142-006	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L		**0.016**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**2.62**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.003**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.046**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L		**18.5**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.011**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.39**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.54**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.12**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.002**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.090**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		**0.0001**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		**0.013**	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		**0.006**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.020**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**2.28**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.005**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.040**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L		**16.8**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.010**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.47**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**1.05**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Atlas-15m-S1	----	----	----	----
				Sampling date / time	05-Sep-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2328142-006	--------	--------	--------	--------
					Result	----	----	----	----
EG052F: Dissolved Silica by ICPAES									
Silicon as SiO2	14464-46-1	0.1	mg/L		**51.2**	**----**	**----**	**----**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**----**	**----**	**----**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**235**	**----**	**----**	**----**	**----**
ø **Total Cations**	----	0.01	meq/L		**218**	**----**	**----**	**----**	**----**
ø **Ionic Balance**	----	0.01	%		**3.72**	**----**	**----**	**----**	**----**

APPENDIX V

Hydraulic Tests

Appendix V
Hydraulic Tests

V-1 ATLAS-19M-D

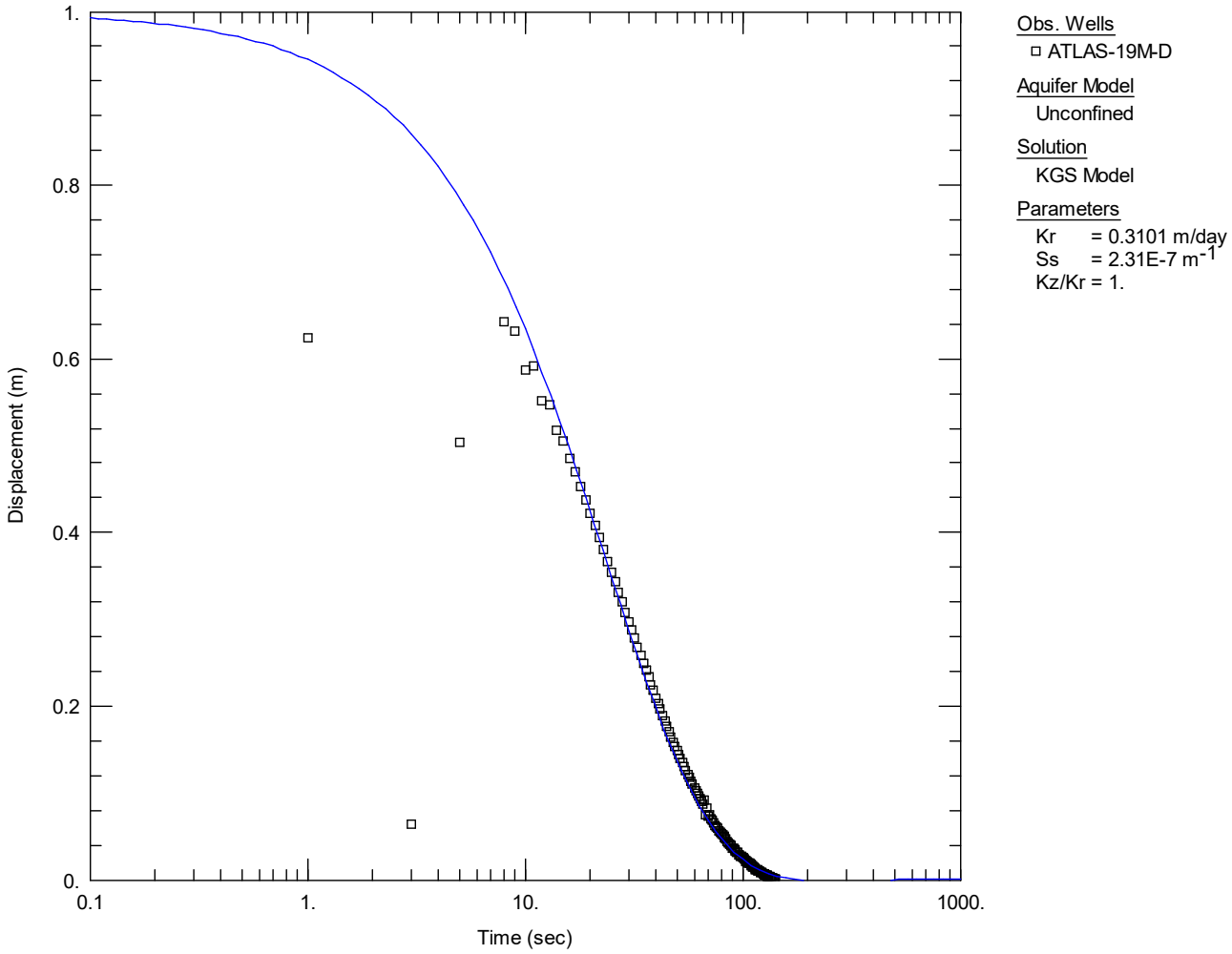

Figure V-1.1 Slug test analysis for Atlas-19M-D (falling head test)

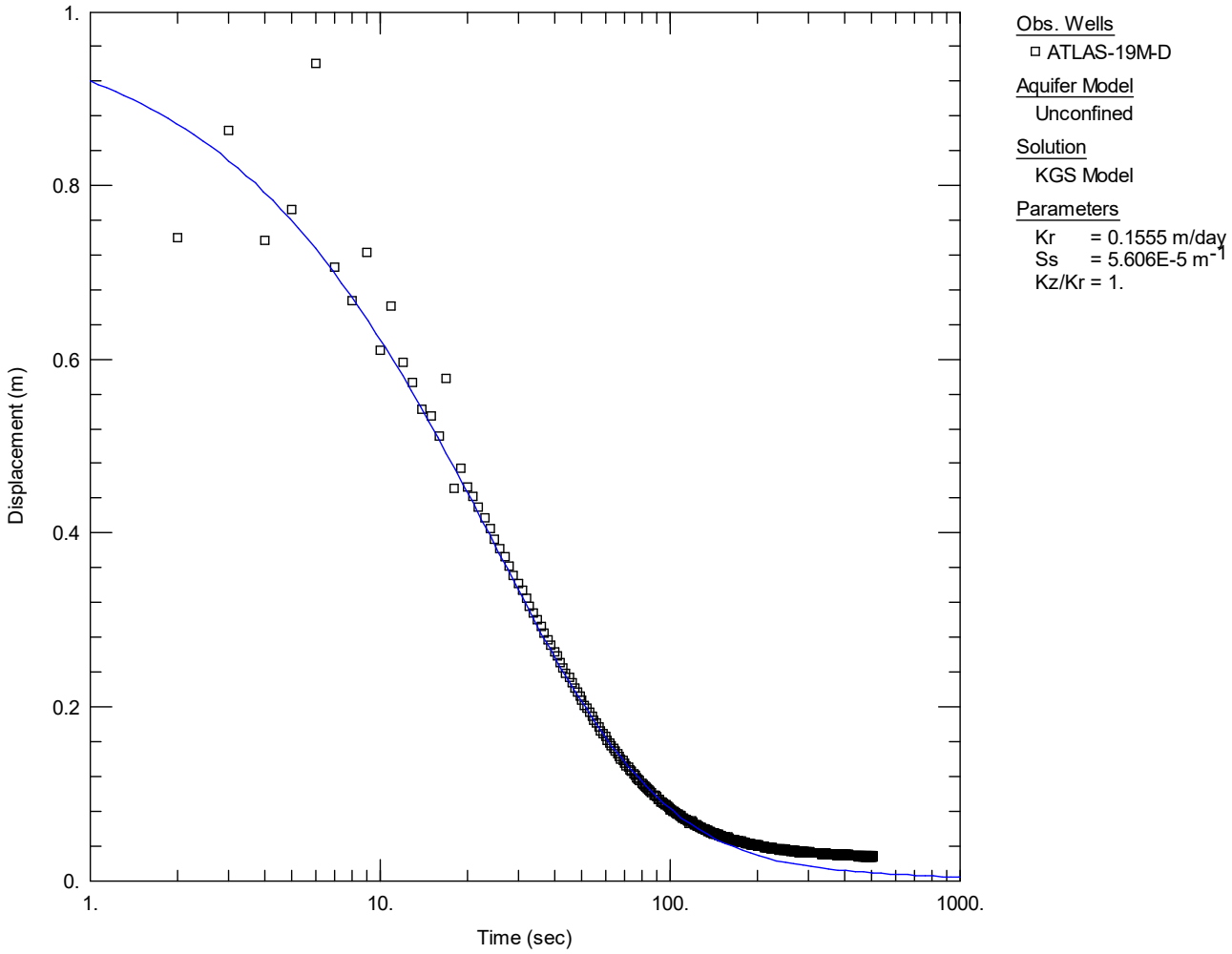

Figure V-1.2 Slug test analysis for Atlas-19M-D (rising head test)