



Orica Australia Pty Ltd

Detailed Site Investigation

Yarwun Manufacturing Facility
30 Reid Road, Yarwun, QLD

31 August 2017

52877 109702 R001 Rev 0

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Executive Summary

JBS&G Australia Pty Ltd (JBS&G) was engaged by Orica Australia Pty Ltd (the client) to conduct a Detailed Site Investigation (DSI) for the land identified as Lot 138 on CTN2123, located at 30 Reid Road, Yarwun, Queensland (the site).

A site location map is presented as **Figure 1**. A site features plan which shows the site boundaries is provided as **Figure 2**.

It is understood that Orica was issued a notice to conduct or commission an environmental evaluation from the Queensland Department of Environment and Heritage Protection (EHP) on 21 July 2017. The notice was issued on the grounds that *under section 326B of the Environmental Protection Act 1994 the administering authority is satisfied on reasonable grounds that an activity or proposed activity is causing, or is likely to cause environmental harm*. The environmental harm relates to increasing concentrations of free cyanide (on site), ammonia and nitrate (on site, at the site boundary and off site) in groundwater. The notice listed a number of requirements for Orica to implement. The first requirement was to engage a Suitable Qualified Person (SQP) to conduct a DSI (this report).

The second requirement was to engage a SQP to produce a revised Conceptual Site Model (CSM).

The third requirement was to engage a SQP to prepare a Contamination Action Plan (CAP).

The objectives of the investigation are to assess the potential for groundwater contamination based on current and historical site activities to draw preliminary conclusions on the following:

- Potential or actual sources of contamination;
- Areas/locations of potential or actual contamination;
- Potential or actual locations that may be pathways for groundwater contamination; and
- Potential ecological receptors.

The objectives of this report have been taken directly from requirement 1 of the notice. Future reports will address other notice conditions.

Subject to the limitations in **Section 9**, it is concluded that:

- A number of potential or actual sources of contamination have been identified. The primary concerns relate to the AN and CC plants;
- Historical groundwater (perched water and shallow aquifer) and surface water investigations have identified that actual contamination exists. The primary concerns relate to cyanide, nitrate and ammonia at concentrations exceeding adopted criteria;
- Potential pathways for groundwater contaminant migration include stormwater and perched water, with perched water likely to represent the primary concern; and
- The potential ecological receptors of site originated contamination which are of greatest concern represent ecosystems dependent upon the tidal mud flats and the broader Port Curtis area.

It is recommended that information gathered in this DSI is used to address the second and third requirements of the notice, being the generation of a revised CSM and CAP.

1. Introduction

1.1 Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by Orica Australia Pty Ltd (the client) to conduct a Detailed Site Investigation (DSI) for the land identified as Lot 138 on CTN2123, located at 30 Reid Road, Yarwun, Queensland (the site).

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The second requirement was to engage a SQP to produce a revised Conceptual Site Model (CSM).

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1.2 Objectives

The objectives of the investigation are to assess the potential for groundwater contamination based on current and historical site activities to draw preliminary conclusions on the following:

- Potential or actual sources of contamination;
- Areas/locations of potential or actual contamination;
- Potential or actual locations that may be pathways for groundwater contamination; and
- Potential ecological receptors.

The objectives of this report have been taken directly from requirement 1 of the notice. Future reports will address other notice conditions.

1.3 Scope of Works

The scope of work completed comprised:

- Review of site conditions and readily available site history records to identify areas of environmental concern (AEC) and associated contaminants of potential concern (COPC);
- Completion of a detailed site inspection;
- Discussions with Orica personnel familiar with current and previous site operations to identify historic site activities;
- Review of previous environmental reports made available to JBS&G; and
- Preparation of a detailed site investigation report in general accordance with relevant Queensland EHP issued and endorsed guidelines and the National Environmental Protection (Assessment of Site Contamination) Measure as amended 2013 (ASC NEPM).

On the basis of the notice (i.e. groundwater focused), the properties of the site contaminants, and the limited nature of the available soil data, this report has not considered historical soil results. The

historical soil data and the need for additional soil assessment will be considered in detail as part of future works to address requirement 2 of the notice.

The scope of works completed in this DSI report was conducted by a SQP in accordance with the EHP *Guideline for Assessing a Suitably Qualified Person* (EHP, 2016) and the *Environmental Protection Act 1994*.

1.4 Previous Reports

A series of environmental investigations and groundwater monitoring rounds have been conducted at the site over the past 17 years. Orica engaged Environmental Ground, Water and Air Consultants Pty Ltd (EGC) to undertake investigations from 2000 to 2007. Groundwater monitoring rounds were completed by CCI Laboratories in July 2007 and January 2008. Between August 2007 and March 2010 a significant number of investigations were undertaken by URS Australia Pty Ltd including development of a detailed Conceptual Site Model (URS, 2009). Since 2010 regular groundwater monitoring has been undertaken at the site by Golder Associates Pty Ltd. Detailed analysis of the results of historical monitoring data (up to January 2017) is presented in the Annual Groundwater Monitoring Report¹ (JBS&G, 2017). The most recent groundwater monitoring undertaken by Golder Associates Pty Ltd in July 2017 has also been referenced in this report.

The following documents were made available for completion of the DSI:

- *Review of Potential Sources of Contamination*, URS Australia, 29 April 2008.
- *Preliminary Offsite Surface Water Assessment Orica Yarwun*, URS Australia, 29 April 2008.
- *Soil and Groundwater Investigation, Orica Yarwun*, URS Australia, 29 April 2008.
- *Off-site Surface Water and Sediment Quality Assessment – Dry Season, Orica Yarwun*, URS Australia, 27 November 2008.
- *Stage 3 Soil and Groundwater Investigation, Orica Yarwun*, URS Australia, 27 November 2008.
- *Revised Conceptual Site Model, Orica Yarwun*, URS Australia, February 2009.
- *Surface Water and Groundwater Monitoring Plan, Orica Yarwun*, URS Australia, 29 September 2009.
- *Orica Yarwun – Status Report Nutrients in Groundwater and Surface Water*, URS Australia, 29 September 2009.
- *Orica Yarwun – July 2009 Groundwater Monitoring and Cyanide Delineation Investigation*, URS Australia, 12 January 2010.
- *Remediation of Nutrients in Groundwater, Orica Yarwun – Preferred Remedial Strategy*, Golder Associates Pty Ltd, 13 May 2011.
- *Orica Yarwun - Remediation of Nutrients in Groundwater: Groundwater Extraction and Treatment Preliminary Design Tasks*, Golder Associates Pty Ltd, 5 September 2011.
- *Yarwun Manufacturing Facility Groundwater Remediation Action Plan*, JBS&G Australia Pty Ltd, 30 June 2014.
- *Orica Australia Pty Ltd Yarwun Manufacturing Facility Groundwater Monitoring Plan Reid Road, Yarwun Queensland*, JBS&G Australia Pty Ltd, 25 October 2016.

¹ Orica Australia Pty Ltd Yarwun Manufacturing Facility Annual Groundwater Monitoring Report Reid Road, Yarwun Queensland, JBS&G Australia Pty Ltd, 29 June 2017

- *Orica Australia Pty Ltd Yarwun Manufacturing Facility Annual Groundwater Monitoring Report Reid Road, Yarwun Queensland, JBS&G Australia Pty Ltd, 29 June 2017.*
- *Orica Australia Pty Ltd Yarwun Manufacturing Facility Receiving Environmental Monitoring Program Preliminary Interpretive Report, Reid Road, Yarwun Queensland, JBS&G Australia Pty Ltd, 26 June 2017.*

Material from the reports listed above has been used in this DSI report to detail the existing understanding of the site.

1.5 National Environmental Protection Measure

This DSI was prepared in general accordance with relevant Queensland EHP issued and endorsed guidelines and the ASC NEPM.

Key components of the ASC NEPM can be found in the following sections of this report (refer to **Table 1.1**).

Table 1.1: Summary of Report Contents Against NEPM Requirements

ASC NEPM Requirement	Section in this DSI
Site Identification	Section 2.1
Current and Proposed Use	Section 2.2
Site History	Section 3.2
Environmental Setting	Section 3.1
Local Geology and Hydrology	Section 3.1.6 and Section 3.1.5
Site Inspection	Section 2.3
Conceptual Site Model (CSM)	An updated CSM will be reported separately to this DSI report as part of addressing requirement 2 of the notice.
Systematic Planning for Collection of Environmental Data	This DSI was completed based on previous investigations that were undertaken on the site. An assessment of the adequacy of previous investigation works to determine if they meet the requirements of the ASC NEPM will be included in the updated CSM. It is noted that the ASC NEPM requires that a DSI should identify the nature of contamination and delineate its lateral and vertical extent to a sufficient degree that an appropriate level of risk assessment may be undertaken and, if necessary, provide the bases for the development of an appropriate remediation or management strategy. This has been addressed in Section 4 to Section 7 of this DSI report.
Sampling Design	
Soil Assessment	
Surface Water Assessment	
Groundwater Assessment	
Vapour Assessment	
Contaminant Fate and Transport Modelling	
Data Analysis	This DSI report meets the reporting requirement of the ASC NEPM, noting that some DSI elements are to be addressed in a future document.
Reporting	

2. Site Condition and Surrounding Land Use

2.1 Site Identification

The site is located in the Yarwun Industrial Estate at 30 Reid Road, Yarwun, Queensland. The site location is shown on **Figure 1**. A site features plan which shows the site boundaries is provided as **Figure 2**. The site details are summarised in **Table 2.1** and described in detail in the following sections.

Table 2.1: Summary Site Details

Lot/Plan	Lot 138 on CTN2123
Address	Yarwun Industrial Estate, 30 Reid Road, Yarwun
Local Government Authority	Gladstone Regional Council
Site Zoning	Special Purpose
Current Use	Industrial – Chemical manufacturing facility
Previous Use	Prior to Orica's occupation of the site, the site was undeveloped
Proposed Use	The site is to remain Industrial – Chemical manufacturing facility
Site Area	50.44 ha

2.2 Site Description

The site occupies an area of approximately 50 ha, of which 20 ha is currently developed. Based on information provided by Orica (URS, 2009), the site manufactures sodium cyanide, nitric acid and ammonium nitrate (AN), and, until recently, chlorine. Development of the greenfield site began in 1990, with the construction of the cyanide and chlorine plants. The first acid plant and the first AN plant were constructed in 1993. The second acid plant was subsequently installed, with the third acid plant and second ammonium nitrate (AN) plant constructed in 2005 and 2006.

The developed portion of the site is divided into three broad zones:

- Chemicals Complex (CC);
- AN Plant; and
- The administration area and visitor carpark.

Additional site infrastructure includes an administration building, two control rooms, workshop, store, various storage areas and a container loading and laydown area. The site has two liquid effluent treatment areas, the AN effluent ponds, located north side of the AN tank farm, and the CC effluent ponds, located east of the chlorine processing plant. The site also includes an expanded polystyrene (EPS) plant, which is located on the western boundary of the site.

2.3 Site Inspection

A site inspection was completed by JBS&G personnel on 22 August 2017. During the inspection JBS&G personnel were accompanied by Gary Hill (Senior Development Engineer Orica Yarwun). The inspection included a general walkover of the site and surrounding area as well as a detailed review of potential source areas described in **Section 4**, **Section 7** and **Appendix D** of this DSI report.

It is also noted that JBS&G personnel involved in the DSI have over nine years' experience working on a variety of projects on the site.

2.4 Surrounding Land Use

Table 2.2 presents a summary of the land use immediately surrounding the site.

The Gladstone Area Water Board (GAWB) water treatment plant and Gladstone Regional Council sewage treatment plant are located on the eastern side of Reid Road. A cleared area between these two facilities designates the former site of the Australian Magnesium Corporation's pilot processing plant. To the north of the GAWB water treatment plant (on the corner of Gladstone Mount Larcom Road and Reid Roads) is the tidal mud flats of the Port Curtis.

South of the site is undulating forested land, and a railway easement. West of the site is forested land, and Rio Tinto's alumina refinery (approximately 1 km west of the site). A high voltage transmission line easement runs east-west along the southern border of the site, and a low voltage transmission line easement runs adjacent to the site's northern boundary. An electrical substation is located on the north side of Gladstone Mount Larcom Road.

Table 2.2: Surrounding Land Use

Location	Detail
North	Gladstone Mount Larcom Road, electrical substation, tidal mud flats of the Port Curtis
East	Reid Road, GAWB water treatment plant, Gladstone Regional Council sewage treatment plant
South	Forested land
West	Forested land

3. Desktop Study

The following presents a summary of desktop information previously collated by others. The information presented in this section has predominantly been taken directly from detailed Conceptual Site Model (URS, 2009), with some minor adjustments made for context.

3.1 Environmental Setting

3.1.1 Climate

Gladstone is located in the sub-tropics of northern Australia which are characterised by dry winters and wet summers. Average annual rainfall is 866 mm across an average of 59 days of rain per year. The warmer months, December to March, have high average monthly rainfalls, ranging from 107 to 177 mm (www.bom.gov.au, accessed August 2017). Rainfall during these months typically represents two-thirds of the annual total, while there is typically very little rainfall recorded between May and September.

3.1.2 Topography

Southwest of the site is a coastal mountain range known as Mount Larcom Range. This range grades into small foot hills to the southwest of the site which are likely to direct surface water in an east to north-easterly direction in the vicinity of the site. Prior to development, the site would have sloped to the north and east in the southern portion of the site, whilst the northern portion of the site would have been relatively flat and low lying, consistent with the adjacent undisturbed land areas. Approximately 200-300 m north of the site boundary are the tidal flats of the Port Curtis.

The current site levels have been altered by cut and fill process during the development of the site. Two benches have been cut into the hill located to the southwest of the site, where the Nitric Acid Plant No.3 is located. The surface level of the several sections of the site have involved levelling of smaller undulations by filling.

The site slopes from the hills located to the south-west and west of the site towards Reid Road on the eastern site boundary. The highest point (22 mAHD) of the site is in the south-west corner, and the lowest (5 mAHD) in the northeast corner (adjacent to the junction of Gladstone Mount Larcom Road and Reid Road).

3.1.3 Stormwater

Natural drainage surrounding the site is poorly defined, reflecting low surface runoff conditions and high infiltration rates within the surface soil layers. Down-slope accumulation and sub-surface outflow zones, reflected by more abundant *Melaleuca* species, occur within the tidal mud flats to the northeast of the site (near the junction of Gladstone Mount Larcom Road and Reid Roads). The construction of the Gladstone Mount Larcom Road appears to have altered the natural drainage pathways and subsequently effected the diversity of the ecosystem within the receiving environment. There appears to have been a gradual change in the composition of the community, which has adapted to the longer periods of water logging. On the northern side of the Gladstone Mount Larcom Road, expansive salt flats extend more than 1.5 km to the mangrove lined shore of the Port Curtis estuary.

Stormwater at the CC is collected via a network of pits and conveyed by underground concrete pipes (invert of approximately 2 m bgl) following local topography to the Stormwater Retention System (SWRS) and licensed stormwater discharge point, CC1 in the northeast. Stormwater from CC and the surrounding area also drains into the CC1 SWRS via aboveground drainage.

Stormwater from the administration area and carpark discharges from the site. The administration area drains via underground pipes to the eastern side of Reid Road near the weighbridge entrance to

the site. The carpark drains via a shallow swale drain to the table drain on the western side of Reid Road.

Stormwater at AN is collected via a network of pits and conveyed by underground concrete pipes (invert of approximately 2 m bgl) following local topography to Dam 1, Dam 2 and the licensed discharge point ANP1/ANP2.

A "first flush" system has been installed at the CC and AN discharge points which is designed to capture the initial rainfall off plant areas and hold stormwater in retention basins prior to discharge from the site.

3.1.4 Potential Ecological Receptors

The zone where stormwater discharges from the site mixes with surface waters from the surrounding catchment is the area to the east of Reid Road. This area has undergone significant disturbance both locally (e.g. road construction and industrial development) and in downgradient areas (i.e. coal terminal construction) that have resulted in hydrological changes. These hydrological changes have significantly altered surface water flow regimes with subsequent and ongoing changes in the distribution of flora and fauna in this area (see below).

Modifications to local drainage (notably due to construction works) have increased flows from impervious surfaces at the Site and together with construction work for the WICET mean that this environment is generally wetter than other wooded areas at Yarwun. Stands of trees and other vegetation that are inundated during the wetter parts of the year essentially dry off during prolonged dry spells. However, the mixing zone is likely to remain damp in comparison to other wooded areas of Yarwun.

URS (2012) characterised the floral and faunal ecological values of land surrounding the Orica plant at Yarwun and reported on a field survey of flora, fauna, and habitat undertaken in May - June 2012. A literature review concluded that although seven flora and fifteen fauna conservation significant species may be present on Site only *Cycas megacarpa* (a cycad) and koala were considered likely to be present. The field survey recorded nine fauna species of conservation significance including echidna (*Tachyglossus aculeatus*) and the blacknecked stork (*Ephippiorhynchus asiaticus*). No Environment Protection Biodiversity Conservation (EPBC) Act Threatened Ecological Communities were located on Site. Much of the surrounding land downgradient of the Orica plant is infiltrated by exotic grasses and declared weeds that generally excluded native ground cover species. The downgradient area was described as "disturbed" with the weeds contributing to low environmental values.

URS (2012) found that the mixing zone environment potentially contained significant habitat values. The presence of large *Eucalyptus tereticornis* (forest red gum) and *Melaleuca viridiflora* (broad – leafed tea tree) represent the vegetation present in this area prior to European settlement. The forest trees and native grasses would offer reasonable habitat values for native ground fauna whereas lower-lying areas of wetland are potentially suitable for the wallum froglet and other amphibians and their predators.

The discharge/mixing zone environment is considered to be highly disturbed. Highly disturbed ecosystems contain aquatic biological diversity that may have been adversely affected to a measurable degree by human activity. Biological communities in such systems remain in a healthy condition and ecosystem integrity is largely retained. Highly disturbed systems also include environments receiving runoff from land disturbed to varying degrees, or marine ecosystems lying immediately adjacent to metropolitan areas.

3.1.5 Regional Hydrology

The receiving environment for stormwater discharged from the site is Port Curtis.

Surface water flow from the site to Port Curtis may potentially occur via two flow paths. The first is via a culvert under Gladstone Mount Larcom Road that represents the flow path for Flying Fox Creek. The second is via drains along the southern edge of Gladstone Mount Larcom Road that discharge to an anabranch of the Calliope River. Due to construction of the Wiggins Island Coal Export Terminal (WICET) flow towards the anabranch has been restricted. It is therefore anticipated that the majority of flows from the site will enter Port Curtis via Flying Fox Creek.

The WICET Environmental Impact Statement (EIS) provides a detailed description of the receiving environment and the area to the north of the culvert under Gladstone Mount Larcom Road is described as:

- An intertidal wetland;
- The higher levels are covered by extensive salt pans;
- As Flying Fox Creek becomes more defined it is lined by mangroves (e.g. *Avicennia/Aegicaras/Rhisporoa/Ceriops*);
- Further north (lower levels of the intertidal zone) aggregated patches of *Zostera* sp. seagrass are present in areas of exposed banks (mud and sand); and
- The open waters of Port Curtis are then encountered.

The receiving environment is a low-gradient, intertidal area that extends from Gladstone Mount Larcom Road to the foreshores of Port Curtis. The sediment substrate is comprised of mud and sand. Sparse salt marsh vegetation is present near the discharge point, but is largely barren for 1.0 km to the uppermost reaches of the mangrove stands. The mud/sand flats are dissected by the drainage system (Flying Fox Creek) from the culvert, but elsewhere drainage patterns are indistinct.

Saline waters cover parts of the flats at high tide and during Spring tides waters flood through the culvert. Stormwater discharged through the culvert or other low lying point is expected to mix with fully saline waters over the flats at high tides, but at low tides stormwater would be channelled predominantly down rivulets in the flats.

Beyond the predominantly barren flats, the north-easterly trending rivulet becomes a larger meandering (serpentine) drainage (Flying Fox Creek) that enters an extensive area of mangroves. The meandering drainage continues beyond the mangroves in intertidal and subtidal elevations in a channel that is navigable by small craft.

3.1.6 Regional Geology

The geology of the site is presented on the Rockhampton 1:250 000 Geological Series Map (GSQ, 1974) and on Geology maps available on the Queensland Globe. These maps indicate that the site is underlain by the Devonian Doonside Formation comprised of red, green and white cherts, jasper, mudstone, siltstone, lithic sandstones, tuff and limestone. In the lower (northern) portion of the site, the Doonside Formation appears to be overlain by Quaternary sands, silts, muds and gravels. Quaternary materials are likely to be alluvium derived from former creeks, and may form preferential pathways for groundwater flow and contaminant migration. Based on the cut and fill earthworks undertaken to achieve the current site levels, near surface soils are likely to have been reworked.

Quaternary sands, silts, muds and gravels which comprise the tidal flats of Port Curtis are located to the north of the site.

The stratigraphy encountered during investigations at the site is summarised in the following table (URS, 2009).

Table 3.1: Site Lithology

Material	Depth (m bgl)	Description
PAVEMENTS	0 – 0.3	Asphaltic cement and concrete pavement
FILL	0 – 1.5	Gravelly clay sand, reworked natural soils.
GRAVELLY CLAY	0.5 – 10	Gravelly clay, with varying sand and silt content with depth and location, gravel 3-10 mm, red to grey some mottling. Varying moist to wet throughout profile. Soft to stiff.
CHERT (possibly some Mudstone)	3.0 – 23	Extremely to highly weathered chert (possible some mudstone), within a matrix of extremely weather chert and red/brown to grey clay.

3.1.7 Acid Sulphate Soils

Review of the Australian Soil Resource Information System² indicates that the site is located within an area with extremely low probability of occurrence of acid sulphate soils.

3.1.8 Regional Hydrogeology

Areas of the site are underlain by up to three groundwater units including: perched; shallow; and deep aquifers. The deep aquifer is present in the rock beneath the site and is characterised by low hydraulic conductivity and is not discussed further in this DSI report.

3.1.8.1 Perched Aquifer/Groundwater

A perched groundwater unit has been identified in the reworked gravelly clay fill materials and the upper portion of the residual gravelly clays. The inferred groundwater flow direction in the perched aquifer during both the wet and dry seasons is in a northeast direction towards Port Curtis, generally following the filled natural drainage pathway, at a gradient between 0.005 and 0.01.

There does not appear to be a continuous perched groundwater unit in the vicinity of the Cyanide Plant.

Significant variation (three orders of magnitude) in hydraulic conductivity (and groundwater flux) has been observed in the perched aquifer. The large variation in groundwater flux at different locations is related to the lithology of the perched aquifer (fill; reworked gravelly clay) and the presence of preferential groundwater flow pathways:

- Overall, preferential flow occurs through the natural drainage pathway backfilled for site construction, towards the north east. Downgradient of the Cyanide Plant the plume has two branches, one migrating to the north beneath Cyanide Alley (P12 had a hydraulic conductivity of 10 m/day, though P13 has a very low K) and one migrating east beneath Rankin Road;
- Preferential flow is inferred to occur in backfilled sub-surface utility trenches, in particular in the vicinity of P13 in Cyanide Alley, and P73 and P75 at Heron Drive; and
- Identified preferential pathways at the AN Plant include those associated with a former cutoff drain and reworked fill in the area near P50 as well as associated with the area near P71.

The following table presents a summary of the hydrogeological characteristics of the perched aquifer at the site (URS, 2009).

² <http://www.asris.csiro.au/> (accessed August 2017)

Table 3.2: Perched Aquifer Hydrogeological Characteristics

Depth (m bgl)	Geology	Gradient	Hydraulic Conductivity (m/day)	Horizontal Seepage Velocity (m/year)**
0.5 to 4.0	Fill, including reworked gravelly clay and upper residual gravelly clay	0.007 to 0.01 (Dry Season) 0.008 to 0.02 (Wet Season)	0.06 to 95 <i>0.12* - 13**</i>	0.2 to 2000 <i>2.2* - 237**</i>

Notes: *Geomean of low flow (<1m per day) conditions
 **Geomean of high flow (>1 m per day) conditions
 ***Calculation is based on an average gradient of 0.01 and an effective porosity of 0.2

Groundwater elevations vary seasonally, with generally higher elevations in the wet season compared to the dry season. Water level hydrographs (in the vicinity of Reid Road) for the wet season indicate that the perched aquifer responds very rapidly to rainfall events (JBS&G, 2014). Peak water levels are observed soon after a rainfall event followed by a relatively rapid decline (although the resulting water level remains higher than that before the rainfall). In paved areas (the manufacturing areas of CC and AN) the rainfall response may be less. Recharge of the perched aquifer in the plant area will be limited to unpaved areas upgradient of the plant, through cracks in roads and potentially leaks from subsurface pipes and sections of stormwater drains above the water table.

3.1.8.2 Shallow Aquifer/Groundwater

A shallow groundwater unit is present within the residual gravelly clays at depths between approximately 2 and 12 m. The inferred shallow groundwater flow direction is in a north-east direction towards Port Curtis. Water level hydrographs (in the vicinity of Reid Road) for the wet season indicate that the shallow aquifer responds slowly to rainfall and is more affected by seasonal variations than individual events.

The hydraulic conductivity calculated for the shallow groundwater is likely to be representative of the natural gravelly clay soils encountered beneath the site. The significantly lower hydraulic conductivity of the shallow aquifer (0.02 m/day) suggests the majority of groundwater flux occurs in the overlying perched aquifer (hydraulic conductivity of 0.1 to 100 m/day). However, since there are no aquitard features between aquifer units, some vertical hydraulic connection between perched and shallow aquifers is likely.

The following table presents a summary of the hydrogeological characteristics of the shallow aquifer (URS, 2009).

Table 3.3: Shallow Aquifer Hydrogeological Characteristics

Depth (m bgl)	Geology	Gradient	Hydraulic Conductivity (m/day)	Horizontal Seepage Velocity (m/year)**
2.0 to 8.0	Residual gravelly clay and reworked gravelly clay fill	0.008 to 0.015 (Dry Season) 0.004 to 0.02 (Wet Season)	0.004 to 0.2 <i>0.02*</i>	0.05 to 10 <i>0.39*</i>

Notes: *Geomean conditions
 **Calculation is based on the average gradient and an effective porosity of 0.2

3.2 Site History

3.2.1 Interviews with Persons Familiar with the Site

Site interviews were completed by JBS&G personnel on 22 August 2017. Interviews were undertaken with Gary Hill (Senior Development Engineer, Orica Yarwun) and Mark Evans (Senior Environmental

Specialist, Orica Yarwun). The interviews identified potential sources of contamination on the site and are described in **Section 7** of this DSI. Historical interview details are described below.

On 6 November 2008, URS representatives visited the site to meet with a former Orica employee (Mr Pradip Parghi), who was employed on the site during the early construction of the plant and had additional knowledge on the site ground conditions prior to and during the construction of the plant.

Through the conversations held with Mr Parghi and the review of the historic photographs, the following was noted (URS, 2009):

- In photographs taken during the initial site preparation works, which showed the site clear of vegetation and with minimal earth works, an apparent natural drainage line was evident running from the west across the site to the north east. There were no specific channels evident, rather the drainage path appeared as section of moist ground (based on colour) which broaden to the north east. Given there was no site infrastructure on the site at the time of the photograph, it is difficult to infer where this drainage path ran across the site in relation to existing infrastructure. However, based on the shape of the clearing the drainage path appeared to enter the site from the area behind the current EPS plant and exited the site through the north eastern corner. The presence and approximate location of the drainage path was also noted in historic geotechnical reports, prepared for the construction of the Cyanide Plant;
- In photographs of the construction of the initial cyanide and chlorine plant operations taken in 1989, filling activities are evident several sections of the site. The most predominant filling activities were in the current car park area and the northern eastern corner of the current AN processing area. Based on the photographs, the area beneath the current AN Aboveground Storage Tank (AST) farm was filled and the area beneath the current EP plant was also filled. It is important to note that an open surface water drainage channel, running from west to east on the southern side of Gladstone Mount Larcom Road also appears to be being filled. Filling activities may have also been completed in the north eastern portion of the site, where the current CN effluent ponds are located, however this looks to have been completed at the time of the photograph;
- Through conversations with Mr Parghi, it is understood that the initial cyanide and chlorine plant operations areas were surrounded by an open surface water drain, which ran from west to east and diverted surface water flowing from the south east around the site. The drain was thought to be an open trench which was approximately 0.5 m deep at the highest point then deepened to approximately 1.5 to 2.0 m depth at the outlet to Reid Road. This drain was subsequently filled during the construction of AN plant 1. The presence of this trench was evident on historic construction photographs taken in 1989 and the backfilling of the trench was evident in photographs taken during the June 1991. The outlet of this trench is inferred to be in the approximate location of the current stormwater output point ANP 1.

3.2.2 Historical Land Ownership

Land title information has been reviewed by JBS&G in order to assess whether any current or historical owners of the site can be associated with specific contaminating activities of concern.

Current land title records indicate that the site is currently owned by Orica Australia Pty Ltd.

Historical land title records obtained by JBS&G (see **Appendix A**) indicate:

- The Deed of Grant lists the original owner of Lot 138 CTN2123 as The Minister for Industrial Development of Queensland;
- The Minister for Industrial Development of Queensland owned the site between 1989 and 1990; and

- ICI Australia Operations Pty Ltd (now Orica Australia Pty Ltd) purchased the site in 1990.

Prior to Orica's occupation, the land title records do not provide any indication of specific potentially contaminating activities.

3.2.3 Historical Aerial Photographs

Historical aerial photographs have been reviewed by JBS&G in order to identify potential areas and activities of concern with respect to contamination (refer to **Table 3.4** and **Appendix B**).

The following table presents a summary of the review conducted, focusing upon the images which are considered to be most representative.

Table 3.4: Summary of Historical Aerial Photograph Observations

Date	Comments
1959	• The site appears heavily forested. • Mount Miller Road is evident in the southwest corner of the photograph. • The tidal mud flats are evident in the southeast corner of the photograph.
1965	• The site appears similar to the 1959 photograph. • Land has been cleared of vegetation along Mount Miller Road.
1970	• The site and surrounding area appears similar to the 1965 photograph.
1973	• The site appears similar to the 1970 photograph. • A cleared easement runs through the centre of the photograph which is assumed to be the electrical transmission line. • A quarry is evident south of the cleared easement.
1979	• The site and surrounding area appears similar to the 1973 photograph.
1989	• The site has been cleared and the administration office, workshop, chlorine plant, cyanide plant and control room are noted on the site. • Reid Road and the GAWB treatment plant is located east of the site. • The Gladstone Regional Council sewage treatment plant is located southeast of the site. • Gladstone Mount Larcom Road and an electrical substation is located north of the site.
1999	• The site has been heavily developed with the nitric acid plants, AN plants, AN bulk stores, container laydown area and substation (north of the site and west of Gladstone Mount Larcom Road) evident. • Offsite, the areas between the Gladstone Area Water Board treatment plant and Gladstone Regional Council sewage treatment plant has been cleared and the Australian Magnesium Corporation's pilot processing plant is evident.
2007	• The container laydown area has been extended to the west and the EPS plant is evident. • The Australian Magnesium Corporation's pilot processing plant is no longer evident.
2017	• The site and surrounding area appears similar to the 2007 photograph.

3.2.4 Regulator Databases Pertaining to Contaminated Sites

In Queensland, the EHP maintains the Environmental Management Register (EMR) and Contaminated Land Register (CLR).

JBS&G completed a search of the EMR/CLR on 3 July 2017 (refer to **Appendix C**). The search results confirmed that the site (Lot 138 CTN2123) is listed on the EMR because the site has been subject to the following *"Notifiable Activity or Hazardous Contaminant, being Chemical Manufacturing or Formulation – Manufacturing, blending mixing or formulating chemicals if –*

- The chemicals are designated dangerous goods under the dangerous goods code; and*

- b) The facility used to manufacture, blend, mix or formulate the chemicals has a design production capacity of more than 1 t per week.”*

The site was not listed on the CLR.

3.2.5 Regulator Databases Pertaining to Environmental Protection Licensing/Approvals

Information provided by Orica indicates that the site is subject to Environmental Authority (EA) EPPR00872013 (current version of the EA was issued on 6 March 2017), which authorises chemical manufacturing at both the AN and CC facilities. The following Environmentally Relevant Activities (ERAs) are listed on the permit:

- 12 (2) Plastic product manufacturing – Manufacturing, in a year, a total of 5t or more of foam, composite plastics or rigid fibre-reinforced plastics;
- 33 Crushing, milling, grinding or screening – Crushing, grinding, milling or screening more than 5000t of material in a year;
- 7 (4b) Chemical manufacturing – Manufacturing, in a year, the following quantities of fertilizer – more than 5000t; and
- 7 (6d) Chemical manufacturing - Manufacturing, in a year, the following quantities of inorganic chemicals, other than inorganic chemicals to which items 1 to 4 apply – more than 100,000t.

3.2.6 Local Government Records

3.2.6.1 Property Reports

A planning scheme property report was obtained for the site³. The report confirmed that the site is zoned Special Purpose and is subject to the following overlay codes:

- Acid sulphate soils;
- Airport;
- Airport obstacle limitation surface;
- Bushfire hazard;
- Coastal hazard;
- Flood hazard;
- Mining lease;
- Regional infrastructure;
- Steep land; and
- Transport.

³ <https://maps.gladstone.qld.gov.au/html/?viewer=planningscheme> (accessed August 2017)

4. Potential Sources of Contamination

Orica personnel completed a desktop review to identify potential sources of onsite contamination. Following the desktop exercise a series of inspections were conducted by Orica and JBS&G personnel at the various locations identified. The intent of these inspections was to look for any obvious signs of contamination, equipment condition that is suggestive of previous releases/contamination, and /or equipment condition that suggests it may act as a path for contamination. The findings of the source review are presented in **Appendix D** (prepared by Orica) and potential sources are summarised below. The site features referred to below are presented on **Figure 2**.

AN Complex

- Nitric Acid Plant No. 1;
- Nitric Acid Plant No. 2;
- Nitric Acid Plant No. 3;
- Acid Neutralisation Pit;
- Nitric Acid Storage Tanks;
- AN Plant No 1;
- AN Plant No. 2;
- Groundwater Treatment Plant;
- AN Solutions Storage;
- Effluent Ponds;
- Hardstand Laydown;
- Bulk Store;
- Emulsion Phase Plant;
- Stormwater Retention Tank;
- Ammonia Bullets; and
- Cooling Towers.

CN Complex

- CN Plant;
- CN Warehouse.;
- CN Effluent and Stormwater Retention;
- CN Isotainer Storage; and
- Cooling Towers.

Diffuse Sources

- CN Complex Stacks;
- AN Complex Stacks; and
- Truck Movements.

5. Potential or Actual Locations that may be Pathways for Groundwater Contamination

Once contaminants have been lost to ground they enter the environment via the following possible routes:

- Direct discharge to stormwater system then migration off-site into surface water systems; and
- Infiltration into the subsurface soil and groundwater.

Stormwater at the site is collected in the Stormwater Retention System via a network of pits and conveyed by underground concrete pipes (approximately 2 m bgl) to one of two licensed stormwater discharge points or to two unlicensed discharges. Stormwater from CC and the surrounding area also drains into the CC1 SWRS via aboveground drainage. A "first flush" system has been installed at the CC and AN discharge points which is designed to capture the initial rainfall off plant areas and hold stormwater in retention basins prior to discharge from the site.

Contaminants that infiltrate into subsurface will:

- Be retained in the upper portion of the soil horizon through mechanisms and processes such as adsorption. The retained contaminants have the potential to act as an ongoing source of surface water and groundwater contamination;
- Move into the perched and/or shallow aquifers and migrate offsite in groundwater. It is believed that the perched groundwater is likely to be associated with natural drainage channels such as paleochannels from former creek beds present at the site (prior to development) or associated with constructed high permeability conduits such as backfilled drains and service trenches;
- Move into the perched and/or shallow aquifers and migrate under and possibly into the stormwater system (and the annulus surrounding the stormwater drains) with subsequent discharge offsite via the Stormwater Retention System and stormwater discharge points. This condition will occur where water levels are greater than the invert levels of the stormwater pipes. In the case that the invert levels are higher than groundwater then stormwater may act as a source of artificial recharge to the perched and/or shallow groundwater aquifers.

Based on the current understanding of the extent of contamination in groundwater and the relative hydraulic conductivities (and transmissivities) of the identified aquifers the highest risk of groundwater contamination is present within the perched aquifer. This aquifer is also the main pathway for offsite migration in groundwater.

Contamination of the perched aquifer is likely to have occurred by infiltration from product lost to ground. Contamination of the shallow aquifer may have occurred through the same mechanisms described for the perched aquifer but also due to vertical migration from the perched aquifer.

6. Areas/Locations of Potential or Actual Contamination

6.1 Groundwater

Since 2009, routine groundwater monitoring has been undertaken at the site by Golder Associates Pty Ltd (**Appendix E**). Monitoring programs have focussed on the two operating areas of the site:

- AN - the main constituents of interest consist of ammonia, nitrate and nitrite (since nitrite represents a small portion of total nitrogen relative to nitrate, total oxidised nitrogen (NO_x) has been analysed since February 2011). 93 monitoring wells are included in the nutrient monitoring program, with monitoring undertaken on a biannual basis.
- CC - the main constituents of interest consist of total cyanide, Weak Acid Dissociable (WAD) cyanide and free cyanide. 35 monitoring wells are included in the cyanide monitoring program, with monitoring undertaken on a biannual basis.

The following sections provide a discussion of the most recent groundwater monitoring results as these results are considered to best approximate contamination conditions at the time of this report. Historical results are assessed on an annual basis as part of the annual groundwater monitoring reports. Groundwater monitoring analytical data for July 2017 is shown in **Figures 5-7**.

6.1.1 Nitrate and Ammonia Groundwater Plume

Perched Groundwater

Nutrients in the perched groundwater unit were noted at the following concentrations in July 2017:

- NO_x (as N): <0.01 mg/l to 1,000 mg/l (P95); and
- Ammonia (as N): <0.01 mg/l to 845 mg/l (P48).

NO_x concentrations at the perched groundwater wells sampled exceeded the Groundwater Monitoring Plan (GWP) (JBS&G, 2016) Assessment Criteria in July 2017, except wells P19, P64, P66, P73, P78, P79 and P87.

The nature and extent of nitrate/NO_x in the perched aquifer is similar to that described in the Revised Conceptual Site Model (URS, 2009). The distribution of NO_x in groundwater appears to be migrating within the two preferential pathways:

- From the ANP1 area towards the north and then north-east as indicated by concentrations generally greater than 100 mg/l in the plant area (P55 and P95), car park and offsite between P88 and P80 along Reid Road in the east. Nitrate/NO_x concentrations were less than GWP Assessment Criteria in perched groundwater well P87 in the forested woodland east of Reid Road and P78 and P79 along Reid Road to the north; and
- From the AN processing area towards the east in the vicinity of P50 to P86 and offsite in the vicinity of P62.

Ammonia concentrations at P12, P33, P48, P50, P55, P61, P69, P70, P71, P80, P88, P89, P94, P95, P103, P104 and P105 exceeded the GWP Assessment Criteria in July 2017.

The nature and extent of ammonia in the perched aquifer is similar to that described in the Revised Conceptual Site Model (URS 2009). In general, the distributions of ammonia and nitrate⁴ in groundwater at the site are similar. Historically, monitoring locations in offsite areas were characterised by significantly lower ammonia concentrations than nitrate concentrations, though

⁴ Or NO_x (nitrate and nitrite), which has been analysed since 2011. Since nitrite has been shown to represent a very small portion of NO_x, NO_x concentrations in groundwater are considered equivalent to nitrate concentrations.

the relative proportion of ammonia has increased since the Revised Conceptual Site Model was prepared within the preferential flow pathway at the car park and offsite at P88.

Ammonia concentrations exceeding 100 mg/l are reported in a zone extending from the ANP1 area (P55 and P95) towards the north-east to the car park and along the eastern site boundary at P88.

Shallow Groundwater

The distribution of nutrients in the shallow aquifer is of a similar pattern to that observed in the perched aquifer. However, this is not attributed to horizontal migration but is likely the result of vertical migration from the perched groundwater (URS 2009).

Nutrients in the shallow groundwater unit were noted at the following concentrations in July 2017:

- NO_x (as N): <0.01 mg/l to 823 mg/l (S3⁵); and
- Ammonia (as N): <0.01 mg/l to 625 mg/l (S3).

Elevated concentrations (exceeding 100 mg/L) of NO_x within shallow groundwater were reported in the vicinity of ANP1 (S55), the car park (S48 and S71), east of the AN processing area (S33, S4, S53) and offsite at S61. NO_x concentrations at S3, S4, S12, S14, S16, S25, S33, S35, S46, S47, S48, S51, S53, S54, S55, S61, S62, S69, S70, S71, S80, S85, S86, S88, S89, S93, S94, S95, S103 and S105 exceeded the GWP Assessment Criteria in July 2017.

Elevated concentrations (exceeding 50 mg/L) of ammonia within shallow groundwater were reported in the vicinity of ANP1 (S55) and the car park (S48 and S71). Ammonia concentrations at S3, S4, S12, S14, S16, S33, S35, S46, S47, S48, S53, S55, S61, S69, S71, S89, S93, S94, S95, S103 and S104 exceeded the GWP Assessment Criteria in July 2017.

6.1.2 Cyanide Groundwater Plume

Perched Groundwater

Cyanide in the perched groundwater unit was noted at the following concentrations in July 2017:

- Total cyanide: <0.004 mg/l to 7.64 mg/l (P12);
- WAD cyanide: <0.004 mg/l to 2.02 mg/l (P12); and
- Free cyanide: <0.004 mg/l to 1.48 mg/l (P12).

Free cyanide concentrations at P12 and P75 exceeded the GWP Assessment Criteria in July 2017.

Based on the current and historical analytical data, the primary source of cyanide contamination in the perched aquifer is considered to be the Cyanide Plant area. Maximum total, WAD and free cyanide concentrations have historically been reported in monitoring well P11 located in backfill around the solids dissolving tank in the centre of the Cyanide Plant (Note: P11 was not sampled during July 2017 as this well is not included in the Groundwater Monitoring Plan (JBS&G, 2016)). Monitoring well P12 located immediately north of the Cyanide Plant, has also reported significant total cyanide concentrations (exceeding 400 mg/L in June 2013, however, following source control work concentrations of cyanide in P12 have reduced by one order of magnitude in 2017).

Downgradient of the Cyanide Plant, a zone of elevated total cyanide extends in the perched aquifer to the east across Rankin Drive (located within the site) and to the north-east towards the site boundary, with total cyanide historically detected above the laboratory reporting limit (LOR) at P64, P65 and P66. The zone of elevated WAD and free cyanide concentrations in the perched aquifer is

⁵ S3 is potentially screened across both the perched and shallow groundwater unit. The second highest concentrations in July 2017 were Ammonia (as N) 181mg/l (S95), NO_x (as N) 521mg/l (S61)

generally less extensive than for total cyanide, with distribution in the vicinity of the Cyanide Plant and in the north-east to P75.

Shallow Groundwater

Cyanide in the shallow groundwater unit was noted at the following concentrations in July 2017:

- Total cyanide <0.004 mg/l to 4.55 mg/l (S14);
- WAD cyanide <0.004 mg/l to 0.043 mg/l (S25); and
- Free cyanide <0.004 mg/l to 0.048 mg/l (S25).

Free cyanide concentrations at S12, S14, S16, and S25 exceeded the GWP Assessment Criteria in July 2017.

The distribution of cyanide compounds in the shallow groundwater generally follows the same pattern as the perched aquifer, although cyanide compounds appear to have a limited extent towards the north-east (cyanide compounds are less than the LOR at S65/S66 at the production plant boundary), and total cyanide may have migrated further east and south-east (as indicated by elevated total cyanide concentration at S54, adjacent to the administration office).

6.2 Surface Water

The site Environmental Authority EPPR00872013 (current version of the EA was issued on 6 March 2017) includes several conditions related to monitoring of the receiving environment for stormwater discharge. The monitoring includes a Receiving Environment Monitoring Program (REMP) that requires annual monitoring and reporting of offsite surface water.

REMP samples are collected from the following locations presented in **Table 6.1**.

Table 6.1: REMP Sample Location Rationale

Location	Description	Purpose
ANP1/ANP2 and CC	Licensed Stormwater Discharges	Assess concentrations of contaminants discharging from the Site.
REMP1	Culvert at Mount Larcom Road (northern or southern side)	Assess concentrations discharging from the mixing zone to the upper portion of the salt pan. This location is considered a suitable screening level location for assessing concentrations of contaminants discharging to the receiving environment.
REMP2	Western side of culvert under Reid Road	Assess concentrations after dilution from flows sourced from the table drain on the southern side of Mount Larcom Road.
REMP3 and REM P4	Pipes under fence line	Assess attenuation of contaminants by dilution from the table drain on the eastern side of Reid Road and attenuation through the Gladstone Area Water Board property. Also assess concentrations entering the mixing zone.
REMP5	Drain at northern edge of carpark	Assess concentrations discharging from the Site via "Reid Road East" and assess potential influences of groundwater discharge.
REMP6	Drain under fence line at southern edge of carpark	Assess concentrations after dilution from flows sourced from the table drain on the western side of Reid Road. Also relevant to assessing potential influence of groundwater discharge on contaminant concentrations.
REMP7 and REM P8	Within diversion drains	Assess concentrations for areas up hydraulic gradient of the Site.

Analytical results are summarised in **Appendix F** and shown in **Figure 8**.

Generally analytical results from the July 2016 to June 2017 period indicate:

- Reported concentrations of ammonia and nitrate at ANP1/ANP2 ranged between 0.78 to 0.89 mg/L and 3.68 and 5.70 mg/L respectively during the sampling events. Concentrations at upgradient sampling locations (REMP7 and REM8) were approximately one order of magnitude lower than those reported at ANP1/ANP2;
- Sampling locations in the mixing zone downgradient of ANP1/ANP2 (REMP3, REM4 and REM6) reported concentrations of ammonia and nitrate approximately one order of magnitude higher than those at ANP1/ANP2;
- The cause of the increase in nitrogen concentrations in the mixing zone compared to those discharged at ANP1/ANP2 may be related to a number of factors including degradation of biological material/vegetation present and/or discharge of groundwater with elevated concentrations of ammonia and nitrate in the mixing zone;
- The concentrations of ammonia and nitrate were approximately one order of magnitude higher in REM6 compared to ANP1/ANP2. Given the significant increases in concentrations between ANP1/ANP2 and REM6 and the very low likelihood that degradation of biological material could contribute significantly over this flow path it is concluded that groundwater discharge is the primary cause of the reported concentrations at REM6;
- All sampling events reported concentrations of ammonia and nitrate had decreased significantly between the mixing zone sample locations and REM1 (discharge point to the receiving environment);
- Free and WAD cyanide was less than the laboratory limit of reporting and the toxicant trigger values at all sample locations for all sampling events; and
- Total cyanide was detected in locations CC (0.007 mg/L on 17 March 2017 and 0.590 mg/L on 22 March 2017) and REM2 (0.006 mg/L on 17 March 2017).

7. Identified Sources of Contamination

Based on the concentrations of contaminants identified in perched and shallow groundwater beneath the site (**Appendix E**), the primary source areas on the site are the following:

- AN Plant No. 1 located in the centre of the AN processing area of the site. High nitrate and ammonia concentrations have been detected at monitoring well P55 located adjacent to AN Plant No. 1. Elevated concentrations were also detected in monitoring well P93, which is also located adjacent to AN Plant No. 1;
- The AN Solutions Storage, located in the northern portion of the AN processing area and north of AN Plant No. 1 was also identified as a potential source area. Elevated nitrate and ammonia concentrations were detected in the monitoring wells P35, located immediately adjacent to the tank farm and monitoring well P94, which is located north east of P35;
- The AN Bulk Store, located in the eastern portion of the AN processing area appears to be source area. Elevated nitrate and ammonia concentrations were detected in monitoring well P33, which is located east of the AN Bulk Store, and P95, which is located north of the AN Bulk Store and north east of AN Plant No. 1; and
- The Cyanide Plant and Warehouse appears to be the major cyanide source on the site. High total and free cyanide concentrations were reported in monitoring well P12 located immediately north of the Cyanide Plant and Warehouse. Elevated concentrations were also reported in P14 and P16 located east of the Cyanide Plant and Warehouse.

8. Conclusions

Subject to the limitations in **Section 9**, it is concluded that:

- A number of potential or actual sources of contamination have been identified. The primary concerns relate to the AN and CC plants;
- Historical groundwater (perched water and shallow aquifer) and surface water investigations have identified that actual contamination exists. The primary concerns relate to cyanide, nitrate and ammonia at concentrations exceeding adopted criteria;
- Potential pathways for groundwater contaminant migration include stormwater and perched water, with perched water likely to represent the primary concern; and
- The potential ecological receptors of site originated contamination which are of greatest concern represent ecosystems dependent upon the tidal mud flats and the broader Port Curtis area.

It is recommended that information gathered in this DSI is used to address the second and third requirements of the notice, being the generation of a revised CSM and CAP.

9. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Figures



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

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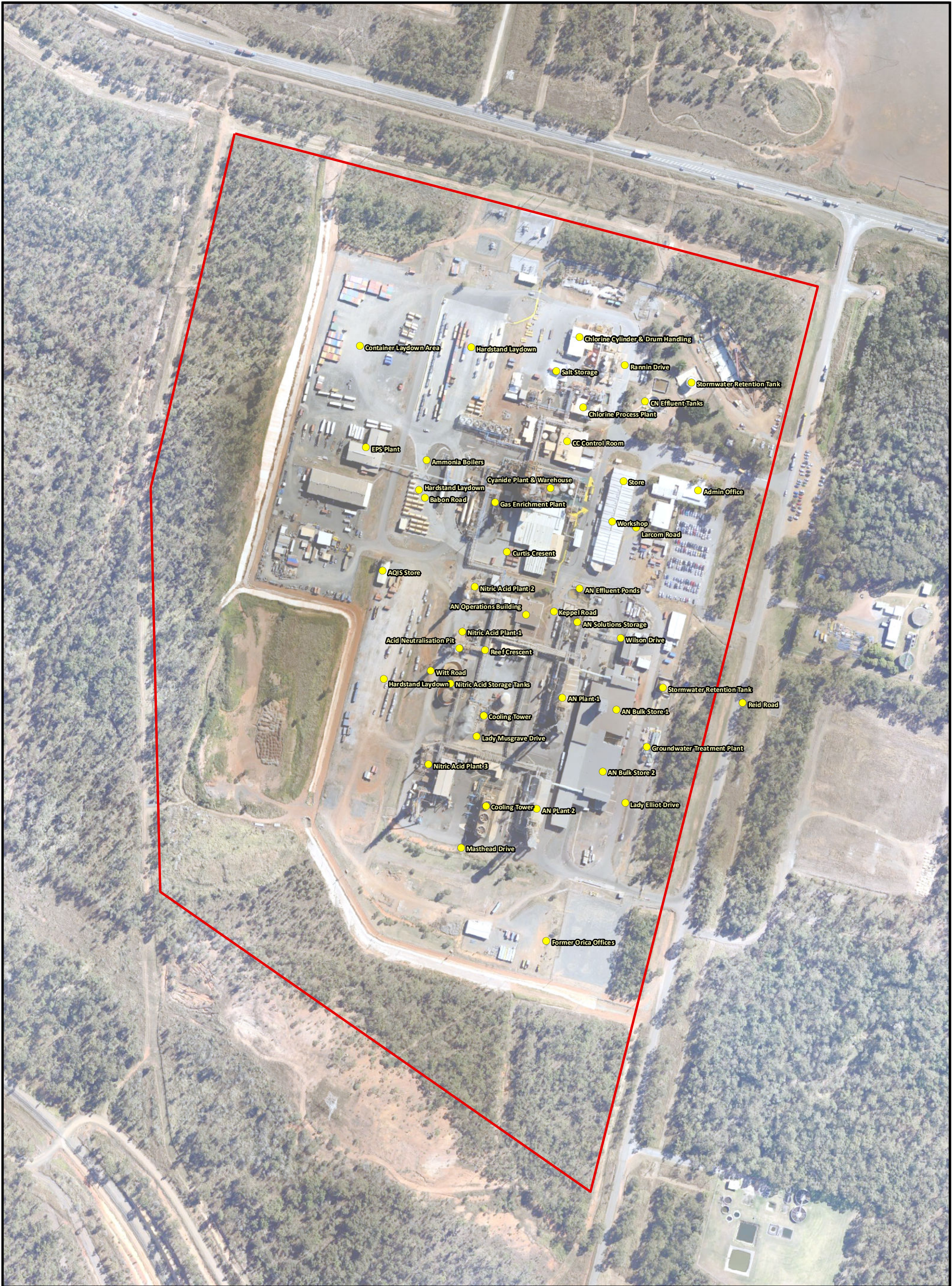
0 365 730 1,460			
m			
Scale: 1:45,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R02	RF	17-11-2017
Rev	Description	Drn.	Date

Legend:
— Approximate Boundary - Lot 138 CTN2123

JBS&G Figure 1: Site Location

Client: Orica Australia Pty Ltd
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)
Job No: 52877
File Name: 52877_01





Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

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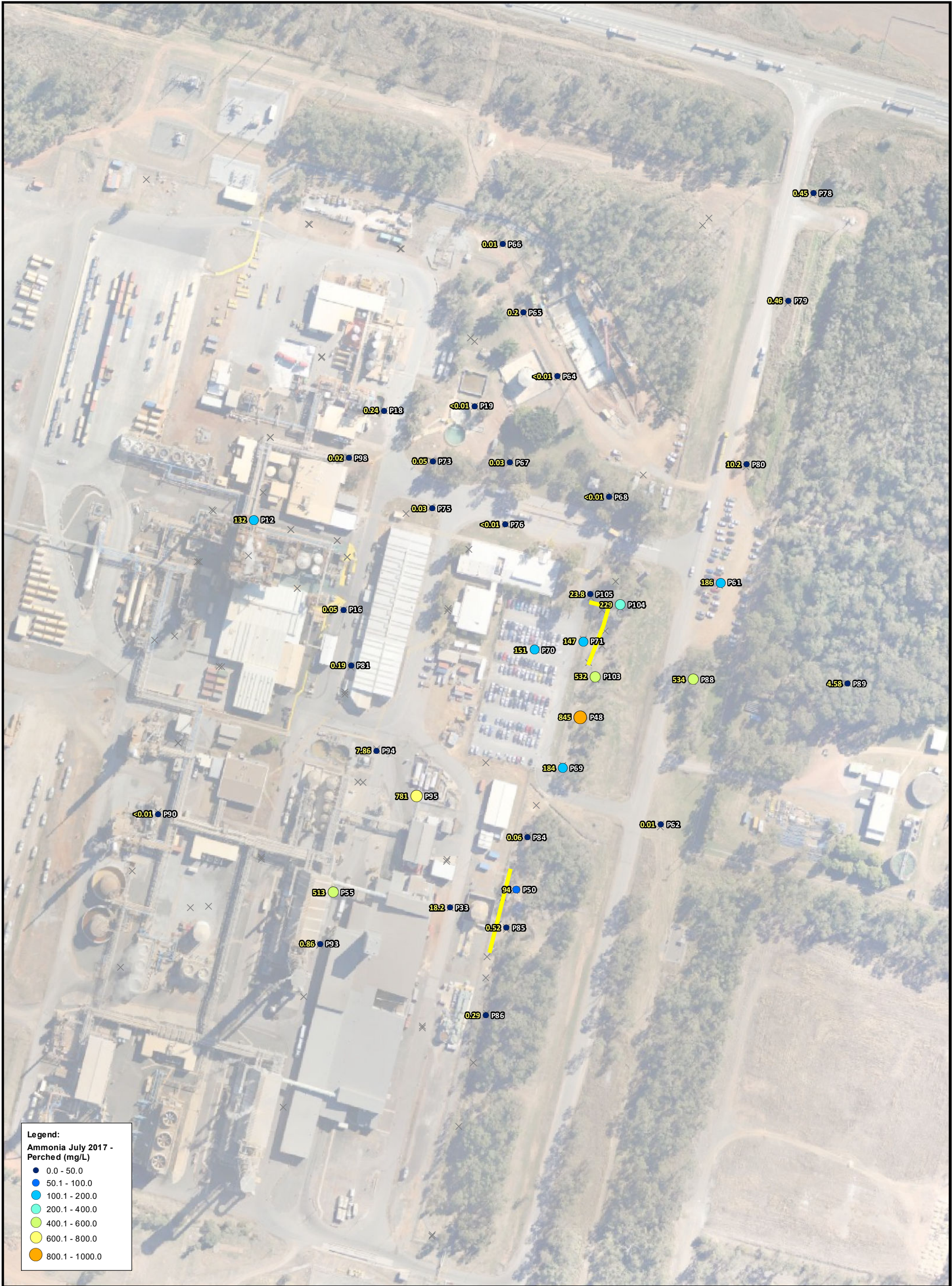
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Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R02	RF	17-11-2017
Rev	Description	Drn.	Date

Legend:
— Approximate Boundary - Lot 138 CTN2123
● Site Features

JBS&G Figure 2: Site Features

Client: Orica Australia Pty Ltd
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)
Job No: 52877
File Name: 52877_02





Legend:
Ammonia July 2017 - Perched (mg/L)

- 0.0 - 50.0
- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 400.0
- 400.1 - 600.0
- 600.1 - 800.0
- 800.1 - 1000.0

Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

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0 15 30 60 m			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Drm.	Date

Legend:

- Groundwater Monitoring Well Location
- Trench Locations
- Ammonia Concentration/Monitoring Well #

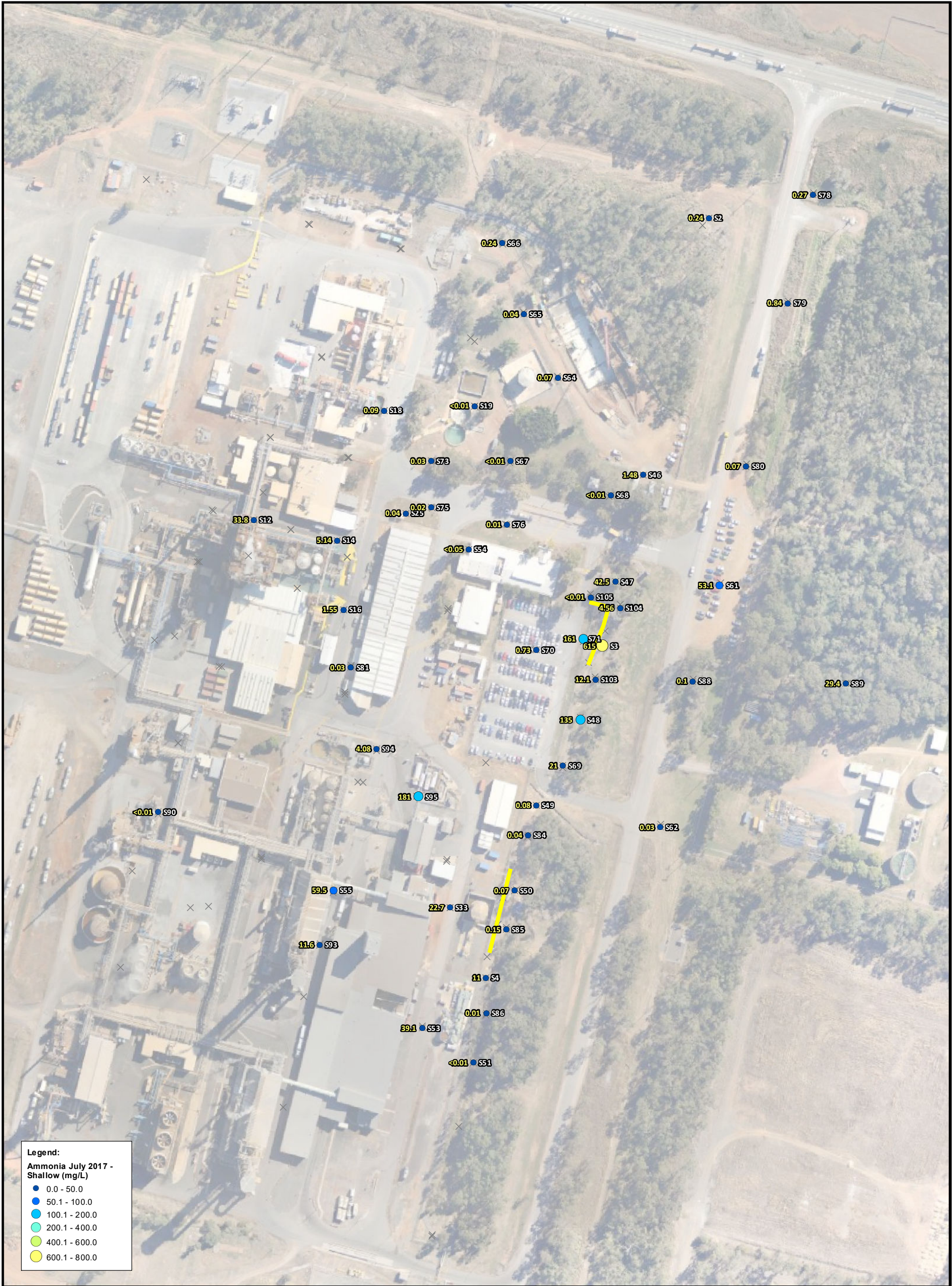
NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 4a: Ammonia as N July 2017 - Perched (mg/L)

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877 File Name: 52877_04a



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

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0 15 30 60 m			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Dmn.	Date

Legend:

- × Groundwater Monitoring Well Location
- Trench Locations
- 0.29 ● P35 Ammonia Concentration/Monitoring Well #

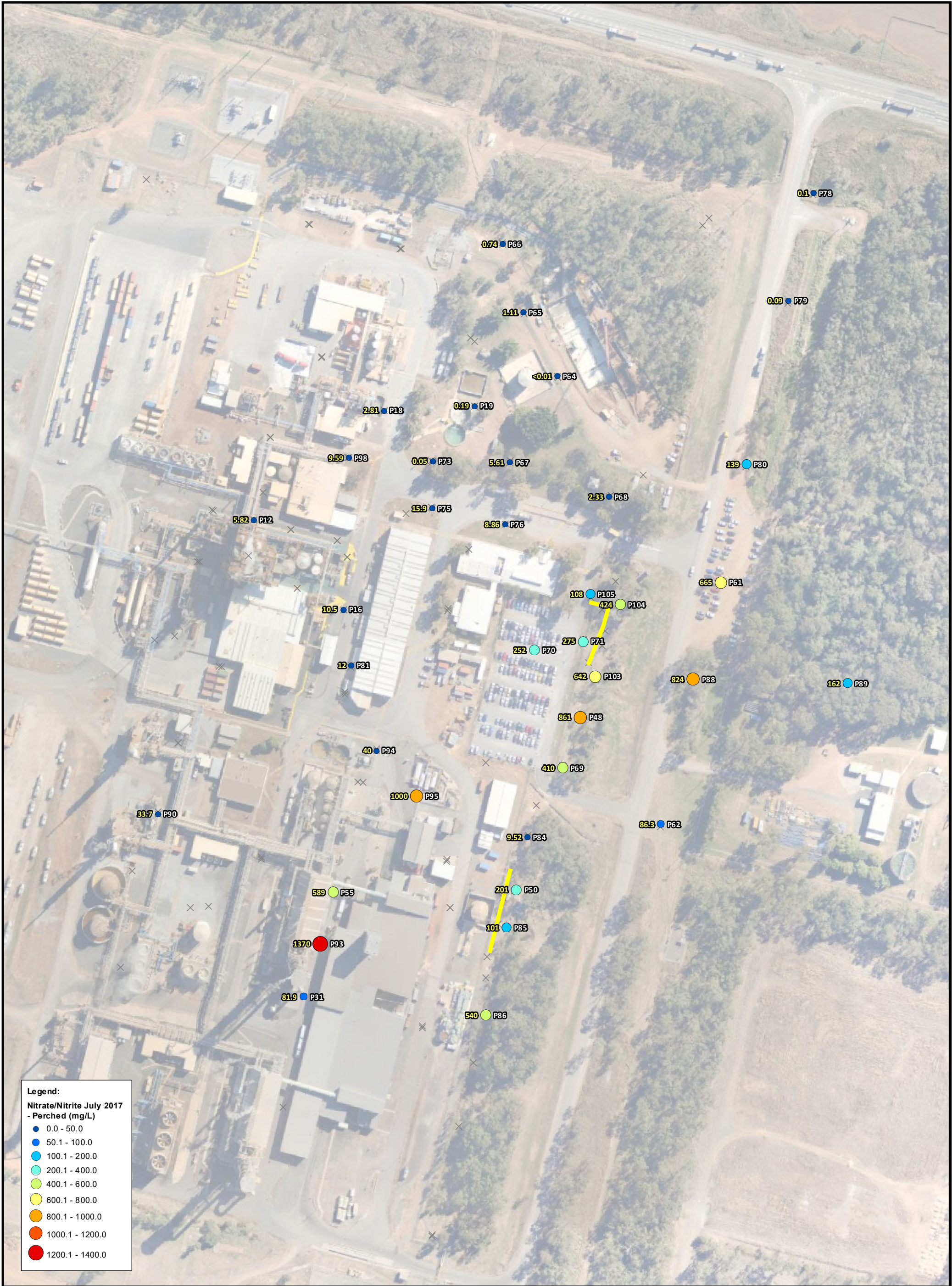
NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 4b: Ammonia as N July 2017 - Shallow (mg/L)

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877 File Name: 52877_04b



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

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0153060m			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Drm.	Date

Legend:

× Groundwater Monitoring Well Location

— Trench Locations

0.29 P33 Nitrate/Nitrite Concentration/Monitoring Well #

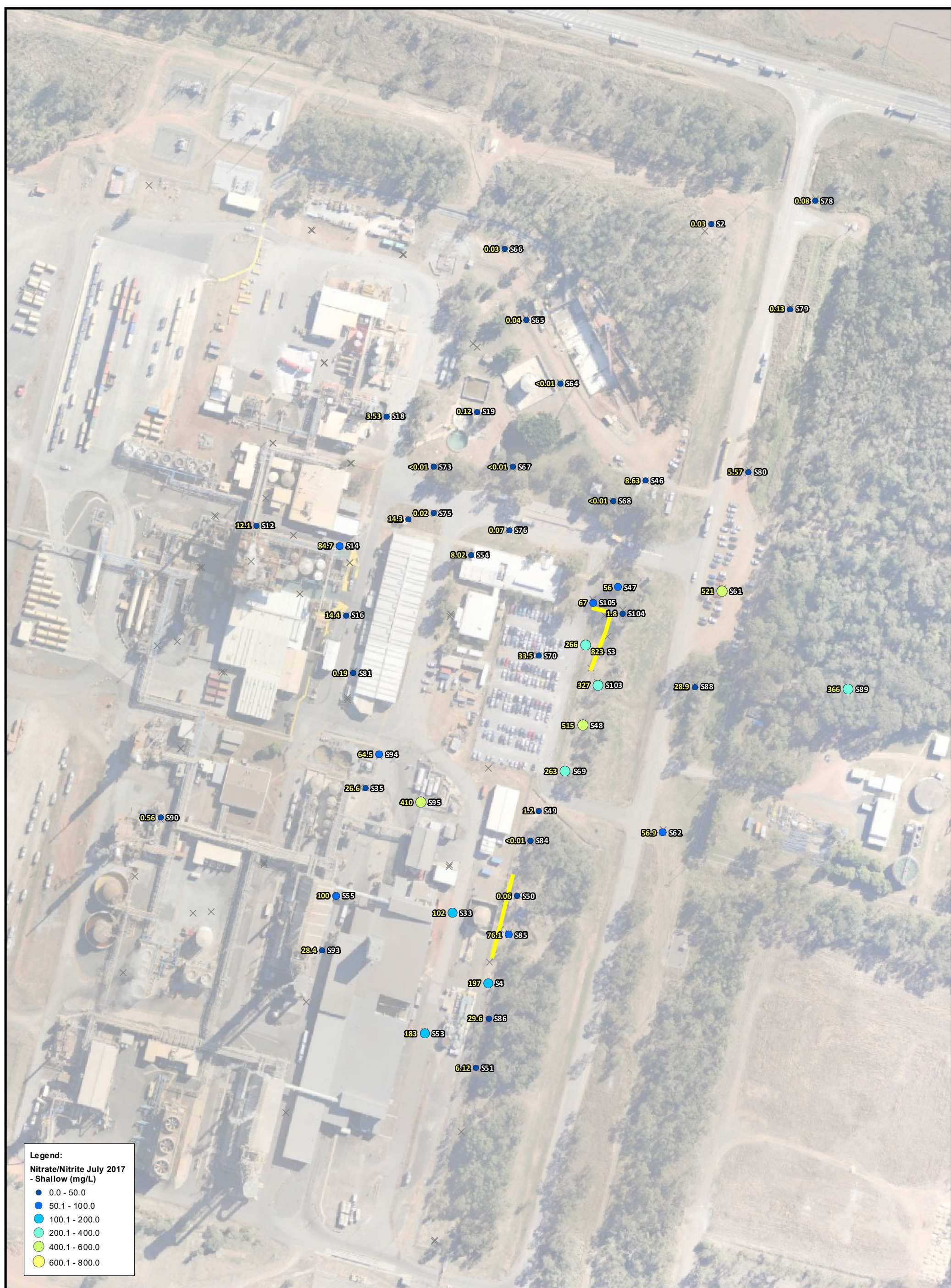
NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 5a: Nitrate as N/Nitrite and Nitrate (NOx) as N July 2017 - Perched (mg/L)

Client: Orica Australia Pty Ltd

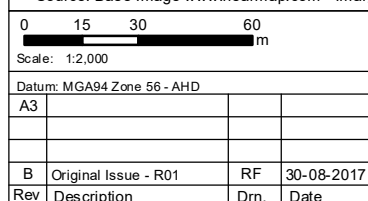
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877 File Name: 52877_05a



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

© 2017 JBS&G



Legend:

- ✕ Groundwater Monitoring Well Location

Trench Locations

0.29 **P86** Nitrate/Nitrite Concentration/Monitoring Well #
NOTE: < symbol indicates concentration less than limit of reporting (<LOR)



Figure 5b: Nitrate as N/Nitrite and Nitrate (NOx) as N July 2017 - Shallow (mg/L)

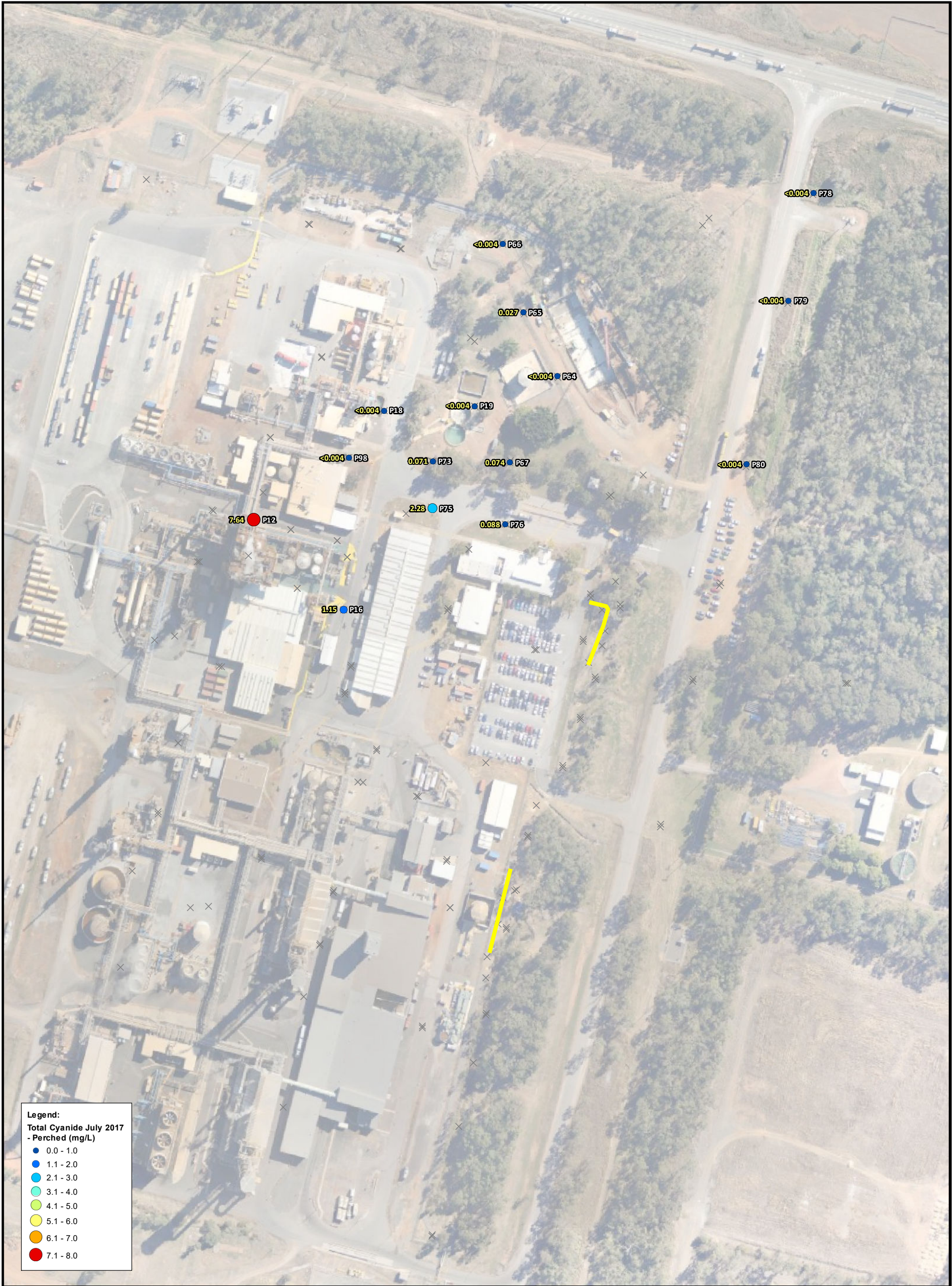
Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877

File Name: 52877_05b





Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

© 2017 JBS&G

0153060m			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Dmn.	Date

Legend:

× Groundwater Monitoring Well Location

— Trench Locations

0.29 P23 Total Cyanide Concentration/Monitoring Well #

NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 6a: Total Cyanide July 2017 - Perched (mg/L)

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877 File Name: 52877_06a



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

© 2017 JBS&G

0153060m			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Drn.	Date

Legend:

X Groundwater Monitoring Well Location

Trench Locations

0.29 235 Total Cyanide Concentration/Monitoring Well #

NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 6b: Total Cyanide July 2017 - Shallow (mg/L)

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877 File Name: 52877_06b



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

© 2017 JBS&G

0153060			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Drm.	Date

Legend:

- Trench Locations
- Groundwater Monitoring Well Location
- Free Cyanide Concentration/Monitoring Well #

NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 7a: Free Cyanide July 2017 - Perched (mg/L)

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877

File Name: 52877_07a



Source: Base Image www.nearmap.com - Imagery Date 7-8-2013. Accessed 29-8-2013

© 2017 JBS&G

0 15 30 60 m			
Scale: 1:2,000			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Drm.	Date

Legend:

- Trench Locations
- Groundwater Monitoring Well Location
- Free Cyanide Concentration/Monitoring Well #

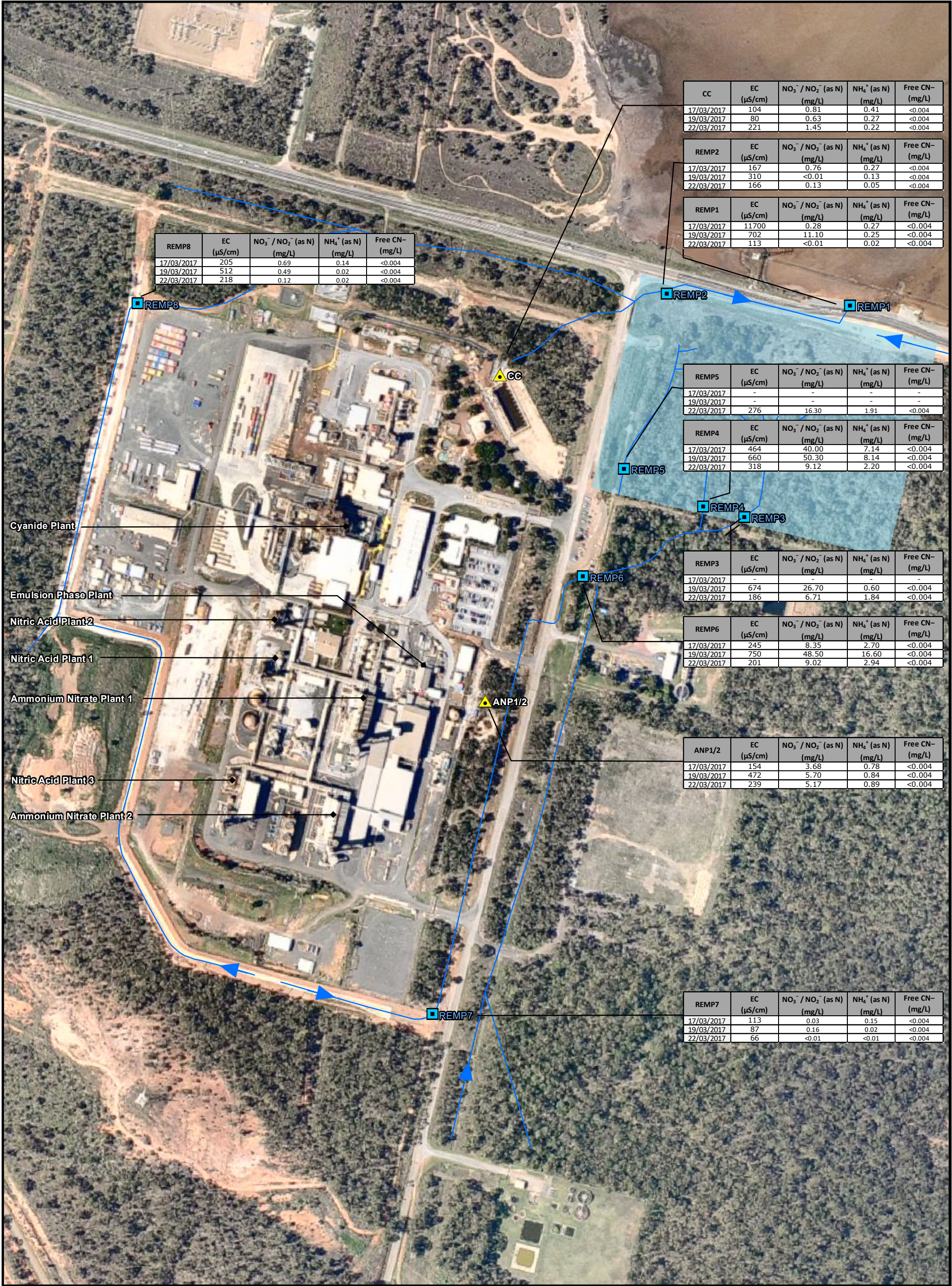
NOTE: < symbol indicates concentration less than limit of reporting (<LOR)

JBS&G Figure 7b: Free Cyanide July 2017 - Shallow (mg/L)

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877 File Name: 52877_07b



Source: Base Image www.nearmap.com - Imagery Date Dec 2014.

© 2017 JBS&G

03570140			
m			
Scale: 1:3,750			
Datum: MGA94 Zone 56 - AHD			
A3			
B	Original Issue - R01	RF	30-08-2017
Rev	Description	Dm.	Date

Legend:	
	Licensed Stormwater Discharge Point
	Surface Water Sample Locations
	Drainage Line
	Mixing Zone

Location	Electrical Conductivity (µS/cm)	Nitrate / Nitrite (as N) (mg/L)	Ammonia (as N) (mg/L)	Free Cyanide (mg/L)
----------	------------------------------------	------------------------------------	--------------------------	------------------------



Figure 8: REMP Monitoring Locations and Sampling Results

Client: Orica Australia Pty Ltd	
Project: Yarwun REMP Interpretive Report	
Job No: 52877	File Name: 52877_08

Appendix A Certificate of Title Historic Searches

ABN: 42 166 543 255
Ph: 02 9099 7400
Fax: 02 9232 7141

Level 14, 135 King Street, Sydney 2000
GPO Box 4103 Sydney NSW 2001
DX 967 Sydney

Summary of Owners Report

LPI

Sydney

Address: 30 Reid Road, Yarwun

Description: Lot 138 CTN 2123

Note: - Lot 138 of CTN 2123 was formerly part of Portions 128 & 109 of the Parish of Calliope

Note: - Part of Lot 138 CTN 2123 was formerly part of Hanson Road – Road Closed by Notification in Government Gazette in 1988

<u>Date of Acquisition and term held</u>	<u>Registered Proprietor(s) & Occupations where available</u>	<u>Reference to Title at Acquisition and sale</u>
24.04.1928	Portion 109 – Open for Selection	
11.10.1934 (1934 to 1939)	Norman Stanley Dunn (Portion 109)	AF (Agricultural Farm) 2271
15.06.1939 (1939 to 1943)	Richard William Hunt (Portion 109)	AF (Agricultural Farm) 2271
02.11.1943 (1943 to 1960?)	Joseph Mick Andrienco (Portion 109) (Term of lease extended for a further period of 10 years, commencing 01.10.1950)	AF (Agricultural Farm) 2271
31.09.1960?	? Expiration of Farm Lease	
07.02.1989 (1989 to 1990)	The Minister for Industrial Development of Queensland	Vol 584 Fol 133
29.10.1990 (1990 to Date)	# ICI Australia Operations Pty Ltd Now # Orica Australia Pty Ltd	Vol 584 Fol 133 Now 30584133

Denotes Current Registered Proprietor

Easements: -

- 27.04.2006 (709546004) – Easement in Gross – Ergon Energy Corporation Limited

Leases: -NIL

* Information found on Plan CTN 546

Yours Sincerely
James McDonnell
31 July 2017

Address ☐ Lot Plan ☒ 30 Reid Road, Yarwun, Queensland, Australia

☐ Select All Results

Lot Plan **138CTN2123**

☐ Address **30 REID ROAD**

Area **0.52 km²**

Lot Plan **ASP187132**

☐ Address **in progress**

Area **3318.63 m²**

Lot Plan **Road Type Parcel**

☐ Address **in progress**

Area **0.1 km²**

Lot Plan **138CTN2123**

☐ Address **30 REID ROAD**

Area **0.52 km²**

Lot Plan **1SP103922**

☐ Address **in progress**

Area **0.37 km²**

Lot Plan **EMTSP165453**

☐ Address **in progress**

Area **0.12 km²**

Lot Plan **1SP165453**

☐ Address **in progress**

Area **0.12 km²**

Lot Plan **ASP188948**

☐ Address **in progress**

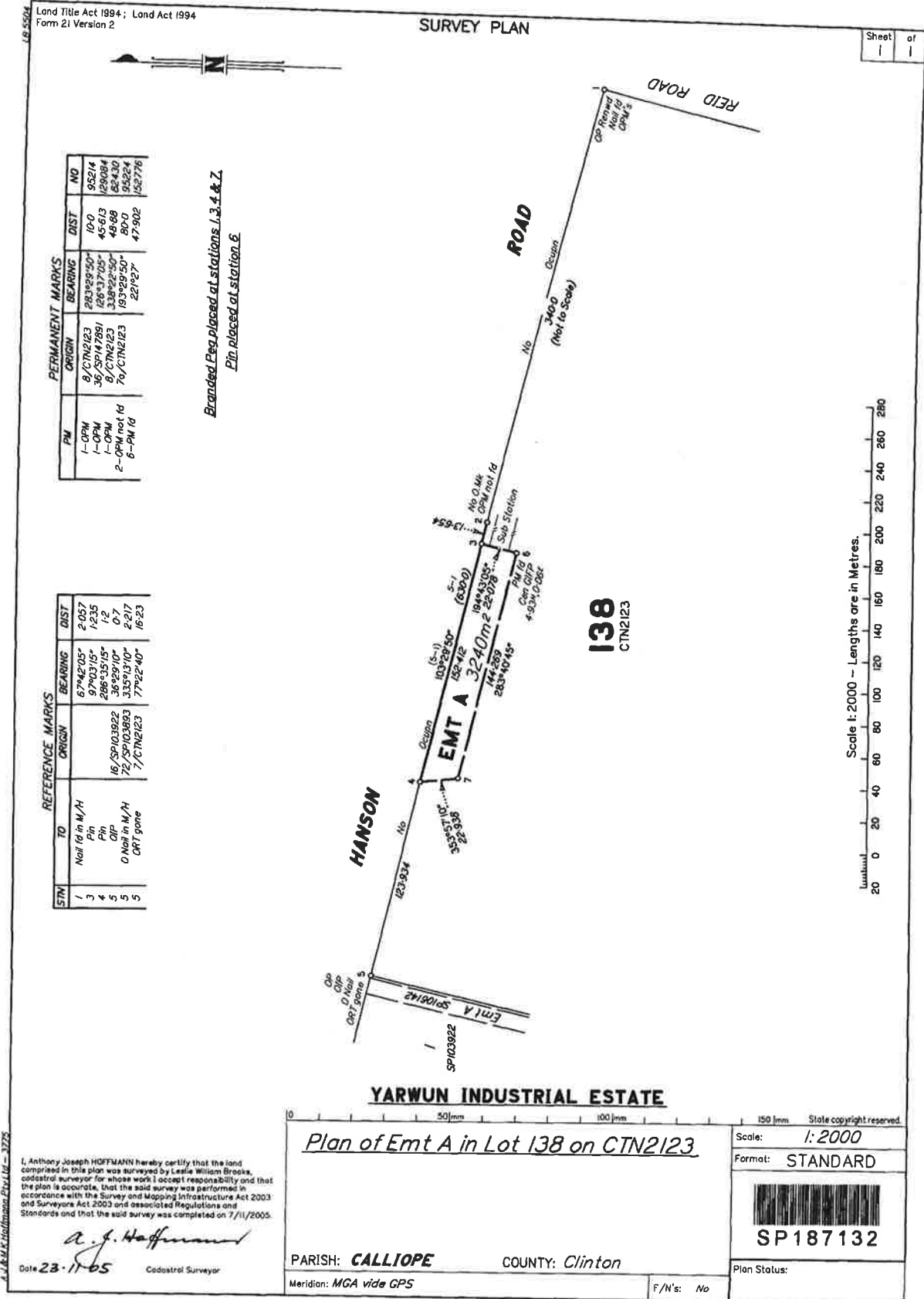
Area **1509.54 m²**

SUMMARY

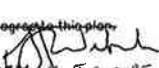
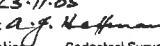
No. of Lots **8**

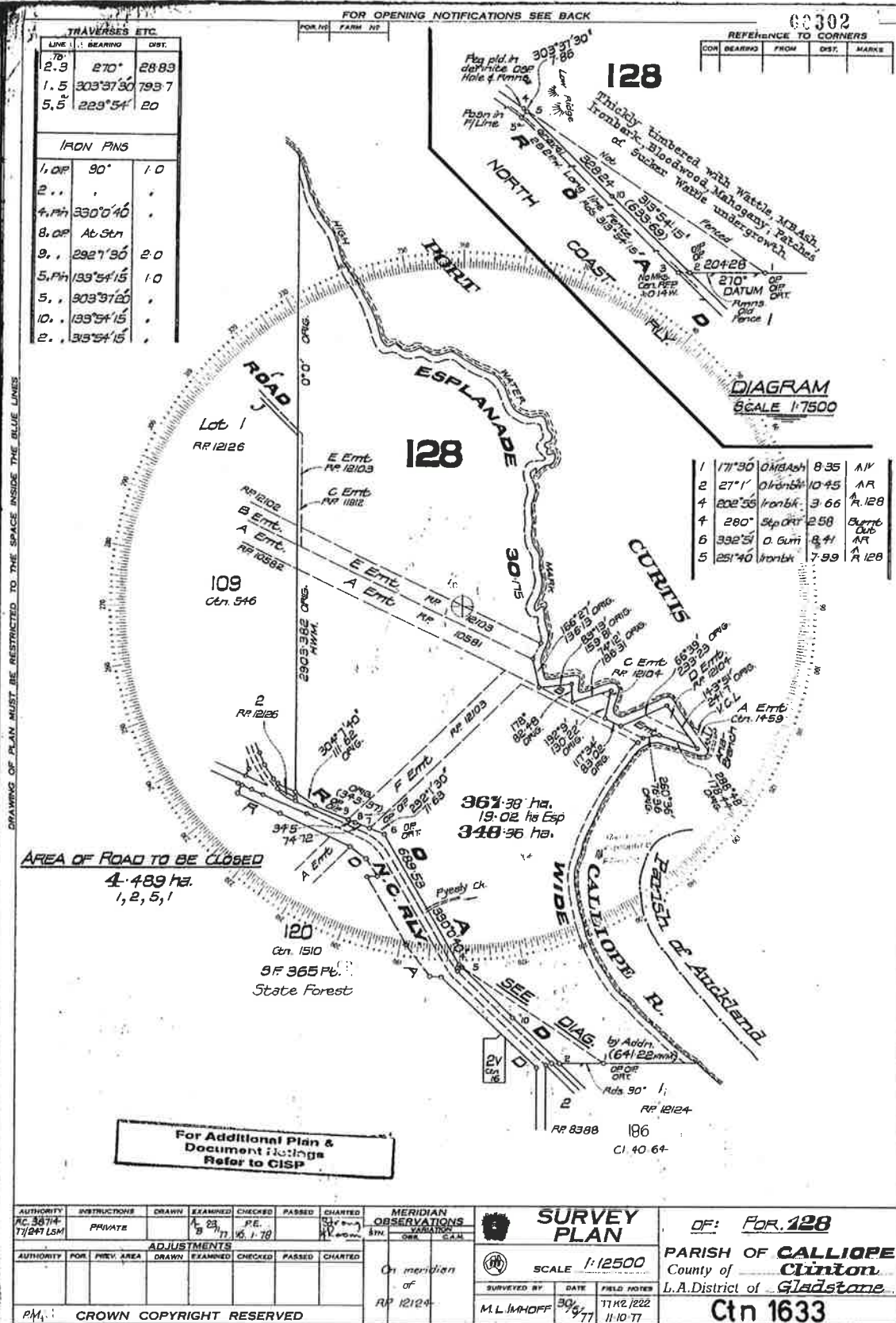
Total Area **1.75 km²**

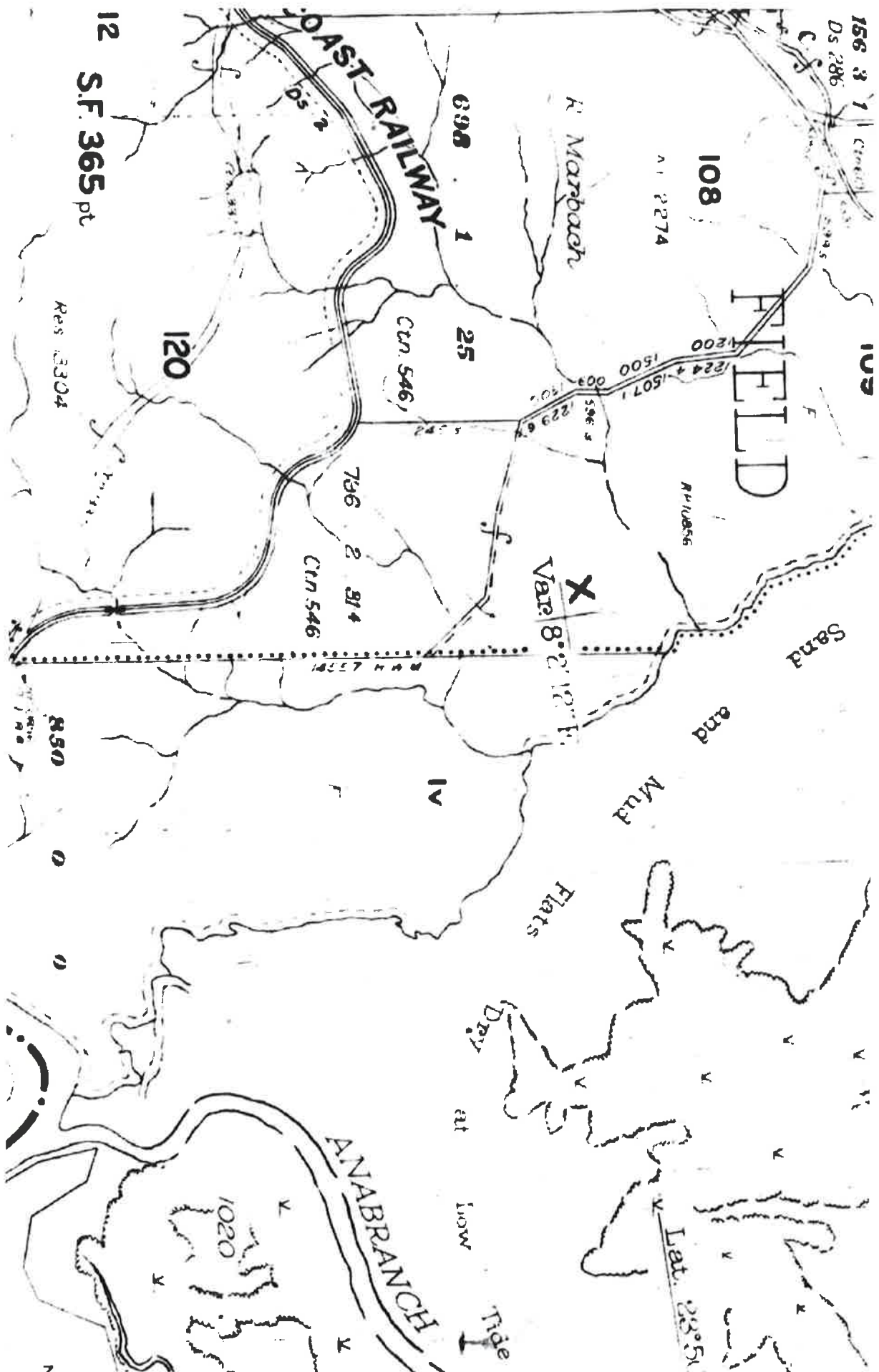
Copyright protects the plan/s being ordered by you. Unauthorised reproduction or amendments are not permitted



709545996 \$242.65 27/04/2006 10:23 TE 400		WARNING : Folded or Mutilated Plans will not be accepted. Plans may be rolled. Information may not be placed in the outer margins.	
Registered		5. Lodged by Ergon Energy Corporation Limited ACN 50 087 646 062 PO Box 1090 22 TOWNSVILLE QLD 4810 (Include address, phone number, reference, and Lodger Code)	

1. Certificate of Registered Owners or Lessees. I/We ICI AUSTRALIA OPERATIONS PTY LTD <u>ORICA AUSTRALIA PTY LTD</u> (Names in full) * as Registered Owners of this land agree to this plan and dedicate the Public Use Land as shown hereon in accordance with Section 50 of the Land Title Act 1994. * as Lessees of this land agree to this plan  GREGORY M. L. COOK, DIRECTOR Signature of *Registered Owners *Lessees A. COOK ANNETTE COOK, SECRETARY  * Rule out whichever is inapplicable					<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="3">6. Existing</th> <th colspan="3">Created</th> </tr> <tr> <th>Title Reference</th> <th>Lot</th> <th>Plan</th> <th>Lots</th> <th>Emts</th> <th>Road</th> </tr> <tr> <td>30584133</td> <td>138</td> <td>CTN2123</td> <td></td> <td>A</td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"> CP CTN2123 Lot 138 on </td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">Lots</td> <td style="text-align: center;">Orig</td> </tr> </table>					6. Existing			Created			Title Reference	Lot	Plan	Lots	Emts	Road	30584133	138	CTN2123		A		CP CTN2123 Lot 138 on		Lots	Orig
6. Existing			Created																												
Title Reference	Lot	Plan	Lots	Emts	Road																										
30584133	138	CTN2123		A																											
CP CTN2123 Lot 138 on																															
Lots	Orig																														
2. Local Government Approval. * hereby approves this plan in accordance with the: % Dated this _____ day of _____ _____ # _____ # * Insert the name of the Local Government. % Insert Integrated Planning Act 1997 or # Insert designation of signatory or delegation Local Government (Planning & Environment) Act 1990					7. Portion Allocation : 8. Map Reference : 9150-31313 9. Locality : Yarwun 10. Local Government : Calliope Shire Council 11. Passed & Endorsed : By : A J Hoffmann Date : 23.11.05 Signed :  Designation : Cadastral Surveyor																										
3. Plans with Community Management Statement : CMS Number : Name :					4. References : Dept File : Local Govt : Surveyor : 3775																										
12. Building Format Plans only. I certify that : * As far as it is practical to determine, no part of the building shown on this plan encroaches onto adjoining lots or road. * Part of the building shown on this plan encroaches onto adjoining * lots and road Cadastral Surveyor/Director * Date * Delete words not required					13. Lodgement Fees : <table style="width: 100%;"> <tr> <td>Survey Deposit</td> <td style="text-align: right;">\$</td> </tr> <tr> <td>Lodgement</td> <td style="text-align: right;">\$</td> </tr> <tr> <td>.....New Titles</td> <td style="text-align: right;">\$</td> </tr> <tr> <td>Photocopy</td> <td style="text-align: right;">\$</td> </tr> <tr> <td>Postage</td> <td style="text-align: right;">\$</td> </tr> <tr> <td>TOTAL</td> <td style="text-align: right;">\$</td> </tr> </table>					Survey Deposit	\$	Lodgement	\$	New Titles	\$	Photocopy	\$	Postage	\$	TOTAL	\$										
Survey Deposit	\$																														
Lodgement	\$																														
.....New Titles	\$																														
Photocopy	\$																														
Postage	\$																														
TOTAL	\$																														
14. Insert Plan Number SPI87132																															

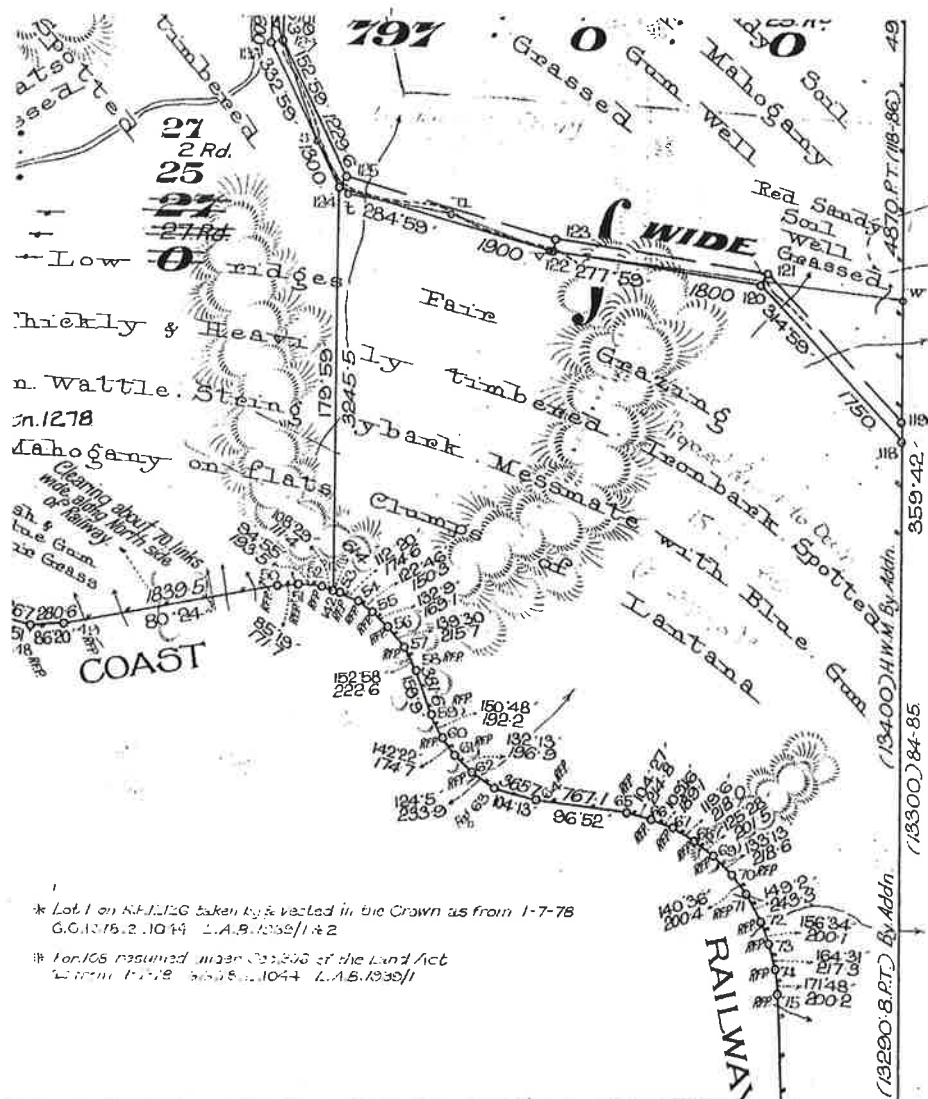




George M. Boyle 23. 22 L. 34. 1202
~~Norman S. Fenn~~ L. 34. 1200
~~Norman S. Fenn~~
 Roy Marbach And. 22. 52 L. 71. 92
 19

IV
~~C. 40.320~~

128
Ctn. 1633



* Lot 1 on R.F. 1126 taken by & vested in the Crown as from 1-7-78
G.O. 1375/2. 1044 L.A. 9/1369/1 & 2

For LOS resumed under 20200 of the Land Act
 20000 1-1-19 20200 1044 L.A.B. 1930/1

29	225 50	Ironb ^h	101.1	A 103
80	279 50	Sp Gum	94.0	..
81	224 30	"	96.3	..
82	200 0	Ironb ^h	84.7	..
83	184 40	Sp Gum	84.3	.. R
86	47 5	"	21.8	..
104	60 25	Ironb ^h	156.4	..
107	348 55	"	468	.. R
109	278 5	M.B.ssh	30.8	..
110	28 5	Ironb ^h	52.6	287
111	86 35	Oak	108.0	109
112	244 40	Blue Gum	60.5	109
23		Fast		.. R
118	30 5	Ironb ^h	85.2	109 R
119	154 10	Gum	88.3	..
120	36 33	Ironb ^h	26.1	.. R
121	182 10	"	72.0	..
122	27 15	Blackw ^d	60.6	..
123	209 35	Blue Gum	21.7	..
124	34 50	Ironb ^h	56.9	109 R
125	181 0	Mellog	49.9	..
126	61 30	Ironb ^h	54.7	103
127	244 10	Sp Gum	37.2	109
128	80 0	Blackw ^d	53.6	103
129	237 15	Sp Gum	42.3	109
130	51 40	Blue Gum	60.1	103
21	345 20	Ironb ^h	106.7	A 103 R
22	23 17	Mellog	177.5	..
24	89 5	Yellow ^d	95.2	..
34	189 35	Blackw ^d	182.0	..
35	144 10	Ironb ^h	118.0	..
36	137 25	"	103.1	..
37	120 15	Sp Gum	120.4	..
38	175 30	"	64.8	..
39	157 20	M.B.ssh	57.6	..
40	113 25	Sp Gum	102.9	..
41	215 8	Blue Gum	78.1	..
42	145 45	Ironb ^h	55.6	..
43	165 5	"	58.0	..
44	239 0	"	88.6	..
45	263 55	Sp Gum	65.5	..
46	285 40	"	117.3	..
47	171 10	"	97.6	..
48	212 50	"	37.2	..
49	178 35	Ironb ^h	79.0	..
50	229 25	Blackw ^d	109.1	..
51	177 25	Sp Gum	125.5	..
52	36 25	Ironb ^h	87.0	..
53	260 15	Mellog ^h	85.7	109
54	282 10	Sp Gum	121.1	..
55	228 40	Blue Gum	57.8	..
56	230 20	Sp Gum	84.4	..

Reference to Corners.		
Cornering	From	To
84	15° 0'	Blood W. 48.2
20	239° 40'	Blue Gum 106.1
20	113° 3'	Blood W. 49.9
		4 1/4 in g
		4 108 R
		106° 0' 0" S

CTN546

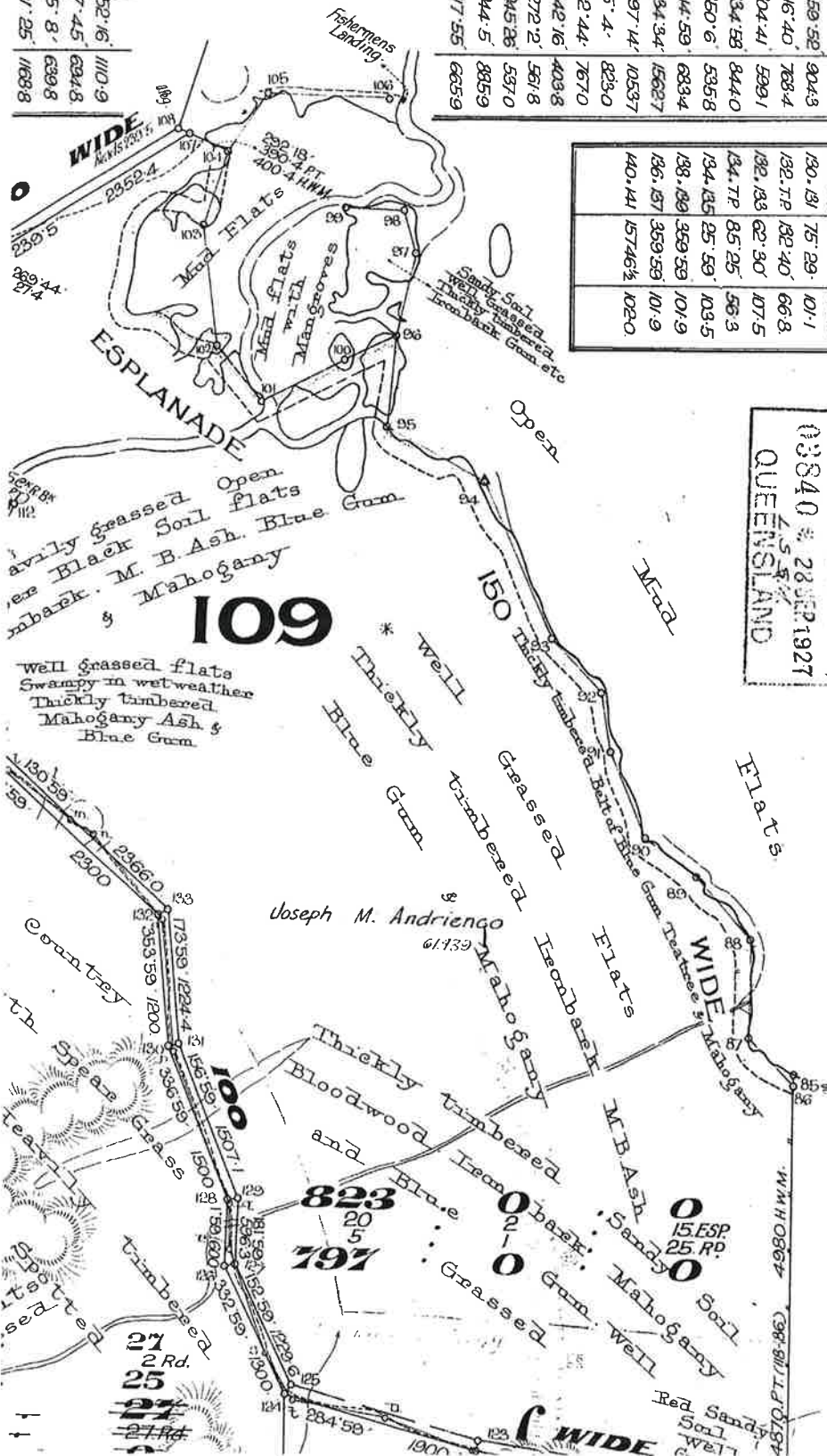
CTN 546

Line	Bearing	Dist.
2		

1970. 15 ^h	304.34	100.0
21. 21 ^h	318.49	100.1
22. 23 ^h	20.58 ^h	77.9
22. 22 ^h	20.58 ^h	200.9
22. 22 ^h	50.43 ^h	300.0
26. 27 ^h	34.22 ^h	559.3
27. 28 ^h	3559.52 ^h	703.4
28. 29 ^h	346.40 ^h	768.4
29. 30 ^h	304.41 ^h	529.1
30. 31 ^h	334.53 ^h	844.0
31. 32 ^h	350.6 ^h	535.8
32. 33 ^h	334.53 ^h	633.4
33. 34 ^h	334.34 ^h	1562.7
34. 35 ^h	297.14 ^h	1053.7
35. 36 ^h	5.4 ^h	823.0
36. 37 ^h	12.44 ^h	767.0
37. 38 ^h	342.16 ^h	403.8
38. 39 ^h	272.2 ^h	561.8
39. 40 ^h	245.26 ^h	537.0
40. 41 ^h	244.5 ^h	885.9
41. 42 ^h	317.55 ^h	665.9

1870	110	3550	42	442.2
180	121	26	29	105.4
122	123	11	29	100.2
124	125	38	50	109.5
126	127	77	29	103.3
128	129	79	29	102.4
130	131	75	29	101.1
132	133	82	40	66.8
134	135	62	30	107.5
136	137	85	25	56.3
138	139	25	59	103.5
139	140	3509	59	101.9
136	137	3509	59	101.9
140	141	5746	3	102.0

102.7	103	352.16	1110.9
103.	104	17.45	694.8
104.	105	35.8	639.8
105.	106	91.25	1168.8

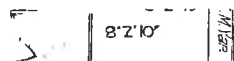


SURVEY OFFICE
03840 28 SEP 1927
QUEENSLAND

See No. 2244 Vol. 128 p. 1376
 Vol. 16 p. 108
 Open to Suburban 7th Ave. N. 2nd St. S.
 See No. 2244 Vol. 128 p. 1376
 Vol. 17 p. 109
 Open for Suburban 7th Ave. N. 2nd St. S.

<u>No.</u>	<u>Name</u>	<u>Solution</u>
108	Peter 2274	George M Boyle
109	A 2274	Mary Ann E. Evans
108	Pete 2274	Roy Marbach And's

Resume : 11173

~~Chn. 547~~

Ctn. ~~1334~~
• 1512

Within the Langmoor Gold Field

(Calliope Shire)

Cal. Book No. 895

Date of Instructions 28.10.26.26.26.3177 PL Tarquinie, South. Run 1657A

Mode of transmission of plaus de

Examined by: *Edith* 19.1.10

Examiner of P.H.Ds: 12/11

Voucher No. 3540 Passed for

[illegible]Sales Register Vol. Fol.

Scale 10. Chains to an Inch

Scale 10. Means to an inch.

PLAN OF
PORTON N^o. 108 & 109.
PARISH OF
County of
Land Agents
District of
Cal. N^o.
Cm. 546

CTN 546



127	84.4	10	Sp Gum	57.2	103.	53	22.9	10	Messm.	85.7	103.
128	80	0	Black ^d	53.6	103.	54	28.0	15	Sp Gum	72.1	103.
129	237	15	Sp Gum	42.3	109.	55	228	40	Sp Gum	57.8	103.
130	51	40	Blue Gum	60.1	108.	56	220	20	Sp Gum	84.4	103.
131	139	0	"	87.7	102.	57	251	5	Ironb ^d	91.4	103.
132	43	35	Ironb ^d	48.9	108.	58	228	10	Sp Gum	107.9	103.
133	279	0	Mehog.	33.0	109.	59	239	10	Black ^d	83.0	103.
134	356	0	Ironb ^d	88.7	108.	60	243	0	"	81.2	103.
135	122	5	Gum.	89.1	109.	61	224	5	Mehog ^y	82.2	103.
136	355	0	Black ^d	144.4	"	62	166	5	Black ^d	85.0	103.
137	141	30	M.B. Ash	34.7	"	63	249	5	"	109.1	103.
140	340	15	Mehog.	79.2	"	64	212	50	Ironb ^d	84.9	103.
141	"	"	Rosy.	"	"	65	219	5	"	75.4	103.
142	9	15	Ironb ^d	52.2	108.	66	184	36	Black ^d	59.6	103.
142	203	40	"	95.3	109.	67	212	20	Sp Gum	59.1	103.
142	164	15	Messm.	72.9	108.	68	257	0	Messm.	120.9	103.
138	36	55	Black ^d	61.4	108.	69	229	35	Black ^d	63.8	103.
139	219	15	Blue Gum	44.9	109.	70	225	40	Ironb ^d	86.9	103.
143	84	10	Mehog.	43.0	108.09	71	223	15	Black ^d	49.5	103.
139	236	20	Teerite	55.8	"	72	233	45	Messm.	73.3	103.
145	182	32	Blue Gum	204.3	"	74	239	45	Black ^d	85.8	103.
139	11	40	Oak	123.3	107.8	73	24.9	55	"	70.7	103.
145	14	0	Blue Gum	80.0	"	75	285	15	Ironb ^d	59.1	103.
						76	307	15	Blue Gum	70.4	103.
						77	280	55	Ironb ^d	107.7	103.
						78	226	25	"	85.0	103.

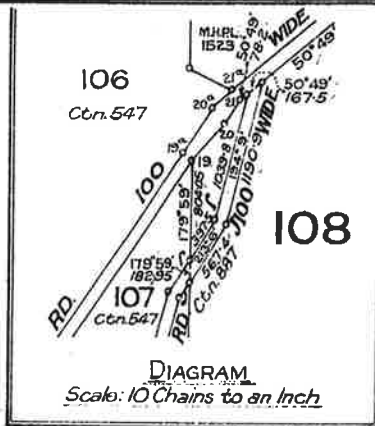
**For Additional Plan &
Document Notings
Refer to CISP**

* Lot 1
G.C. 1
For 1

104.	105	35	8	639.8
105.	106	91	25	1168.8
107.	108	292	18	194.9
109.	110	344	24	103.7
112.	113	207	16	56.3
113.	114	265	53	75.1
114.	115	219	47	75.01
115.	116	242	19	413.5
116.	117	247	19	573.7
117.	118	261	21	551.2
122.	123	52	18	414.5
124.	125	80	9	344.0
126.	127	75	5	324.1
128.	129	96	35	503.5
130.	131	99	15	902.7
132.	133	102	10	393.3
134.	135	108	10	467.0
136.	137	125	35	332.1
138.	139	125	25	746.1
140.	141	121	30	250.5
142.	143	137	25	106.1
144.	145	174	5	1190.
146.	147	157	25	477.2
148.	149	178	45	444.6
150.	151	158	45	1005.5
152.	153	146	45	505.2
154.	155	99	45	910.5
156.	157	108	50	876.5
158.	159	97	0	3048.0

I hereby certify that I, in person, made and on the 16. 7. 1927 completed the survey represented by this plan, on which are written the bearings and lengths of the lines surveyed by me, and that the survey has been conducted in accordance with the existing regulations of the Surveyor-General's Department.

16. 7. 1927
J. G. M. M. M.
Surveyor



Noted on Ch. 545
For 108 adjusted, vide RC 24258 4/10/27

2105	2106
94	30
7.6	27
23.5018	23.49
10 Hrs.	23.50
23.50	148.39
23.50	148.43
9.8	36
13.35	59
3.46	236
3.54	235
8.37	8.2
8.2	17
8.2	10
8.2	10

NOTE: Observing stations are shown by a triangle on a rod.

C.A.M.

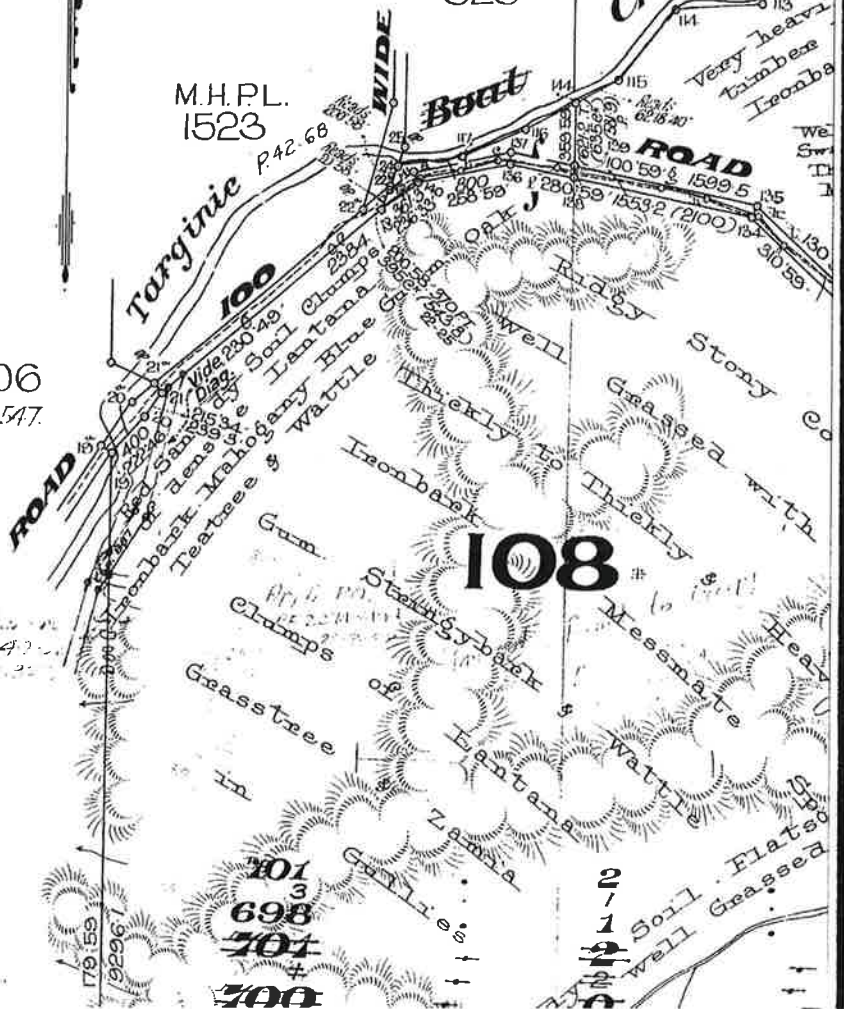
Meridian Observations

(This form can also be adapted to stellar observations)

106
Ch. 547

RC 24258
4/10/27

107



Conversion under Section 11 of
"The Land Acts Amendment Act of 1929."

A.F. No. 2271

DISTRICT OF GLADSTONE

"THE LAND ACTS, 1910 TO 1929,"

Strike out if not
applicable.

~~THE PRICKLY-PEAR LAND ACTS, 1923 TO 1929~~

License to Occupy an Agricultural Farm.

WHEREAS NORMAN STANLEY DUNN, held
to occupy as a Perpetual Lease Selection the land in the
of GLADSTONE, surveyed as portion 109
parish of CALLIOPE, county of CLINTON
comprising 797 acres

And whereas the said NORMAN STANLEY DUNN has given
notice under Section 11 of "The Land Acts Amendment Act of 1929"
that he elects to have the tenure of his holding converted to that of
Agricultural Farm.

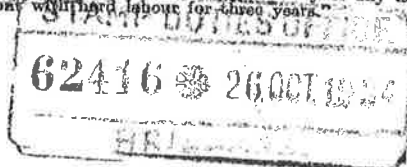
Now I, William John Monteith, the Commissioner
for the said district do hereby license the said NORMAN STANLEY DUNN
to occupy the said land (which will be
known as Agricultural Farm No. 2271, GLADSTONE
District), subject to the performance of all the conditions prescribed by "The
Land Acts, 1910 to 1929," in respect of Agricultural Farms.

The conditions to be performed by the selector with respect to the
said land are as endorsed on this license.

GIVEN under my hand at Rockhampton, the twenty-fourth
day of August, 1931



By Section 478 of "The Criminal Code" it is provided as follows:—"Any person who wilfully and
unlawfully, and with intent to defraud, removes or defaces any object or mark which has been lawfully
erected or made as a indication of the boundary of any land is guilty of a misdemeanour, and is liable
to imprisonment with hard labour for three years."



THIS STAMPING ACTED BY
W. J. Monteith
Land Commissioner,
Warden

ENDORSEMENT.

Term of Lease.

The term of the lease is twenty years from the **1st October, 1930**

Conditions.

You must occupy and continue to occupy the land continuously and *bona fide* from the date upon which you commenced to occupy it until the expiration of the term or until such earlier time as you obtain a deed of grant of the land in fee-simple. ~~*Provided that you must perform the condition of personal residence by your continuous and bona fide residence on the selection.~~ *W. J. L. M.*

~~After the expiration of the term of the lease, you must perform the condition of occupation by the continuous and bona fide residence on the land of yourself or your registered bailiff. Such registered bailiff must be a person who is himself qualified to select a similar selection, and his appointment must be registered in this office as by law provided.~~

W. J. L. M. An annual payment equal to one-fortieth of the purchasing price must be made on or before the 31st day of March in each year. The remainder of the survey fee must be paid in **two(2)** instalments of £3.14s.0d. each on the thirty-first March, ~~1932~~ **in the years 1932 and 1933** respectively.

Within five years from the date of this license, or such extended time as the Land Court may allow, you must either enclose the land with a good and substantial fence or make substantial and permanent improvements thereon of a value equal to the cost of such a fence, and within the same period you must apply to the Commissioner for a certificate that you have done so.

At any time after the expiration of five years from the commencement of the lease you may apply to the Commissioner for a certificate that all conditions precedent have been performed, and upon obtaining such certificate and paying the balance of the purchasing price and the deed fees, you will be entitled to a deed of grant of the land in fee-simple.

~~You must destroy the noxious plant or noxious plants specified in the condition contained in the notification opening the land for selection within the period specified in such condition. During each year of such period you must destroy an equal proportion of the noxious plant or plants according to the number of years in the period, and carry out such destruction in equal proportions during each half of such year, so that at the expiration of the period the land shall be absolutely freed from the noxious plant or plants. After the expiration of the period, and during the continuance of the lease, you must keep the holding absolutely free from the noxious plant or plants so specified.~~ *W. J. L. M.*

W. J. L. M. You must also destroy in accordance with law all noxious plants ~~other than the noxious plant or plants specified in the condition above referred to, or, if no noxious plant or plants are so specified, then all noxious plants~~ as defined in "The Land Acts, 1910 to 1929," and all other plants declared to be noxious plants for the purposes of those Acts, and thereafter during the continuance of the lease you must maintain the holding free from noxious plants.

If within three months after the expiration of the said term of twenty years, if the lease is then still in force, and after payment of all moneys accrued due to the Crown under the lease you make application to the Minister under your hand, you will be entitled either—

- (a) To a perpetual lease of the selection commencing on the date of the expiration of the said term and at an annual rental during the first fifteen years equal to one pound ten shillings per centum of the purchasing price of the farm; or
- (b) To be granted an extension of your lease of the selection as an agricultural farm for a further period of ten years and at an annual rental equal to one-tenth part of the balance of purchase money which remained unpaid at the expiration of the twentieth year of the said term.

Upon breach of any of the above conditions or of any other condition to which the tenure of the land is subject or upon—

- (a) Default in payment of the rent payable on the due date; or
- (b) Failure to exercise your option to acquire the selection in fee-simple within twelve months after the expiration of the said term of twenty years, assuming that you do not secure either a perpetual lease of the selection or ten years' extension of the lease as an agricultural farm, as aforesaid; or
- (c) Failure to exercise your option to acquire the selection in fee-simple within twelve months after the expiration of the ten years' extension of lease if you secure such extension,

the selection may be forfeited: Provided that in the case of non-payment of rent you may defeat the forfeiture by payment of the rent within ninety days after the due date with an additional sum by way of penalty equal to interest thereon at the rate of ten per centum per annum for the period of default.

Mr. Norman S. Dunn,
YARLON N.C. Line.

W. J. L. M.
Land Commissioner.

* In cases where the condition of personal residence does not apply, strike out the words between asterisks.

Endorsements covering License to Occupy

A.F. 2271 Gladstone

Mortgage produced the 13 th day of February 1930	
from	Norman Stanley Dunn
to the	
"Corporation of the Agricultural Bank"	
accepting repayment of advances made and further	
advances with interest as therein set forth	
No.	51633
14-5-1930	R. A. Schell
Registrar, Lands Department, Victoria	

Form 27.

P.L.S. No. 2271

DISTRICT OF GLADSTONE

"THE LAND ACTS, 1910 TO 1925,"

~~"THE PRINCIPAL LAND ACT OF 1923."~~

|| Strike out if
not applicable.

13 APR 1929

Notice of Approval of Application to Select a Perpetual Lease Selection.

DISTRICT LAND OFFICE,

Gladstone, 8 April, 1929.

SIR,—

I hereby notify you of the approval by the Land Court ~~Principally near Land Commission~~ of your application, No. 2271, to select as a Perpetual Lease Selection the land surveyed as portion 109, parish of Calliope, county of Clinton, comprising 797 acres.

The lease will be a lease in perpetuity, commencing on the quarter day next ensuing after the date of the license to occupy, to be hereafter issued to you.

The conditions to be performed by you with respect to the said land are as follow:—

1. Within six months after the issue to you of a license to occupy, you must enter into occupation of the land, and thereafter you must occupy it continuously and *bond fide*. ~~*During the first period of five years you must perform the condition of personal residence by your continuous and bond fide personal residence on the selection. After such period you must perform the condition of occupation by the continuous and bond fide residence on the selection of yourself or your registered bailiff. Such registered bailiff must be a person who is himself qualified to select a similar selection, and his appointment must be registered in this office as by law provided. During the first years of the term you must cultivate~~ ~~*You must cultivate an area of~~ ~~acres of the selection and place such area under crop of**~~

2. Rent must be paid on the thirty-first day of March in each year. For the second year of the term the rent will be a peppercorn if demanded, and thereafter during the remainder of the first period of fifteen years the annual rent will be £11.19s.2d. The rent for each period of 15 years after the first will be determined by the Land Court. ~~Principally near Land Commission~~ The remainder of the survey fee must be paid in four equal annual instalments on the thirty-first day of March in the four years next following the issue of the license to occupy.

3. Within five years from the issue of the license to occupy, or such extended time as the Land Court ~~Principally near Land Commission~~ may allow, you must either enclose the land with a good and substantial fence or make substantial and permanent improvements thereon of a value equal to the cost of such a fence, and within the same period you must apply to the Commissioner for a certificate that you have done so. ~~*You must commence to make the requisite improvements on the selection not later than twelve months from the date of the commencement of the term and thereafter make reasonable progress in making them to the satisfaction of the Minister.~~

* In cases where the condition of personal residence does not apply, strike out the words between asterisks.

† In cases where the selector has not undertaken the condition of cultivation, strike out the words to the end of the sentence.

** In cases where the notification does not impose a condition of cultivation, strike out the words between double asterisks. If condition imposed, state requirements of the notification.

3,000—18-8-26;

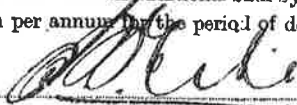
Norman Stanley Dunn

YARWUN.

4. You must destroy the noxious plant or noxious plants specified in the condition contained in the notification opening the land for selection within the period specified in such notification. During each year of such period you must destroy an equal proportion of the noxious plant or plants according to the number of years in the period; and carry out such destruction in equal proportions during each year of such year, so that at the expiration of the period the land shall be absolutely freed from the noxious plant or plants. After the expiration of the period, and during the continuance of the lease, you must keep the holding absolutely free from the noxious plant or plants so specified.

You must also destroy in accordance with law all noxious plants other than the noxious plant or plants specified in the condition above referred to, or, if no noxious plant or plants are so specified, then all noxious plants as defined in "The Land Acts, 1910 to 1925," and all other plants declared to be noxious plants for the purposes of those Acts, and thereafter during the continuance of the lease you must maintain the holding free from noxious plants.

5. Upon breach of any of the above conditions or of any other condition to which the tenure of the land is subject, or upon default in payment of the rent payable on the due date, the selection may be forfeited: Provided that in the case of non-payment of rent you may defeat the forfeiture by payment of the rent within ninety days after the due date with an additional sum by way of penalty equal to interest thereon at the rate of ten per centum per annum for the period of default.



Deputy Land Commissioner.
XXXXXX



DISTRICT Gladstone.

MAXIMUM AREA ALLOWED } 1280 acres

"THE LAND ACTS, 1910 TO 1925,"

|| Strike out if not applicable.

|| AND ~~"THE PRICKLY-PEAR LAND ACTS, 1923 TO 1926."~~

Application for a Perpetual Lease Selection.

RECEIVED this **Twelfth** day of **December** 1928, at 1.30pm o'clock
 p. Land Agent at Gladstone.

* State Christian Name and Surname in full.

I,

Norman Stanley Dunn, of **Yarwan**

† State Occupation.

Farmer

, hereby apply to select the Crown Lands described in the Schedule hereto, as a Perpetual Lease Selection, under the provisions of

|| Strike out if not applicable.

"The Land Acts, 1910 to 1925," || and "The Prickly-pear Land Acts, 1923 to 1926," and I herewith lodge the sum of **Eleven** pounds **Thirteen** shillings and **Five** pence, on account of the First Year's Rent and Survey Fee.

‡ Insert "Natural Born" or "Naturalised."

§ Insert age last birthday.

I am a **† natural born** subject of His Majesty, and am **§ thirtyone** years of age. I apply to select the land in order that I may hold and use it for my own exclusive benefit according to law, and not as a trustee, agent, or servant of or for any other person. The said land, together with all other land now held by me as Agricultural Selections in the same District, does not exceed

1280 acres, and the area of all such lands held by me in the State does not exceed 2,560 acres.

SCHEDULE

Date of notification : **24.4.28.**Portion Nos. **109.**Page in Gazette : **1398.**Area of each Portion : **797 acres**County : **Clinton.**Total Area applied for : **797 acres**Parish : **Calliope.**

Particulars of other Selections held or applied for by Applicant : **Nil.**

Stp Duty
12/6d paid.

Dated at **Gladstone** this **Twelfth** day of **December** 1928.

(Signature of Applicant)

N. S. Dunn

WITNESS

Area of Land Applied for.			Annual Rent per Acre.	Deposit.		
A.	B.	C.		2	s.	d.
797	0	0	3 3/5d	7	19	5.
Survey Fee				3	14	..
Total				11	13	5.

COMMISSIONER'S

DECISION.

Witnessed

Accepted
White
 Dep. Land Commr
 9th Jan. 1929
 FOR O.K.

Department of Public Lands,
Brisbane, 24th April, 1928.

IT is hereby notified, in pursuance of the provisions of "The Land Acts, 1910 to 1927," that the Land specified in the Schedule hereto, and situated in the undermentioned Land Agents' Districts, will be open for selection as PERPETUAL LEASE SELECTIONS, under the provisions of the said Acts, as surveyed or designed land, on and after the dates and at the hours and places stated in the said Schedule, at the annual rent specified against each lot respectively in the said Schedule.

The amount required to be lodged with the application to select, and comprising the total of the first year's rent and one-fifth of the prescribed survey fee, is as specified against each lot respectively in the said Schedule.

The capital value of the land is as specified against each lot respectively in the said Schedule.

The maximum area which may be applied for or held by any one person as a Perpetual Lease Selection or as Perpetual Lease Selections, in the whole area to which this notification has reference, is 1,280 acres.

The value of any improvements must be paid by the selector within twenty-one days after notice of such value as by law determined has been given to him.

Exch. 461; Targuin Stn. 1657A; L.O. 87 Stan.

M. J. KIRWAN,
For the Secretary for Public Lands.

THE SCHEDULE.

No. of Lot.	Land Agent's District.	Existing Tenure.	Parish.	Whether Surveyed or Designed.	No. of Former Selection.	Area.	Survey Fee.	Capital Value per Acre.	Annual Rent per Acre.	Deposit to be Lodged with Application.	Maximum Area.	Provisional Valuation of Improvements.
						A. R. P.	£ s. d.	£ s. d.	s. d.	£ s. d.	Acres.	£ s. d.
To be Open at CAIRNS on and after FRIDAY, 1st JUNE, 1928, at ELEVEN O'CLOCK A.M.												
1	Cairns	...	Sophia ...	Surveyed	P.L. 1802	63	305 0 12	11 0 0	1 0 0	0 0 0	5 5 7	41 0 0
To be Open at MARYBOROUGH on and after FRIDAY, 1st JUNE, 1928, at ELEVEN O'CLOCK A.M.												
2	Maryborough	...	Glenbar	Designed	...	15	707 0 0	18 10 0	1 2 0	0 0 0	15 13 8	57 0 0
3	Ditto	...	ditto	ditto	...	16	737 0 0	18 10 0	1 2 0	0 0 0	15 2 9	8 0 0
4	Ditto	...	ditto	ditto	...	17	625 0 0	16 15 0	1 7 8	0 0 0	16 4 10	0 0 0
To be Open at IPSWICH on and after TUESDAY, 5th JUNE, 1928, at TWELVE O'CLOCK NOON.												
5	Ipswich	...	Buaraba	Surveyed	G.F. 3560	40	1172 0 0	23 10 0	0 15 0	0 0 0	17 17 9	70 9 0
6	Ditto	...	ditto	ditto	...	40	1120 8 0	23 10 0	0 16 8	0 0 0	18 15 0	50 0 0
To be Open at ROCKHAMPTON on and after TUESDAY, 5th JUNE, 1928, at ELEVEN O'CLOCK A.M.												
7	Rockhampton	...	Faraday	Surveyed	P.L. 4912	47	210 1 24	11 0 0	0 16 8	0 0 0	4 16 8	324 8 0
8	Ditto	...	ditto	ditto	P.L. 5387	78	202 3 30	11 0 0	0 16 8	0 0 0	4 14 9	217 16 0
To be Open at BUNDABERG on and after WEDNESDAY, 6th JUNE, 1928, at ELEVEN O'CLOCK A.M.												
9	Bundaberg	...	Gin Gin	Surveyed	P.L. 5284	114	3 0 15	3 0 0	1 10 0	0 0 0	0 9 6	...
10	Ditto	...	Warro	...	P.L. 5356	67	1065 2 0	23 0 0	0 16 0	0 0 0	16 7 9	30 0 0
To be Open at GLADSTONE on and after THURSDAY, 7th JUNE, 1928, at ELEVEN O'CLOCK A.M.												
11	Gladstone	...	Calliope	Surveyed	...	18	171 3 23	10 0 0	0 12 0	0 0 0	3 12 3	1,280
12	Ditto	...	ditto	ditto	...	104	738 0 0	18 10 0	0 10 0	0 0 0	9 4 5	1 16 0
13	Ditto	...	ditto	ditto	...	105	305 2 0	18 10 0	0 10 0	0 0 0	5 14 4	4 10 0
14	Ditto	...	ditto	ditto	...	106	835 0 0	20 10 0	0 16 0	0 0 0	13 9 11	10 0 0
15	Ditto	...	ditto	ditto	...	107	423 1 20	14 15 0	0 10 0	0 0 0	8 2 7	...
16	Ditto	...	ditto	ditto	...	108	700 0 0	18 10 0	0 10 0	0 0 0	5 10 0	...
17	Ditto	...	ditto	ditto	...	109	707 0 0	18 10 0	1 0 0	0 0 0	11 13 5	13 0 0
To be Open at GYMPIE on and after THURSDAY, 7th JUNE, 1928, at ELEVEN O'CLOCK A.M.												
18	Gympie	...	Nearie	Surveyed	P.L. 7022	109	258 2 15	11 7 8	0 10 0	0 0 0	4 1 4	16 10 4
19	Ditto	...	Nocoma	...	A.F. 3025	164	230 1 52	11 15 0	0 10 0	0 0 0	4 4 7	...
To be Open at BEMERD on and after THURSDAY, 7th JUNE, 1928, at ELEVEN O'CLOCK A.M.												
20	Bemerald	...	Alpha	Surveyed	P.L. 2306	116	686 2 34	16 15 0	0 10 0	0 0 0	8 2 7	23 13 0
To be Open at STANTHORPE on and after THURSDAY, 7th JUNE, 1928, at ELEVEN O'CLOCK A.M.												
21	Stanthorpe	...	Fulkestone	Surveyed	P.L. 1165, 2565, and 3040 inclosed & 193	174 to 177, 179, & 193	486 3 1	15 15 0	0 16 8	0 0 0	9 4 9	419 8 2
22	Ditto	...	Pikedale	ditto	P.L. 3024 and 3027	223 & 225	149 2 37	0 5 0	2 10 0	0 0 0	7 8 4	306 13 4

Department of Public Lands,
Brisbane, 24th April, 1928.

IT is hereby notified, in pursuance of the provisions of "The Land Acts, 1910 to 1927," that the Land specified in the Schedule hereto, and situated in the INGHAM LAND AGENT'S DISTRICT, will be open for selection as a PERPETUAL LEASE SELECTION, under the provisions of the said Acts, on and after FRIDAY, the FIRST day of JUNE, 1928, at ELEVEN O'CLOCK A.M., at the LAND OFFICE, INGHAM, at the annual rent specified in the said Schedule.

The amount required to be lodged with the application to select, and comprising the total of the first year's rent and one-fifth of the prescribed survey fee, is as specified in the said Schedule.

The capital value of the land is as specified in the said Schedule.

The maximum area which may be applied for or held by any one person as a Perpetual Lease Selection, in the whole area to which this Notification has reference, is 149 acres.

The condition of PERSONAL RESIDENCE is imposed in respect of the selection of this land during the first five years of the term.

During the period from the First day of June, 1928, until FRIDAY, the THIRTIETH day of NOVEMBER, 1928 (both inclusive), only persons who do not hold any land under the said Acts in Queensland, or do not hold any freehold land in Queensland other than town or suburban land, shall have the right to apply for the said land.



QUEENSLAND.

Agricultural Farm No. 2271

Gladstone District.

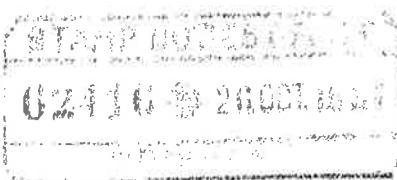
Lease of Agricultural FARM
under "The Land Acts, 1910
to 1932."

George the Fifth, by the Grace of God, of Great
Britain, Ireland, and the British Dominions
beyond the Seas, King, Defender of the Faith,
Emperor of India:—

To All to whom these Presents shall come, Greeting:

Whereas, NORMAN STANLEY DUNN

in Our State of Queensland, in pursuance of the provisions of "The Land Acts, 1910 to 1932" (hereinafter referred to as "the said Acts"), is now entitled to a Lease of the Land described in the Schedule endorsed on these Presents, for the term of twenty Years, at the yearly rent hereinafter mentioned, and with, under, and subject to the rights, powers, privileges, terms, conditions, provisions, exceptions, restrictions, reservations, and provisos in the said Acts, and hereinafter contained: Now Know YE, that in consideration of the premises and of the rent hereby reserved and of the payment of the rent payable under the said Acts for the said Land, and of the prescribed part of the Survey Fee—We, in pursuance of the said Acts, Do HEREBY, for Us, Our Heirs and Successors, Demise and Lease unto the said Norman Stanley Dunn (hereinafter with his Successors in title designated "the Lessee"), and his lawful Assigns, ALL that parcel of Land described in the Schedule endorsed on these presents, To HOLD the same unto the Lessee, and his lawful Assigns, for and during the term of twenty Years, to be computed from the First day of October in the year One thousand nine hundred and thirty with, under, and subject to the reservations hereinafter particularly mentioned, and with, under, and subject to the rights, powers, privileges, terms, conditions, provisions, exceptions, restrictions, reservations, and provisos in Section 99 of the said Acts, and to all other rights, powers, privileges, terms, conditions, provisions, exceptions, restrictions, reservations, and provisos referred to, contained, or prescribed in and by the said Acts, "The Mining on Private Land Acts, 1909 to 1929," and "The Petroleum Acts, 1923 to 1929," or any Regulations made or which may hereafter be made under the aforesaid Acts or any of them: YIELDING AND PAYING unto Us, Our Heirs and Successors, on or before the thirty-first day of March in each and every year during the said term, the yearly rent or sum of Fourteen pounds eighteen shillings and eleven pence



such payments to be made at the Treasury in Brisbane, in Our said State, or at such other place as may from time to time be appointed by the Governor of Our said State in Council: PROVIDED ALWAYS AND WE DO HEREBY RESERVE unto Us, Our Heirs and Successors, all Gold and Minerals (the term "Minerals" to have the same meaning as in *The Mining on Private Land Acts, 1909 to 1929*), on and below the surface of the said Land, and all Mines of Gold and Minerals, on and below the surface of the said Land: AND WE DO HEREBY ALSO RESERVE unto Us, Our Heirs and Successors, and to such persons as shall from time to time be duly authorised by Us in that behalf during the term of the said Lease, the free right and privilege of access, including ingress, egress, and regress, into, upon, over, and out of the said Land, for the purpose of searching for or working Gold and Minerals, or any of them, or mines of Gold and Minerals, or any of them, in any part of the said Land: AND WE DO HEREBY ALSO RESERVE unto Us, Our Heirs and Successors, all Petroleum (the term "Petroleum" to have the same meaning as in *The Petroleum Acts, 1923 to 1929*), on or below the surface of the said Land: AND ALSO all rights of access for the purpose of searching for and for the operations of obtaining Petroleum in any part of the said Land: AND ALSO all rights of way for access and for pipe lines and other purposes requisite for obtaining and conveying Petroleum in the event of Petroleum being obtained in any part of the said Land: AND WE DO HEREBY ALSO RESERVE unto Us, Our Heirs and Successors, all Helium found in association with Petroleum in any part of the said Land: AND WE DO FURTHER RESERVE the right of any person duly authorised in that behalf by the Governor of Our said State in Council at all times to go upon the said Land, or any part thereof, for any purpose whatsoever, or to make any survey, inspection, or examination of the same.

In Testimony whereof, We have caused this Our Lease to be sealed with the Seal of Our said State.

Witness Our Right Trusty and Well-beloved Counsellor, Sir LESLIE ORME WILSON, Colonel on the Retired List of Our Royal Marines, Knight Grand Commander of Our Most Exalted Order of the Star of India, Knight Grand Commander of Our Most Eminent Order of the Indian Empire, Companion of Our Most Distinguished Order of Saint Michael and Saint George, Companion of Our Distinguished Service Order, Governor of Our State of QUEENSLAND and its Dependencies, in the Commonwealth of Australia, at Government House, Brisbane, in Queensland aforesaid, this

eleventh day of October

in the twenty-fifth year of Our Reign, and in the year of Our Lord One thousand nine hundred and thirty-four.

Leslie Wilson

SCHEDULE.

Register No. of Selection 2271

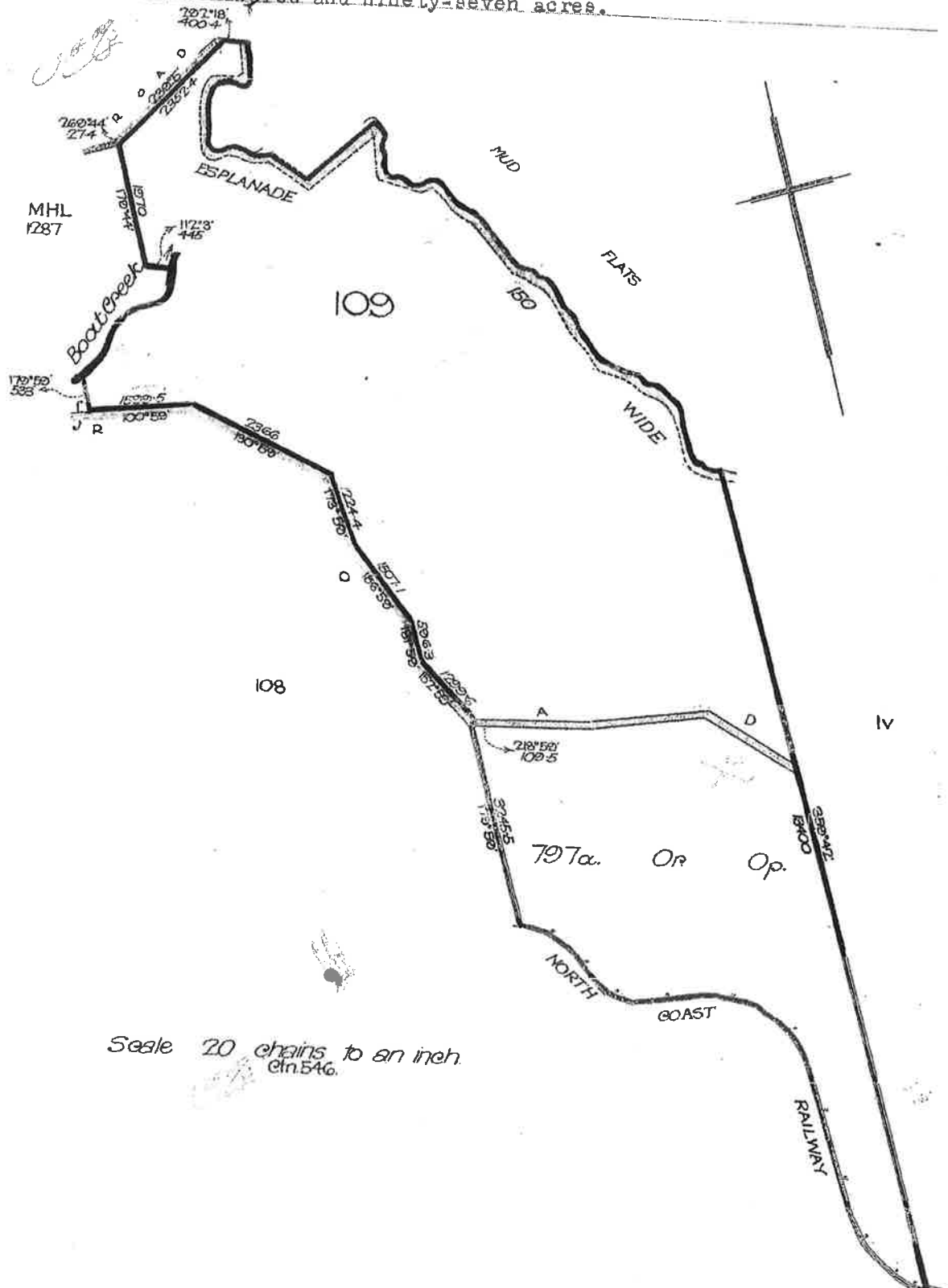
Gladstone District.

County Clinton

Parish Calliope

• Portion One hundred and nine

Area ~~Seven hundred and ninety-seven acres.~~
20718



Seale 20 chains to an inch.
Ctn. 546.

Transfers, Assignments, Mortgages, and Subleases Registered.

18/12
RELEASE REGISTERED
this 16th day of May 1935
5-1930

Secretary, Land Administration Board.

Mortgage No. 127709 from Joseph
Mick Andrienco to

Bank of New South Wales

for advances as therein set forth
Registered 21.10.1934

for Secretary, Land Administration Board.

Mortgage No. 68123 from Norman Stapley
Dunn to Bank of New South Wales.
RELEASE REGISTERED
this 26th day of May 1935

Secretary, Land Administration Board.

TRANSFER of the Lessee's Interest in the
within-described holding to

Richard William Hunt.

Registered: 15 JUN 1939

Secretary, Land Administration Board.

TRANSFER of the Lessee's Interest in the
within-described holding to

Joseph Mick Andrienco

Registered: 2 NOV 1943

Secretary, Land Administration Board.

Mortgage No. 89851 from
Mick Andrienco to
The Queensland National Bank Limited
securing advances as therein set forth
Registered 2 NOV 1943

Secretary, Land Administration Board.

Mortgage No. 99744 from Joseph Mick
Andrienco to

The National Bank of Australasia Limited

securing advances as therein set forth

Registered 3.8.1948.

Secretary, Land Administration Board.

PURSUANT to Section 98 A (b) of "The Land Act,
1910 to 1950", the Selector of the within-named
Agricultural Farm has been granted an extension of
the within lease for a further period of ten years
commencing on the first day of October 1950.
at an annual rental of £27.17.8

for

Secretary, Land Administration Board.



Registration
Vol. **C 584** Fol. **133**

C 528/255

VOL: C 584 FOLIO: 133



30584133

Deed of Grant of Land

Land Act 1962-1986

Elizabeth the Second, by the Grace of God, Queen of Australia, and Her other Realms and Territories,
Head of the Commonwealth:—

To All to whom these Presents shall come, Greeting:

We, with the advice of the Executive Council of Our State of Queensland, and in pursuance of the provisions of the Land Act 1962-1986 and
Section 6B of the Industrial Development Act 1963-1987

do hereby Grant in fee simple unto the person described in the Second Schedule hereto,

ALL that Parcel of Land in Our said State described in the First Schedule hereto and delineated on plan registered in the Department of Geographic Information, and having
Catalogue Number as stated in such First Schedule,

SUBJECT TO the Reservations and Conditions hereinafter specified, and such other Reservations and Conditions as may be contained in and declared by the Laws of Our
said State.

Specified Reservations:—

1. (a) All minerals (as defined by the Mining Act 1968-1986) on and below the surface of the land; and
(b) The right of access for the purpose of searching for and working any mines (as defined by the Mining Act 1968-1986) in any part of the land.
2. (a) All petroleum (as defined by the Petroleum Act 1923-1986) on or below the surface of the land; and
(b) All rights of access for the purposes of searching for and for the operations of obtaining petroleum in any part of the land, and all rights of way for access and for pipe-lines and other purposes requisite for obtaining and conveying petroleum in the event of petroleum being obtained in any part of the said land.

D.G. Andrews

Specified Conditions:—

IN TESTIMONY WHEREOF, We have caused this Our Grant to be Sealed with the Seal of Our said State.

WITNESS Our Trusty and Well-beloved the Honourable Sir DORMER GEORGE ANDREWS

Chief Justice of the State of Queensland, Deputy for and on behalf of

WITNESS Our Trusty and Well-beloved His Excellency the Honourable Sir WALTER BENJAMIN CAMPBELL, one of Her Majesty's Counsel learned in the law, Governor in and over the State of Queensland and its Dependencies in the Commonwealth of Australia, at Government House, Brisbane, in Queensland aforesaid, this Twenty-sixth day of January, in the thirty-seventh year of Our Reign and in the year of Our Lord One thousand nine hundred and eighty-nine.

FIRST SCHEDULE—DESCRIPTION OF LAND

Lot 138 on Plan CTN2123

County CLINTON

Parish CALLIOPE

Area 50.44 HECTARES

SECOND SCHEDULE—GRANTEE

THE MINISTER FOR INDUSTRIAL DEVELOPMENT OF QUEENSLAND

Department of Lands File Reference:—RC.47408

ENTERED in the Register Book, Vol. **C 584** Folio **133** this 7th day of February, 1989
9150-31

B.B. McMahon
DEPUTY Registrar of Titles
(CLINTON)

REGISTERED PROPRIETOR

ICI Australia Operations Pty Ltd

NATURE	INSTRUMENT		REGISTERED	Signature of Registrar of Titles
	NUMBER	PRODUCED		
Tfr	C606101P	29 Oct 1990	28 OCT 1990	<i>R. A. Anderson</i> 

THIRD SCHEDULE (EASEMENTS, ENCUMBRANCES AND INTERESTS)

[illegible]

E 478—Govt. Printer, Oid.

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR OF TITLES ARE CANCELLED

* Dealings with this Lease will be Registered on the Original Lease only instead of on this Deed of Grant.

HISTORICAL TITLE SEARCH
DEPT OF NATURAL RESOURCES AND MINES, QUEENSLAND

Request No: 26397343
Search Date: 11/07/2017 16:19

Title Reference: 30584133
Date Created: 07/02/1989

REGISTERED OWNER

Dealing No: 709546010 27/04/2006

ORICA AUSTRALIA PTY LTD A.C.N. 004 117 828

CHANGE OF NAME No 709546010
ORICA AUSTRALIA PTY LTD A.C.N. 004 117 828
Lodged at 10:24 on 27/04/2006

ESTATE AND LAND

Estate in Fee Simple

LOT 138 CROWN PLAN CTN2123
Local Government: GLADSTONE

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. EASEMENT IN GROSS No 709546004
burdening the land
ERGON ENERGY CORPORATION LIMITED
over
EASEMENT A ON SP187132
Lodged at 10:24 on 27/04/2006
2. SURVEY PLAN No 709545996
surveys part of the land into
EASEMENT A ON SP187132
Lodged at 10:23 on 27/04/2006
3. Rights and interests reserved to the Crown by
Deed of Grant No. 30584133 (Lot 138 on CP CTN2123)

ADMINISTRATIVE ADVICES - NIL
UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Historical Title Search **

COPYRIGHT THE STATE OF QUEENSLAND (DEPT OF NATURAL RESOURCES AND MINES) [2017]
Requested By: D-ENQ INFOTRACK PTY LIMITED

CURRENT TITLE SEARCH

DEPT OF NATURAL RESOURCES AND MINES, QUEENSLAND

Request No: 26397475

Search Date: 11/07/2017 16:26

Title Reference: 30584133

Date Created: 07/02/1989

REGISTERED OWNER

Dealing No: 709546010 27/04/2006

ORICA AUSTRALIA PTY LTD A.C.N. 004 117 828

ESTATE AND LAND

Estate in Fee Simple

LOT 138 CROWN PLAN CTN2123

Local Government: GLADSTONE

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 30584133 (Lot 138 on CP CTN2123)

2. EASEMENT IN GROSS No 709546004 27/04/2006 at 10:24
burdening the land

ERGON ENERGY CORPORATION LIMITED

over

EASEMENT A ON SP187132

ADMINISTRATIVE ADVICES - NIL

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

COPYRIGHT THE STATE OF QUEENSLAND (DEPT OF NATURAL RESOURCES AND MINES) [2017]
Requested By: D-ENQ INFOTRACK PTY LIMITED

Appendix B Historical Aerial Photographs



Source: Department of Natural Resources and Mines - 1959.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1959**

Client: Orica Australia Pty Ltd	
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)	
Job No: 52877	File Name: 52877_1959



Source: Department of Natural Resources and Mines - 1965.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1965**

Client: Orica Australia Pty Ltd	
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)	
Job No: 52877	File Name: 52877_1965





Source: Department of Natural Resources and Mines - 1970.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1970**

Client: Orica Australia Pty Ltd	
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)	
Job No: 52877	File Name: 52877_1970





Source: Department of Natural Resources and Mines - 1973.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1973**

Client: Orica Australia Pty Ltd	
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)	
Job No: 52877	File Name: 52877_1973





Source: Department of Natural Resources and Mines - 1979.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1979**

Client: Orica Australia Pty Ltd	
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)	
Job No: 52877	File Name: 52877_1979





Source: Department of Natural Resources and Mines - 1989.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1989**

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877

File Name: 52877_1989



Source: Department of Natural Resources and Mines - 1999.

© 2017 JBS&G

050100200m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 1999**

Client: Orica Australia Pty Ltd	
Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)	
Job No: 52877	File Name: 52877_1999



Source: Department of Natural Resources and Mines - 2007.

© 2017 JBS&G

050100200 m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

 **Figure: Historical Aerial Photograph 2007**

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877

File Name: 52877_2007





Source: Near Maps - <http://www.nearmap.com.au/>. Imagery 04-04-2017.

© 2017 JBS&G

0 50 100 200 m			
Scale: 1:6,000			
Datum: MGA94 Zone 56 - AHD			
A3			
A	Original Issue - R01	BC	10-07-2017
Rev	Description	Dm.	Date

Legend:

JBS&G Figure: Historical Aerial Photograph
2017

Client: Orica Australia Pty Ltd

Project: 30 Reid Road, Yarwun, QLD (Lot 138 on CTN2123)

Job No: 52877

File Name: 52877_2017

Appendix C EMR/CLR Search



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Stuart Derham
JBS&G Level 3, 32 Turbot Street
Brisbane QLD 4000

Transaction ID: 50389553 EMR Site Id: 12395 03 July 2017
Client Reference:
Cheque Number:

This response relates to a search request received for the site:
Lot: 138 Plan: CTN2123

EMR RESULT

The above site IS included on the Environmental Management Register.
Lot: 138 Plan: CTN2123
Address: REID ROAD
GLADSTONE4680

The site has been subject to the following Notifiable Activity or Hazardous Contaminant.
CHEMICAL MANUFACTURE OR FORMULATION - manufacturing, blending, mixing or formulating chemicals if -

- (a) the chemicals are designated dangerous goods under the dangerous goods code; and
- (b) the facility used to manufacture, blend, mix or formulate the chemicals has a design production capacity of more than 1 t per week.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Appendix D Potential Sources of Contamination

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
AN Complex	Nitric Acid Plant 1	Plant produces 60% Nitric acid and is approximately 26 years old. Any LOC from the concrete bunded area that is not remediated would result in nitric acid / ammonia entering the soil and potentially into groundwater. Comments: Any small leaks of NH₃ will be as vapour or if in liquid form will rapidly vaporise. Any meaningful contamination of the soil by Ammonia would require a significant LOC of liquid NH₃ or ammoniated oily water outside the bunded area. No such incidents are known. As such contamination by NH₃ is highly unlikely. It is noted however for completeness of the review. Observation: Some concrete damage in the middle of the building is noted most likely from steam and condensate. This damage however is not near the main source of acid within the plant i.e. the absorber. The bunded area immediately around the absorber is stainless steel lined and appears in good condition. Some minor surface damage to the surrounding concrete is noted.	Nitric Acid – Primary Ammonia – Secondary	Medium
	Nitric Acid Plant 2	Plant produces 60% Nitric acid and is approximately 24 years old. Any LOC from the concrete bunded area that is not remediated would result in nitric acid entering the soil and potentially into groundwater. Comments: Any small leaks of NH₃ will be as vapour or if in liquid form will rapidly vaporise. Any meaningful contamination of the soil by Ammonia would require a significant LOC of liquid NH₃ or ammonia oily water outside the bunded area. No such incidents are known. As such contamination by NH₃ is highly unlikely. It is noted however for completeness of the review. Observation: Some concrete damage in the middle of the building is noted most likely from steam and condensate. This damage however is not near the main source of acid within the plant i.e. the absorber. The bunded area immediately around the absorber is stainless steel lined and appears in good condition. Some minor surface damage to the surrounding concrete is noted.	Nitric Acid – Primary Ammonia – Secondary	Medium
	Nitric Acid Plant 3	Plant produces 60% Nitric acid and is approximately 12 years old. Note the plant was originally built in Denmark and relocated to the Yarwun site in 2005. Any LOC from the concrete bunded area that is not remediated would result in nitric acid entering the soil and potentially into groundwater. Comments: Any small leaks of NH₃ will be as vapour or if in liquid form will rapidly vaporise. Any meaningful contamination of the soil by Ammonia would require a significant LOC of liquid NH₃ or ammonia oily water outside the bunded area. No such incidents are known. As such contamination by NH₃ is highly unlikely. It is noted however for completeness of the review. Observation: Concrete and tiling through the majority of the building is in good condition. However there are some areas where the integrity is compromised.	Nitric Acid – Primary Ammonia – Secondary	Medium
	Neutralisation Pit	The acid neutralisation pit receives waste nitric acid from the 3 acid plants. Any leakage through the walls of the tiled pit would allow a LOC of Nitric Acid into the soil and potentially into groundwater. Comments: The neutralisation pit is part of the original plant installation. Observation: The tiles lining the pit appear in good condition however there are some areas where the integrity may be sub-optimal. In the entry section of the pit it is not possible to do a	Nitric Acid	Medium

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
		meaningful visual inspection as the tiles/grout are submerged under liquid.		
	Nitric Acid Storage Tanks	There are two above ground storage 60% Nitric Acid storage tanks and associated pumps and pipework. Any LOC from the concrete bunded area that is not remediated would result in nitric acid entering the soil and potentially into groundwater. Comments: None. Observations: The two acid storage tanks are located in large concrete bunded areas. The bund/concrete around the original acid storage tank 33-3901 shows damage to the original coating and there are locations where the concrete may have been compromised. The bund/concrete around the second acid storage tank 33-3921 is in better condition. The coating appears largely intact and there are some areas where the concrete may be compromised. There are two historical incidents (gasket failure / weld failure) where a notable amount of nitric acid was present in the concrete bund. The bund associated with NA pumps and pipework is stainless steel lined and appears in good condition.	Nitric Acid	Medium
	AN1 Building	The AN1 building manufactures Ammonium Nitrate by mixing NH3 and Nitric acid. There are numerous process operations and process vessels within the building and includes the Prill Scrubbing and Drier Scrubber bunds. Any LOC from the main process building through the floor or discharged beyond the bunding of the building may enter the soil and potentially into groundwater. It should be noted that much of the immediate area outside the AN1 bund would drain to stormwater. Comments: The ground floor is often exposed to small amounts of AN solid or AN solution of varying concentration and as such this is considered the primary contaminant. Ammonia / Aqua Ammonia and Nitric Acid is present in the building. Aqua is possible to be present on the ground floor although unlikely. Liquid NH3 is highly unlikely to ever be present on the ground floor. As such contamination by NH3 is highly unlikely. There is some known historical damage to the floor from nitric acid leaks from small bore pipework. The quantities and degree of exposure is very low compared to Ammonium Nitrate. It is noted however for completeness of the review. Observations: There are some areas of the floor in AN1 where the integrity is compromised. Floor repairs were conducted in 2012 however a further audit of the success of the repairs may be required to ensure these areas don't contribute to groundwater contamination. A review of the integrity of the stainless steel trench insert and annular space should also be conducted. There is also an in ground tank for solids redissolving (33-4501). This is a stainless steel tank contained within a concrete bund lining. There are inspection ports to check for leaks from the inner tank. There were no known issues of leakage being reported from the last inspection. There is some compromised concrete surfaces around the drier scrubber and under the drier itself.	Ammonium Nitrate – Primary Ammonia – Secondary Nitric Acid – Secondary	High
	AN2 Building	The AN2 building manufactures Ammonium Nitrate by mixing NH3 and Nitric acid. There are numerous process operations and process vessels within the building and includes the Prill scrubbing and drier scrubber bunds. Any LOC from the main process building through the floor or discharged beyond the bunding of the building may enter the soil and potentially into groundwater. It should be noted that much of the immediate area outside the AN2 bund would drain to stormwater. Comments: AN2 has been offline for a period of approximately 2 years and as such is highly unlikely to be making any contribution to recent contamination. The following comments refer to its likely state under normal operating conditions. The	Ammonium Nitrate – Primary Ammonia – Secondary Nitric Acid – Secondary	Medium

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
		ground floor is often exposed to small amounts of AN solid or AN solution of varying concentration and as such this is considered the primary contaminant. Ammonia / Aqua Ammonia and Nitric Acid is present in the building. Aqua is possible to be present on the ground floor although unlikely. Liquid NH₃ is highly unlikely to ever be present on the ground floor. As such contamination by NH₃ is highly unlikely. There is some known historical damage to the floor from nitric acid leaks from small bore pipework. The quantities and degree of exposure is very low compared to Ammonium Nitrate. It is noted however for completeness of the review. Observations: The AN2 ground floor is in relatively good condition. There is no stainless steel liner in the trench as in AN1. The original tiles and grouting are present. As the trench is under grating and partially filled by water it is not possible to provide any assessment of its current condition. There are some areas of the floor in AN2 where the integrity is compromised. There is also an in ground tank for solids redissolving (33-5501). This is a stainless steel tank contained within a concrete bund lining. There are inspection ports to check for leaks from the inner tank. In 2014 a capital project was started to replace this tank because of known leaks from the inner tank. This work is yet to be completed. The integrity of the concrete bund is not known.		
	Groundwater Treatment Plant	The GWTP Stage 1 / 2 has been installed onsite recently to treat the site's groundwater. Any LOC from the concrete area that is not remediated would result in groundwater re-entering the soil. Comments: There are numerous chemical additives used in this plant. None of them have the potential to contribute NH₃ or NO₃. Observation: All storage tanks are in concrete bunded areas. The expanded treatment plant sits on a concrete base. The facility is new and in good condition and no specific concerns are noted.	Ground Water – Primary	Low
	AN Solutions Storage	This area includes the main tank farm, fertiliser concentrator, and associated pumps to the east. The area contains AN solution of varying concentration up to a maximum of 88.5%. The area also includes some additives, namely Aqua Ammonia and Ammonia vapour. Any LOC from the bunded or tiled area that is not remediated would enter the soil and potentially groundwater. Comments: There are small dosing lines within this area coming from other locations containing Aqua Ammonia and Ammonia vapour. While it is possible for them to be present in the bunded area it is considered unlikely. There are no known incidents of significant LOC of these chemicals in this area. As such Ammonium Nitrate is considered to be the primary contaminant. During periods of high rainfall, it is possible that tanks may overflow into the bund, with the bund containing large quantities of weak AN solution before being transferred for temporary storage in ISO's for later treatment. Observations: There are compromised areas on the bund floor noted. On the eastern side of the tank farm is a bunded area containing the pumps. It is tiled and grouted in the same manner as the AN1/AN2 ground floor. The tiles are in good condition, but some loss of grouting was noted at the northern end. The trench at the rear is partially obscured by the installed grating and ¾ of the bottom is covered in silt/dirt preventing any meaningful assessment of the integrity of the trench. At the	Ammonium Nitrate – Primary Aqua Ammonia – Secondary Nitric Acid – Secondary	Medium

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
		northern end some tiles and grouting were visible and at least for those sighted appeared in reasonable condition.		
	Effluent Ponds	This area includes the two effluent ponds that are below ground and handle all effluent discharged from the AN Complex. Any leakage through the walls or floor of the ponds would allow a LOC of Effluent into the soil and potentially into groundwater. Comments: The concentration of NH₃/ NO₃ in effluent is typically as follows NH₃ < 10 mg/l and NO₃ < 30mg/l and the ponds were relined in 2009/10. Observations: The ponds and lining appear to be in good condition and no concerns were noted. The floor of both is partially obscured by particulates / sludge so a full assessment of the floor can not be made. Based on the conditions of the walls however no concerns were noted.	Effluent – Primary May contain NH ₃ or NO ₃ .	Low
	Hardstand Laydown	The Hardstand area is located to the west of the nitric acid plants. It is and has been used to store full and empty ISO's containing weak AN liquor for subsequent processing thorough the fertiliser system, as well as fertiliser grade AN solution (60%). As there is no concrete, any LOC from the ISO's would go direct to ground and potentially into groundwater. Comments: No known incidents of significant LOC to ground. Observations: No obvious sign of any spills to ground were noted however given the truck movements in the area it's likely that these may be masked relatively quickly.	Ammonium Nitrate	Low

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
	Bulk Store	The bulk store area includes the connected Bulk Store's as well as the tunnel for bulk loading and the annexe for bag storage and loading. The area contains solid Ammonium Nitrate in the form of prill. Any LOC from the concrete area that is not remediated may enter the soil and potentially groundwater. It should be noted that much of the immediate area outside the Bulk Store would drain to stormwater. Comments: It was noted by some plant operators that condensation does occur primarily on the back (east) wall of the bulk store. The presence of water does aid the movement of AN through any imperfection or crack. In terms of groundwater this would only be significant if it was through the floor. The writer was unable to assess the risk that this presents but has noted this for completeness. Observations: There are numerous patch repairs to the concrete on the main floor surface in both Bulk Store 1 and 2. There are more of these in Bulk Store 1 as it is approximately 25 years old compared to Bulk Store 2 which is approximately 12 years. It was not possible to view the entire bulk store floor due to current stock levels. Some compromise to the lining at the entrance to Bulk Store 1 was also noted. Concrete under the reclaim conveyor in Bulk Store 1 was removed and then replaced due to damage from Ammonium Nitrate approximately 5-10 years ago. The current concrete shows some damage from AN exposure but is considered in reasonable condition. The nib walls also exhibit some damage from AN as well. Within the bulk loading tunnel there is a drain were all spilt AN in the tunnel is washed as well as any accumulated prill from the western side of the bulk store. The drain flows to a sump before it is pumped away to fertiliser. This drain was lined with stainless steel some years ago. As the liner is under grating and partially covered it is not possible to assess the integrity of the drain from a visual inspection. There is also a sump underneath the weighbridge that accumulates liquor. There has been no opportunity to date to complete a visual inspection. The liquor in this sump is also pumped away to fertiliser.	Ammonium Nitrate	Medium
	Emulsion Phase Plant	The Emulsion Phase (EP) plant includes three oxidiser solution tanks (Approx 80% AN Solution) within a bund, ELK and Mono pumps for EP manufacture and a fuel blend farm within a separate bund. There is also two sheds nearby which are used for Gasser manufacture and subsequent storage. Storage of Urea also occurs in the vicinity in a dedicated shed. Any LOC from the bunded or concrete areas to the ground which is not remediated may enter the soil and potentially groundwater. Comments: None of the chemicals within the fuel blend farm can contribute to NH₃ / NO₃ contamination and hence this area is not considered a potential source. EP (Emulsion phase) in its final product form is unlikely to diffuse into the ground as it is solid and water resistant. Observations: The bund and coating around the oxidiser solution tanks is generally in good condition. No major LOC within the bund has occurred. No specific concerns noted. The Gasser sheds contain liquid solutions of Sodium Nitrite. The floors in both sheds are concrete with a bunded lip except where vehicle access is required. The concrete in both sheds was in good condition. The Urea storage shed had a concrete	Ammonium Nitrate – Primary Sodium Nitrite – Secondary Urea – Secondary	Low

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
		floor and that part of the floor which could be seen was in good condition.		
	Stormwater Retention Tank	The stormwater retention tank sits within a concrete bund and is designed to store excess stormwater. Any LOC from the tank and then subsequently the bund that is not remediated may enter the soil and potentially groundwater. Comments: The tank is normally empty and as such is unlikely to be a source of ongoing contamination Observations: The tank and bund are both relatively new and in good condition. There currently is some water in the bund so the condition of the floor of the bund could not be assessed. That aside no concerns were noted.	NH3 and NO3 contaminated stormwater.	Low
	Ammonia Bullets	The Ammonia Bullets is an area which contains three pressured bullets for storage of liquefied Ammonia. There is one 300t bullet currently in service and two 100t bullets that have been out of service for approximately 2-3 years. There are also storage tanks of Aqua Ammonia and an associated scrubber. Any significant liquid LOC from the bullets or loss of Aqua Ammonia from its bunded area and that is not remediated may enter the soil and potentially groundwater. Comments: Any small leaks of NH3 will be as vapour or if in liquid form will rapidly vaporise. Any meaningful contamination of the soil by Ammonia would require a significant LOC of liquid NH3 from one of the bullets or associated pipework. Observations: These vessels are registered pressure vessels and require routine (four yearly) inspections to confirm their integrity. No major issues with the integrity of these vessels are known. The more likely source of a LOC is leakage from flanges or specific pieces of equipment. As noted above however these are most likely to manifest as a discharge of vapour to atmosphere not liquid to the ground. There are no known major LOC incidents involving liquid Ammonia. The Aqua Ammonia storage vessels, scrubber, and bunding are all in good condition and no concerns were noted.	Ammonia	Low
	Cooling Towers	The AN cooling towers are three distinct cooling tower cells located at the southern end of the AN Complex. The water in the cooling towers has ongoing low level contamination with Ammonia and Nitrates. Any LOC from the cooling tower bunds that is not remediated may enter the soil and potentially groundwater. Comments: Typical levels of contamination in cooling water are, NH3 < 10 mg/l, NO3 < 30 mg/l. All cooling towers do exhibit some drift i.e. water droplets that may be carried by the wind away from the tower. This is a relatively small volume of water and unlikely to be significant. Observations: The only portion of the cooling tower bund that can be visually inspected is the external wall. For all three towers this was observed to be in good condition and no specific concerns were noted. The condition of the floor of the bunds and any leakage that may be occurring there cannot be assessed.		Low

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
CN Complex	CN Building	The CN building is the main process building for CN manufacture. There are numerous process operations and process vessels within the building. The ground floor contains the main tank farm, a submerged tank (solids redissolving), decontamination bay, drainage, and the effluent sump. The concrete floor is fully coated. Any LOC from the concrete or banded area that is not remediated would enter the soil and potentially groundwater. Comments: There are numerous washouts or process related activities that results in cyanide liquor coming into contact with the ground floor. In the context of this review it was assumed that the entire floor will at some point come in contact with CN contaminated liquor. Observations: The coated floor in CN covers a relatively large area. Overall its condition is reasonable but there are some areas of compromise of the coating. There are also numerous circular covers, and others have noted an electrostatic earth that provide a potential leak point. The coating was redone in 2012. There are several drains that run across the ground floor some of which are lined with plastic. As with most drains it is difficult to establish their integrity level from a visual inspection. At least one drain is concrete only. Within the pump bund on the northern side of the tank farm there is a drainage trench. Within this trench the lining appears compromised and requires maintenance. There are also the underground drains and associated pits which go to the effluent sump. These are all underground and no assessment of their condition can be made based on the visual inspection completed to date. The effluent sump is an in ground storage tank which receives cyanide contaminated waste water. The tank itself is concrete and has an inner rubber lining. There have been repairs to the rubber lining previously and the annular space is monitored for level to detect any break through. As the concrete behind the rubber cannot be seen no assessment of its condition can be made. The solids dissolving tank is an in ground dual skin stainless steel tank with a level transmitter to detect a LOC from the inner tank. This tank was upgraded from its original design which had a single skin only. Since the upgrade there have been no incidents relating to LOC from the inner tank. It's not possible to assess the condition of the outer tank visually.	Cyanide	Medium
	CN Warehouse	The CN Warehouse area includes the bulk sparge filling process, Cyanide liquor filling & Sparge maintenance area, and warehouse which includes box filling and storage. There is a coated floor in portions of this area, more details provided in the observations. A sump exists to accumulate liquids and solids which are returned to the process. A leak from these sumps to ground or a LOC from the concrete area that is not remediated may enter the soil and potentially groundwater. Comments: Observations: The sparge filling area is coated concrete which does show areas of damage to the coating where the ISO's are placed on the ground. Spillage within the sparge area drains to its own in ground sump. It's not possible to assess the integrity of the sump from visual inspection. The cyanide liquor loading area is a coated concrete pad with a central drain to send all spilt liquor to the effluent sump. The condition of this area was considered reasonable with no major concerns noted.	Cyanide	Medium

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
		Immediately adjacent is a bunded coated concrete area used for sparge maintenance which also empties to the same drain. The condition of this area was considered reasonable with no major concerns noted. The box filling equipment is located on coated concrete. The coating that is visible appears in good condition but it's not possible to see the floor or sump in underneath the box filling machine. While the floor in box filling drains to the sump some areas were noted to have stains consistent with liquor pooling on the floor and then drying out. There is also some storage of unsaleable boxed CN product on the coated floor in this area. As such it was not possible to inspect that section of flooring and assess its condition. The remainder of the warehouse contains the final boxed product which is stacked on a concrete floor most of which is not visible as it is under the boxed product. There are no known significant LOC incidents within the warehouse area.		
	CN Effluent & Stormwater Retention	This area includes the two effluent ponds as well as the CN Stormwater Basin, and Stormwater Retention Tank. A leak from the ponds, basin or tank and bunding that is not remediated would enter the soil and potentially groundwater. Comments: The levels of Free CN in effluent are low typically < 0.2 mg/l. This is low compared to other potential sources. Observations: The two effluent ponds are in ground concrete ponds. Both ponds show notable damage to the concrete. The original coating / paint is no longer visible, and the exposed concrete surface has notable pitting and the underlying aggregate is visible. This is a consequence of the concentrated acid dosing that occurs in these ponds. Comments: The stormwater tank is normally empty and as such is unlikely to be a source of ongoing contamination. The basin cannot be completely emptied due to pumping constraints. As such there will always be some stormwater present. Observation: The basin, tank and bund are all relatively new and in good condition. No specific concerns were noted. The basin is currently approximately 20% full so no assessment of the floor condition can be made however given its age and the condition of the walls it is unlikely to be an issue.	Cyanide	Medium
	Cooling Towers	This area contains the multi cell cooling tower located to the north west of the CN Main Process Building. The water in the cooling towers has ongoing low level contamination of CN. Any LOC from the cooling tower bunds that is not remediated may enter the soil and potentially groundwater. Comments: Typical levels of contamination are < 0.3 mg/l of Free CN. This is low compared to other potential sources. All cooling towers do exhibit some drift i.e. water droplets that may be carried by the wind away from the tower. This is a relatively small volume of water and unlikely to be significant. Observations: The CN cooling tower bund is built into the natural ground slope and at the western end is effectively in ground. As you move to the east the bund is increasing out of the ground and by the eastern end it is fully above ground. The only portion of the cooling tower bund that can be visually inspected is the above ground external wall. This was observed to be in good condition and no specific concerns were noted. The condition of the floor of the bund and any leakage that may be occurring there cannot be assessed.		Low

Site Area	Item of Plant	Issue/Potential Pathway	Potential Contaminants	General Risk*
	CN Isotainer Storage	This area contains the empty / full Isotainers. LOC from the isotainers and then subsequently from the concrete pad that is not remediated would then enter the soil and potentially groundwater. Comments: Difficult to assess the groundwater results for this area as there is no well that has been sampled recently which could provide an indicator of contamination from this source. Observations: This is a very large concrete area that has only recently been installed in 2012/13. The concrete is in very good condition and no major concerns were noted. No significant LOC incidents known since the concrete has been installed.	Cyanide	Low
AN Complex	Stacks	There are several stacks on the AN complex that have the potential to discharge particulate AN to atmosphere. These particulates may then settle to the ground and then ultimately enter the soil and subsequently groundwater. The relevant stacks in AN are AN1 (Drier Scrubber) AN2 (Drier Scrubber) AN OBL (Fertiliser Concentrator, Bulk Store Scrubber) Comments: Observations: AN is noted to be present on the side of the stacks at times. In heavy rain this may splash out of the bund but this would then become a point source and not diffuse. The stacks are routinely tested to ensure regulatory compliance. There are no known incidents of significant AN dust from the sources above being recorded on site.	Ammonium Nitrate	Medium
	Truck Movements	Bulk loadout and bag loadout of AN has the potential to disperse solid AN from the Bulk Store area to surrounding roads as the trucks leave the Bulk Store and exit via the southern gate. Any LOC of AN from the road that does not enter stormwater would then enter the soil and potentially groundwater Comments: Observations: Discussions with bulk store personnel indicate trucks, including tyres are washed down prior to leaving the bulk store tunnel. Incidents that have occurred typically relate to drips of potentially AN contaminated water falling on the road. Observing solid AN being left of the road was noted as being very rare.	Ammonium Nitrate	Medium
CN Complex	Stacks	There are three stacks on the CN complex that have the potential to discharge particulate CN to the atmosphere. These particulates may then settle to the ground and then ultimately enter the soil and subsequently groundwater. The relevant stacks in CN are BE1 Drier Scrubber BE2 Drier Scrubber Warehouse Cyclone Comments: Observations: There are no known incidents of significant CN dust from the sources above being recorded on site.	Cyanide	Medium

*Risk was assessed based on physical observations, known issues and current understanding on groundwater conditions.

Appendix E Summary of Analytical Groundwater Results

Table 1: Bore Details

Orica Yanwun,
1668104Table 1
Orica Yanwun - Historical Groundwater Monitoring Data
Groundwater Bore Identifications and Bore Details

Well Identification			Groundwater Unit	Location		Elevation		Well Screen Interval					Comments
Location Number	Old Well ID	New Well ID		Eastings	Northing	Ground Level (mAHD)	Top of Casing (mAHD)	Top (mbgl)	Bottom (m bgl)	Length (m)	Top (mAHD)	Bottom (mAHD)	
7	Perched Groundwater												
8	S11	P7	Perched	313232	7362710	7.55	7.50	1.00	2.00	1.00	6.55	5.55	
11		P8	Perched	313253	7362556	8.93	8.87	1.50	3.50	1.00	7.43	5.43	
12		P11	Perched	313176	7362570	6.96	7.75	0.50	2.00	1.50	6.46	4.96	
13		P12	Perched	313290	7362780	6.85	6.76	0.50	2.00	1.50	6.35	4.85	
14		P13	Perched	313311	7362774	6.87	6.79	0.50	2.00	1.50	6.37	4.87	
15		P14	Perched	313338	7362768	6.80	6.69	0.50	2.00	1.50	6.30	4.80	
16		P15	Perched	313344	7362759	6.90	6.80	0.50	2.00	1.50	6.40	4.90	
18		P16	Perched	313341	7362728	6.51	6.40	0.50	2.00	1.50	6.01	4.51	
19		P18	Perched	313365	7362843	6.96	6.86	1.00	4.00	3.00	5.96	2.96	
23		P19	Perched	313417	7362846	6.49	7.58	1.00	4.00	3.00	5.49	2.49	
28		P23	Perched	313315	7362741	6.84	6.95	1.00	4.00	3.00	5.84	2.84	
29		P28	Perched	313246	7362651	8.95	8.88	1.00	3.00	2.00	7.95	5.95	
31		P29	Perched	313220	7362577	9.00	8.92	1.00	3.50	2.50	8.00	5.50	
34		P31	Perched	313318	7362505	8.09	8.04	1.00	3.00	2.00	7.09	5.09	
35		P34	Perched	313423	7362640	6.35	6.30	0.70	2.00	1.30	5.65	4.35	
43	S43	P35	Perched	313350	7362629	7.83	7.74	0.50	2.50	2.00	7.33	5.33	
48	S48	P43	Perched			10.96	10.86	1.20	4.20	3.00	9.76	6.76	
50	S50	P48	Perched	313478	7362666	5.94	5.865	0.8	2.3	1.5	5.140	3.640	
53		P50	Perched	313441	7362566	6.36	7.18	1.00	2.50	1.50	5.36	3.86	
55	S55	P53	Perched	313387	7362488	8.02	7.79	1.00	3.00	2.00	7.02	5.02	
59	S59	P55	Perched	313335	7362565	7.94	7.85	1.50	4.00	2.50	6.44	3.94	
61	S61	P59	Perched	313294	7362584	7.98	7.94	1.50	4.00	2.50	6.48	3.98	
62	S62	P61	Perched	313559	7362744	5.14	6.11	1.00	2.50	1.50	4.14	2.64	
64		P62	Perched	313524	7362604	5.67	6.65	1.00	2.50	1.50	4.67	3.17	
65		P64	Perched	313465	7362863	6.19	6.99	1.50	3.50	2.00	4.69	2.69	
66		P65	Perched	313445	7362900	6.26	7.08	1.00	3.00	2.00	5.26	3.26	
67		P66	Perched	313433	7362939	5.64	6.48	1.50	3.50	2.00	4.14	2.14	
69		P67	Perched	313437	7362813	6.25	7.08	1.00	3.00	2.00	5.25	3.25	
70		P69	Perched	313468	7362637	6.23	7.08	1.50	3.50	2.00	4.73	2.73	
71		P70	Perched	313451	7362705	5.57	5.47	1.00	3.00	2.00	4.57	2.57	
72		P71	Perched	313480	7362710	5.75	5.71	1.00	3.00	2.00	4.75	2.75	
73		P72	Perched	313269	7362696	6.90	6.80	1.00	2.00	1.00	5.90	4.90	
74		P73	Perched	313393	7362814	6.52	7.35	1.00	4.00	3.00	5.52	2.52	
75		P74	Perched	313401	7362727	6.53	6.41	0.50	2.50	2.00	6.03	4.03	
76		P75	Perched	313393	7362787	6.34	6.30	0.50	2.50	2.00	5.84	3.84	
77		P76	Perched	313435	7362777	5.98	5.93	1.00	3.00	2.00	4.98	2.98	
78		P77	Perched	313342	7362679	6.60	6.53	0.50	2.00	1.50	6.10	4.60	
79		P78	Perched	313612	7362968	4.51	5.35	1.50	3.50	2.00	3.01	1.01	
80		P79	Perched	313598	7362906	4.58	5.41	1.00	3.00	2.00	3.58	1.58	
81		P80	Perched	313574	7362812	5.01	5.86	1.00	2.50	1.50	4.01	2.51	
82		P81	Perched	313346	7362696	6.58	6.45	0.50	2.50	2.00	6.08	4.08	
84		P82	Perched	313393	7362368	7.85	8.83	0.50	2.00	1.50	7.35	5.85	
85		P84	Perched	313447	7362597	6.16	7.00	0.50	2.50	2.00	5.66	3.66	
86		P85	Perched	313435	7362545	6.55	7.51	0.50	2.00	1.50	6.05	4.55	
87		P86	Perched	313423	7362494	7.16	8.15	0.50	1.50	1.00	6.66	5.66	
88		P87	Perched	313772	7362743	3.73	4.57	0.50	2.00	1.50	3.23	1.73	
89		P88	Perched	313543	7362688	5.65	6.41	0.50	2.50	2.00	5.15	3.15	
90		P89	Perched	313632	7362686	4.93	5.75	0.50	3.00	2.50	4.43	1.93	
92		P90	Perched	313234	7362610	8.76	8.67	0.50	2.50	2.00	8.26	6.26	
93		P92	Perched	313401	7362584	7.83	7.75	0.50	2.50	2.00	7.33	5.33	
94		P93	Perched	313328	7362535	8.06	7.96	1.00	3.00	2.00	7.06	5.06	
95		P94	Perched	313360	7362647	6.639	7.50	0.50	2.00	1.50	6.14	4.64	
96		P95	Perched	313383	7362620	7.70	7.65	1.00	3.00	2.00	6.70	4.70	
97		P96	Perched	313374	7362936	6.81	7.70	1.00	4.00	3.00	5.81	2.81	
98		P97	Perched	313321	7362951	6.99	7.89	1.00	4.00	3.00	5.99	2.99	
99		P98	Perched	313345	7362816	7.13	7.05	1.00	4.00	3.00	6.13	3.13	
100		P99	Perched	313299	7362827	7.04	6.93	1.00	3.00	2.00	6.04	4.04	
101		P100	Perched	313329	7362873	7.07	7.00	0.90	3.90	3.00	6.17	3.17	
102		P101	Perched	313266	7362785	6.91	6.80	0.39	3.90	3.51	6.52	3.01	
103		P102	Perched	313258	7362756	6.94	6.80	0.80	3.80	3.00	6.14	3.14	
104		P103	Perched	313493	7362689	5.22	6.22	1.00	2.50	1.50	5.220	3.72	
105		P104	Perched	313507	7362730	4.81	5.81	1.00	2.50	1.50	4.810	3.31	
		P105	Perched	313489	7362736	6.57	6.57	1.00	2.50	1.50	5.570	4.07	

Table 1: Bore Details

Orica Yarwun,
1668104Table 1
Orica Yarwun - Historical Groundwater Monitoring Data
Groundwater Bore Identifications and Bore Details

Well Identification			Groundwater Unit	Location		Elevation		Well Screen Interval					Comments
Location Number	Old Well ID	New Well ID		Eastings	Northing	Ground Level (mAHD)	Top of Casing (mAHD)	Top (mbgl)	Bottom (m bgl)	Length (m)	Top (mAHD)	Bottom (mAHD)	
	Shallow Groundwater												
3	S3	S3*	Perched / Shallow	15110206	2350404	4.88	5.39	2.50	5.50	3.00	2.38	-0.62	
4	S4	S4	Shallow	15110131	2350499	6.90	7.45	2.50	5.50	3.00	4.40	1.40	
5	S5	S5	Shallow	313418	7362885	6.640	7.431	3.80	5.80	2.00	2.84	0.84	
7	S7	S7*	Shallow / Deep	15110048	2352230	6.85	7.57	6.60	9.60	3.00	0.25	-2.75	
12	S12	S12	Shallow	313181	7362594	6.93	6.93	3.00	6.00	3.00	3.93	0.93	
16	S16	S16*	Shallow / Deep	313244	7362554	6.56	6.56	7.00	10.00	3.00	-0.44	-3.44	
23	S23	S23*	Perched / Shallow	313206	7362556	6.68	6.98	0.50	6.50	6.00	6.18	0.18	
28	S28	S28*	Shallow / Deep			9.10	9.00	7.00	10.00	3.00	2.10	-0.90	
33	S33	S33	Shallow	313403	7362556	7.67	7.61	5.00	8.00	3.00	2.67	-0.33	
46	S46	S46	Shallow	313515	7362809	5.47	6.20	1.00	5.00	4.00	4.472	0.472	
47	S47	S47	Shallow	313498	7362743	5.87	6.60	1.50	4.50	3.00	4.370	1.370	
48	I48	S48	Shallow	313478	7362665	5.96	6.65	4.00	6.00	2.00	1.958	-0.042	
49	S49	S49	Shallow	313455	7362629	6.14	6.94	3.00	6.00	3.00	3.142	0.142	
50	I50	S50	Shallow	313441	7362566	6.35	7.24	4.70	9.70	5.00	1.647	-3.353	
54	S54	S54	Shallow	313414	7362763	6.22	7.11	2.00	8.00	6.00	4.22	-1.78	
55		S55	Shallow	313336	7362566	7.93	7.83	5.00	8.00	3.00	2.93	-0.07	
59		S59	Shallow	313294	7362585	8.04	7.87	4.50	7.50	3.00	3.54	0.54	
61	I61	S61	Shallow	313558	7362742	5.15	6.10	4.00	8.00	4.00	1.15	-2.85	
62	I62	S62	Shallow	313524	7362603	5.66	6.51	4.00	7.00	3.00	1.66	-1.34	
64		S64	Shallow	313465	7362862	6.20	6.99	5.00	8.00	3.00	1.20	-1.81	
65		S65	Shallow	313446	7362899	6.29	7.08	5.00	8.00	3.00	1.29	-1.71	
66		S66	Shallow	313433	7362940	5.60	6.26	5.00	8.00	3.00	0.60	-2.40	
67		S67	Shallow	313438	7362814	6.22	7.05	5.00	8.00	3.00	1.22	-1.78	
68		S68	Shallow	313495	7362794	6.18	6.98	5.00	8.00	3.00	1.18	-1.82	
69		S69	Shallow	313468	7362638	6.22	7.04	5.00	8.00	3.00	1.22	-1.78	
70		S70	Shallow	313453	7362705	5.56	5.51	5.00	8.00	3.00	0.56	-2.44	
71		S71	Shallow	313480	7362711	5.71	5.62	5.00	8.00	3.00	0.71	-2.29	
72		S72	Shallow	313271	7362695	6.89	6.83	6.00	9.00	3.00	0.89	-2.11	
73		S73	Shallow	313392	7362814	6.51	7.26	5.00	8.00	3.00	1.51	-1.49	
74		S74	Shallow	313402	7362729	6.49	6.39	5.00	8.00	3.00	1.49	-1.51	
75		S75	Shallow	313392	7362787	6.33	6.28	5.00	8.00	3.00	1.33	-1.67	
76		S76	Shallow	313436	7362777	5.99	5.92	5.00	8.00	3.00	0.99	-2.02	
77		S77	Shallow	313342	7362680	6.62	6.53	5.00	8.00	3.00	1.62	-1.38	
78		S78	Shallow	313612	7362967	4.57	5.42	5.00	8.00	3.00	-0.43	-3.43	
79		S79	Shallow	313598	7362905	4.56	5.43	5.00	8.00	3.00	-0.44	-3.44	
80		S80	Shallow	313574	7362811	5.03	5.85	5.00	8.00	3.00	0.03	-2.97	
81		S81	Shallow	313346	7362695	6.56	6.45	5.00	8.00	3.00	1.56	-1.44	
84		S84	Shallow	313448	7362598	6.13	6.94	5.00	8.00	3.00	1.13	-1.87	
85		S85	Shallow	313433	7362546	6.503	6.620	4.00	6.00	2.00	2.50	0.50	
86		S86	Shallow	313424	7362495	7.13	7.95	4.00	7.00	3.00	3.13	0.13	
87		S87	Shallow	313773	7362743	3.71	4.55	5.00	8.00	3.00	-1.29	-4.29	
88		S88	Shallow	313543	7362687	5.63	6.35	5.00	8.00	3.00	0.63	-2.37	
89		S89	Shallow	313631	7362686	4.95	5.71	5.00	8.00	3.00	-0.05	-3.05	
90		S90	Shallow	313234	7362611	8.76	8.69	5.00	8.00	3.00	3.76	0.76	
91		S91	Shallow	313213	7362522	9.12	9.09	1.50	4.50	3.00	7.62	4.62	
92		S92	Shallow	313401	7362583	7.81	7.74	3.50	5.50	2.00	4.31	2.31	
93		S93	Shallow	313328	7362535	8.07	7.98	5.00	8.00	3.00	3.07	0.07	
94		S94	Shallow	313358	7362649	6.600	7.500	4.00	7.00	3.00	2.60	-0.40	
95		S95	Shallow	313385	7362620	7.71	7.64	5.00	8.00	3.00	2.71	-0.29	
96		S96	Shallow	313375	7362936	6.83	7.69	5.00	8.00	3.00	1.83	-1.17	
97		S97	Shallow	313322	7362950	6.97	7.84	5.00	8.00	3.00	1.97	-1.03	
98		S98	Shallow	313344	7362816	7.10	6.99	5.00	8.00	3.00	2.10	-0.90	
99		S99	Shallow	313299	7362827	7.04	6.93	5.00	8.00	3.00	2.04	-0.96	
100		S100	Shallow	313329	7362874	7.08	6.97	5.00	8.00	3.00	2.08	-0.92	
101		S101	Shallow	313266	7362785	6.89	6.83	5.00	8.00	3.00	1.89	-1.11	
102		S102	Shallow	313257	7362756	6.96	6.87	5.00	8.00	3.00	1.96	-1.04	
103		S103	Shallow	313493	7362688	5.21	6.21	4.50	6.00	1.50	1.71	0.21	
104		S104	Shallow	313507	7362730	5.87	5.87	4.50	6.00	1.50	1.37	-0.13	
105		S105	Shallow	313489	7362735	6.53	6.53	4.50	6.00	1.50	2.03	0.53	

Legend

- * - Well is potentially screened across two groundwater units
- Estimated GL as TOC mAHD - 1.0 based on monument cover construction

Table 2: Standing Water Levels

Orica Yarwun,
1668104Table 2
Orica Yarwun - Historical Groundwater Monitoring Data
Standing Water Levels - March 1997 to July 2017

Well Identification			Standing Water Level (mAHd)																																						
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Apr-10	Jun-10	Sep-10	Feb-11	Jun-11	Oct-11	Feb-12	Jun-12	Nov-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17			
S11	P6	Perched Groundwater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.64	-	4.27	-	4.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P7	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.83	5.79	6.37	-	-	-	6.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P8	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.54	6.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.45	-	-	-	-	-	-	-	
	P11	Perched	-	-	-	6.19	-	-	-	-	-	5.13	5.31	6.55	5.34	6.87	-	5.27	5.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P12	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.16	5.22	-	5.74	-	-	-	-	-	-	-	-	-	5.52	5.81	5.20	5.42	5.88	5.25	5.84	5.74	5.49	5.34		
	P13	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.95	5.01	-	5.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P14	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	dry	5.11	-	5.48	-	-	-	5.47	-	-	-	-	-	5.21	5.34	-	5.02	5.25	4.90	5.05	5.27	5.04	4.78		
	P15	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	dry	5.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P16	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.00	5.17	-	5.74	-	-	-	5.76	-	-	-	-	-	-	-	-	4.91	5.30	4.78	5.16	5.36	4.96	4.65		
	P18	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.96	5.34	-	5.30	-	-	5.30	-	5.26	4.88	-	-	5.19	5.28	4.70	4.99	5.14	4.84	5.12	5.28	5.02	4.76			
	P19	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.08	4.91	-	4.65	-	4.84	-	4.88	4.61	-	-	4.73	4.74	4.50	4.52	5.04	4.59	4.62	4.61	4.39	4.63	-	-		
	P23	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P28	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.26	6.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P29	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.06	6.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P31	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.39	6.10	-	6.84	-	-	-	-	-	-	-	-	-	-	-	-	6.84	-	-	-	-	-	-	-	
	P33	Perched	-	-	-	-	-	-	-	-	5.29	5.44	5.75	5.82	6.27	-	6.16	6.10	-	5.24	-	6.08	6.15	6.38	-	6.00	6.45	5.72	5.71	6.45	6.21	6.27	5.60	5.90	6.13	5.63	5.97	6.33	5.96	5.72	
	P34	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.42	5.51	-	5.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P35	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.79	5.93	DRY	6.09	5.54	5.77	6.08	-	5.69	6.04	5.50	5.40	6.13	5.83	5.99	-	5.47	5.74	5.27	5.68	5.95	5.57	5.29		
S43	P43	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	7.73	7.91	7.73	7.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S48	P48	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.57	4.57	4.73	-	4.32	-	4.91	5.07	5.04	-	4.80	4.97	4.65	-	5.06	4.93	4.96	4.60	4.71	4.07	4.63	4.74	4.99	4.67	4.45
S50	P50	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	5.53	7.15	6.01	5.81	5.21	6.02	5.86	5.87	6.02	-	5.76	6.00	5.78	-	6.09	6.58	5.63	5.60	5.84	5.78	5.38	5.55	5.81	5.64	5.76	
S53	P53	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	6.35	5.93	DRY	-	-	-	6.15	6.27	6.46	-	5.95	6.43	5.88	5.85	6.53	6.33	6.37	5.70	5.97	6.19	5.69	6.03	6.38	6.08	5.84	
S55	P55	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	5.78	6.11	6.09	6.02	5.16	6.43	6.00	6.80	6.39	-	5.99	6.34	5.66	5.63	6.49	6.24	6.29	5.30	5.80	6.17	5.53	5.07	6.28	5.90	5.67	
S59	P59	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	5.97	6.29	6.22	6.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S61	P61	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	3.88	4.61	3.99	3.87	3.82	4.22	4.14	4.23	4.18	-	4.04	4.14	4.01	3.93	4.26	4.20	4.14	4.00	4.00	4.11	4.06	4.04	4.26	4.02	3.90	
S62	P62	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	4.49	5.65	4.62	4.45	4.41	4.81	4.69	4.81	4.80	-	4.52	4.45	4.53	-	4.91	4.81	4.78	4.50	4.48	4.65	4.52	4.63	4.90	4.48	4.55	
P64	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.47	3.38	-	4.52	-	4.21	-	4.44	-	4.44	4.12	3.80	-	4.33	4.34	4.20	4.17	4.89	4.24	-	4.75	4.04	4.21			
P65	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.88	3.85	-	4.48	-	4.21	-	4.33	-	4.38	4.17	4.04	-	4.28	4.38	4.10	4.14	4.37	3.20	4.44	4.73	4.11	4.17			
P66	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.82	2.19	-	-	-	3.75	-	4.00	-	4.18	3.85	-	-	4.12	3.94	3.70	3.68	3.96	3.78	4.18	4.49	3.56	3.69			
P67	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.42	4.51	-	4.78	-	4.69	-	4.79	-	4.78	4.53	-	-	4.72	4.48	4.30	4.45	5.58	4.29	4.38	4.73	4.17	4.16			
P68	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.73	3.26	4.07	4.67	4.53	4.41	4.63	4.66	4.38	4.56	4.33	4.66	-	4.57	4.40	4.30	4.33	4.80	4.32	4.41	5.75	4.68	4.10			
P69	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.77	4.84	4.35	5.10	4.97	5.03	5.14	-	4.87	4.98	4.46	-	5.19	5.08	5.13	4.70	4.80	4.98	4.76	4.88	5.15	4.80	4.58			
P70	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.52	4.76	4.37	4.44	4.98	5.00	5.12	-	4.84	5.07	4.66	4.61	5.14	5.02	5.00	4.80	4.75	4.93	4.76	4.80	5.09	4.75	4.48			
P71	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.50	4.80	4.41	5.08	4.98	5.01	5.10	-	4.85	5.11	4.73	-	5.14	5.06	5.01	4.70	4.79	4.94	4.75	4.82	5.09	4.77	4.51			
P72	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.53	5.55	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P73	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.31	4.31	-	5.00	-	4.79	-	4.96	-	4.80	4.46	-	-	4.76	4.62	4.40	4.47	5.59	4.31	4.43	4.89	4.39	4.49			
P74	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.78	4.96	-	5.39	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P75	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.64	4.88	-	5.46	-	5.16	-	5.31	-	5.25	4.80	-	-	5.09	5.15	4.60	4.83	5.38	4.71	5.19	5.18	4.86	4.62			
P76	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.60	4.75	-	-	-	-	-	5.11	-	5.03	4.67	-	-	4.93	4.94	4.60	4.72	5.23	4.65	5.03	5.00	4.70	4.55			
P77	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.21	5.37	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P78	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.57	2.07	DRY	-	-	2.59	1.79	2.75	-	2.35	1.75	2.72	2.17	2.71	2.70	2.62	1.90	2.04	2.59	2.37	-	2.41	2.81	2.18	2.51	
P79	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.77	2.23	DRY	-	-	2.92	3.34	3.24	-	2.75	3.34	2.82	2.34	3.11	2.61	2.76	2.20	2.22	2.87	2.63	-	3.27	2.28	2.47		
P80	Perched	-	-	-	-																																				

Table 2: Standing Water Level

Table 2
Orica Yarwun - Historical Groundwater Monitoring Data
Standing Water Levels - March 1997 to July 2017

Well Identification			New Well ID			Groundwater Unit	Standing Water Level (mAHd)																																
Old Well ID	Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	May-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Apr-10	Jun-10	Sep-10	Feb-11	Jun-11	Oct-11	Feb-12	Nov-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jan-17	Jul-17				
Shallow Groundwater																																							
R24	R24	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
R26	R26	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
R27	R27	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
S2	S2	Shallow	2.52	2.68	2.40	2.29	2.13	1.31	2.47	1.52	1.51	2.74	3.15	2.49	3.54	2.75	-	1.19	-	2.84	3.13	3.27	3.40	2.59	3.36	2.72	3.40	3.23	3.20	2.47	2.20	2.19	2.78	2.80	2.12	3.35	-	2.21	
S3	S3*	Perched / Shallow	4.17	4.41	4.46	4.30	4.25	4.24	4.34	4.10	4.13	4.39	4.86	3.51	4.66	4.59	4.74	-	4.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S4	S4	Shallow	5.28	5.59	5.71	5.44	5.35	4.86	5.24	4.83	5.01	5.46	6.01	5.74	7.00	6.23	5.94	5.12	5.94	5.97	5.96	6.05	-	5.80	6.09	5.87	-	6.19	5.90	5.96	5.60	5.88	5.83	5.48	4.71	4.79	2.97	4.72	4.51
S5	S5	Shallow	4.50	3.88	3.25	3.32	3.82	2.78	3.51	3.21	2.94	2.54	4.41	2.83	4.39	3.67	-	-	-	4.98	4.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S6	S6	Shallow	5.77	4.91	5.26	5.88	4.60	3.32	4.54	3.50	3.37	5.20	6.22	5.10	6.41	5.40	4.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S7	S7*	Shallow / Deep	5.63	5.61	5.12	5.55	5.90	5.33	5.51	5.50	6.65	5.48	5.50	5.56	5.97	5.89	6.18	-	6.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S8	S8*	Shallow / Deep	6.19	6.35	6.26	6.24	6.51	6.09	6.38	6.24	6.22	8.33	6.98	6.23	7.39	6.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S9	S9	Shallow	7.98	8.34	7.68	8.21	7.1	8.20	8.86	8.40	8.10	10.08	9.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S12	S12	Shallow	-	-	-	-	5.10	5.09	4.86	4.09	5.02	5.09	5.24	5.13	5.22	5.85	5.29	5.62	-	5.79	-	-	-	-	-	-	-	-	5.65	5.94	5.30	5.56	5.95	5.41	5.94	5.81	5.58	5.40	
S13	S13	Shallow	-	-	-	-	4.98	4.91	4.74	4.91	4.73	4.87	5.03	5.12	4.93	5.29	5.00	-	5.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S14	S14	Shallow	-	-	-	-	4.72	4.73	4.61	4.66	4.41	4.30	4.82	4.89	4.78	4.77	4.91	-	5.62	-	-	-	-	-	-	-	-	5.38	5.50	4.90	5.19	5.49	5.08	5.27	5.45	5.25	4.99		
S15	S15	Shallow	-	-	-	-	4.43	4.48	4.45	4.45	4.23	4.33	4.51	4.66	4.32	4.32	-	-	-	-	-	-	-	-	-	-	-	5.38	5.50	4.90	5.19	5.49	5.08	5.27	5.45	5.25	4.99		
S16	S16*	Shallow / Deep	-	-	-	-	4.53	4.83	4.26	4.51	4.43	4.54	4.18	4.18	4.40	4.72	4.64	5.00	-	5.84	-	-	-	-	-	-	-	5.68	5.89	5.10	5.06	5.73	5.21	5.84	5.61	5.31	0.13		
S17	S17*	Shallow	-	-	-	-	5.11	5.02	4.66	4.94	4.72	4.92	5.13	5.37	5.16	5.58	5.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S18	S18	Shallow	-	-	-	-	4.43	4.53	4.58	4.42	4.14	4.40	4.74	4.87	4.76	4.88	4.87	-	5.47	-	5.62	-	-	-	-	-	5.33	5.76	5.03	5.12	5.72	5.21	4.95	5.24	5.41	5.15	4.88		
S19	S19	Shallow	-	-	-	-	3.91	3.91	3.28	3.92	3.80	4.84	3.89	3.88	3.56	5.17	3.76	-	4.65	-	4.45	-	4.58	-	4.52	4.34	-	4.44	4.47	4.20	4.27	4.87	4.29	4.35	4.81	4.15	4.37		
S23	S23*	Perched / Shallow	-	-	-	-	5.24	5.17	5.23	5.24	5.44	5.42	5.54	5.55	5.62	5.54	5.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S25	S25	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S28	S28*	Shallow / Deep	-	-	-	-	-	-	-	-	6.03	5.81	5.84	6.03	6.00	6.37	6.65	-	-	-	-	-	-	-	-	-	-	-	5.30	5.31	4.90	5.05	5.68	4.93	5.40	5.41	5.09	4.84	
S29	S29*	Shallow / Deep	-	-	-	-	-	-	-	-	6.70	6.65	5.69	6.85	7.24	7.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S30	S30*	Shallow / Deep	-	-	-	-	-	-	-	-	-	5.87	5.97	6.04	6.50	6.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S31	S31	Shallow	-	-	-	-	-	-	-	-	5.47	5.77	6.16	6.18	6.54	6.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S34	S34	Shallow	-	-	-	-	-	-	-	-	4.99	5.11	5.91	5.70	5.77	5.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S35	S35*	Perched / Shallow	-	-	-	-	-	-	-	-	4.74	4.86	5.56	-	5.54	5.92	-	4.95	6.20	5.82	5.91	6.21	-	5.83	6.15	5.42	5.42	6.27	5.97	6.13	5.40	-	-	-	-	-			
S37	S37	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S41**	S41**	Blocked Wall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S46	S46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S47	S47	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
I46	I46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S49	S49	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
I60	I60	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S51	S51	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S52	S52	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S53	S53	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S54	S54	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S55	S55	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S56	S56	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S59	S59	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
I61	I61	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S61	S61	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S62	S62	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S64	S64	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S65	S65	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S66	S66	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-</			

Legend

- * Well is potentially screened across two groundwater units
- ** Unknown well construction
- *Not Gauged*
- # The sample collected from S41 is not considered representative, therefore the result has been excluded from interpretation
- *** Blocked well

Table 3: Field pH

Orica Yanwun,
1668104Table 3
Orica Yanwun - Historical Groundwater Monitoring Data
Groundwater pH - March 1997 to July 2017

Well Identification		Groundwater																																								
Old Well ID	New Well ID	Unit	Mar-97	Dec-97	Sep-98	Dec-99	Jul-00	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Jun-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17				
Perched Groundwater																																										
	P5	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	-	-	-	6.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P7	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.69	7.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P8	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.91	6.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S11	P11	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	P12	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.55	7.32	-	-	-	6.63	-	-	-	-	9.88	9.45	10.65	10.35	9.43	9.63	9.37	9.51	9.46	-	-			
	P13	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	P14	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	6.70	-	-	-	-	7.10	-	-	-	7.31	7.15	Dry	Dry	7.03	Dry	7.42	7.02	6.85	-	-			
	P15	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	P16	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.34	6.43	-	-	-	-	6.60	-	-	-	-	-	-	-	Dry	8.12	7.33	Dry	7.79	7.11	7.15			
	P18	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.21	-	-	-	7.56	-	6.07	-	-	5.72	5.94	7.62	6.02	6.18	6.47	7.10	7.92	6.60	-	-			
	P19	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.69	-	-	6.79	-	6.96	-	7.30	-	-	6.64	6.34	6.57	6.91	6.28	6.67	7.06	7.01	6.47	-	-		
	P23	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P28	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.51	6.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P29	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.49	6.78	-	-	-	-	-	-	-	-	-	-	-	-	7.35	-	-	-	-	-	-			
S33	P31	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.66	5.44	-	-	-	-	-	-	-	-	-	-	-	-	-	6.20	-	-	6.00	-	-			
	P33	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.19	4.80	5.24	5.49	7.02	-	4.88	5.29	4.76	4.05	4.47	5.27	4.87	5.84	4.27	4.56	6.34	4.40	4.98	-	-			
	P34	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.26	4.73	4.30	-	4.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	P35	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.50	5.70	Dry	5.76	3.89	5.70	-	-	4.44	5.64	2.94	4.82	4.48	Dry	Dry	3.97	Dry	6.34	6.40	Dry	-		
S43	P43	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.19	6.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S48	P48	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.12	5.63	5.42	-	5.11	5.63	5.17	4.96	-	4.46	-	4.42	4.09	4.29	4.28	3.49	4.41	4.00	4.23	4.21	3.89	3.88	-	-
S50	P50	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	5.71	5.04	5.29	5.38	5.07	6.89	5.97	-	5.09	5.47	6.30	5.51	5.50	4.72	5.49	5.56	4.19	5.17	5.36	4.27	4.38	-	-
P53	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.13	6.82	Dry	6.23	6.06	7.15	-	5.99	6.74	5.88	6.88	6.83	7.08	6.31	7.69	5.54	Dry	6.54	6.24	5.93	-	-		
S55	P55	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	3.54	3.41	2.96	2.47	3.92	4.12	4.20	-	3.62	4.23	3.74	3.26	4.56	3.88	4.15	3.38	3.84	4.64	3.88	2.18	3.09	-	-
S59	P59	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.13	5.81	4.98	6.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S61	P61	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.14	6.85	4.50	4.31	4.41	3.30	7.16	5.13	-	5.03	5.24	4.37	4.59	4.71	5.40	4.28	5.64	4.98	4.42	5.90	4.25	4.04	-	-
S62	P62	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.42	5.63	6.41	6.04	5.71	5.95	7.78	6.40	-	5.58	6.03	5.70	5.64	6.29	4.98	5.27	5.82	6.17	6.30	6.41	6.05	-	-	
P64	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.89	6.75	-	-	7.12	-	6.49	-	5.97	-	-	7.04	5.69	6.84	5.84	7.11	6.13	1	5.89	6.06	-	-		
P65	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.14	5.90	-	-	7.36	-	6.57	-	5.97	-	-	5.25	6.94	6.85	6.53	5.88	6.04	7.62	6.14	6.22	-	-		
P66	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.15	Dry	-	-	6.85	-	5.77	-	6.23	-	-	6.06	6.84	6.23	5.86	6.00	5.85	6.19	6.07	5.91	-	-		
P67	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.13	5.71	-	-	6.38	-	6.81	-	7.96	-	-	6.72	6.45	6.89	7.87	6.28	6.83	7.05	7.01	Dry	-	-		
P68	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.50	4.75	5.29	5.77	5.18	6.56	-	6.67	6.52	6.11	6.17	6.08	6.40	6.98	6.03	5.65	6.50	7.22	6.68	6.42	-	-		
P69	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.58	4.65	4.88	5.92	4.80	5.46	-	5.74	6.42	4.89	5.15	4.79	4.29	4.02	4.52	4.00	4.30	4.84	4.20	4.14	-	-		
P70	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.54	5.22	5.02	5.86	5.01	-	5.17	5.51	5.10	4.84	4.72	4.88	5.42	5.42	4.60	4.75	5.90	4.37	5.01	-	-			
P71	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.13	5.24	5.02	5.03	5.64	5.28	-	5.18	5.86	4.93	4.74	4.74	5.22	5.13	8.15	3.44	4.67	5.21	4.60	4.64	-	-		
P72	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.03	7.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P73	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.14	6.21	-	-	6.44	-	6.89	-	6.50	-	-	6.34	6.20	6.59	6.69	6.54	6.37	6.56	6.60	6.48	-	-		
P74	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.95	6.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P75	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.12	5.89	-	-	6.22	-	6.51	-	6.61	-	-	7.01	6.29	7.70	6.62	6.94	6.60	7.22	6.67	6.55	-	-		
P76	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.87	6.44	-	-	-	-	6.60	-	6.81	-	-	6.12	6.47	7.31	6.65	6.32	6.67	7.09	6.60	6.34	-	-		
P77	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.48	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
P78	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.15	4.82	Dry	6.20	5.20	5.52	-	5.81	6.62	4.85	5.83	5.42	6.36	5.39	6.38	6.42	5.54	7.08	5.68	5.56	-	-		
P79	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.12	5.37	Dry	5.02	5.24	5.86	-	4.96	5.55	5.17	5.45	5.60	5.29	4.41	4.54	4.02	4.42	***	5.22	4.55	-	-		
P80	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.99	6.39	6.00	6.53	7.39	6.85	-	6.38	6.58	6.83	6.03	5												

Table 3: Field pH

Orica Yarwun,
1668104Table 3
Orica Yarwun - Historical Groundwater Monitoring Data
Groundwater pH - March 1997 to July 2017

Well Identification		Groundwater																																						
Old Well ID	New Well ID	Unit	Mar-97	Dec-97	Sep-98	Dec-99	Jul-00	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Jun-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17		
Shallow Groundwater																																								
R24	R24	Shallow	-	-	-	-	-	6.23	-	-	-	-	6.85	-	6.73	-	7.15	5.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
R26	R26	Shallow	-	-	-	-	-	6.58	-	-	-	-	5.63	-	6.30	-	6.12	6.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
R27	R27	Shallow	-	-	-	-	-	6.78	-	-	-	-	6.89	-	6.31	-	7.40	6.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S2	S2	Shallow	3.90	6.80	4.04	4.48	4.41	4.50	4.46	4.55	4.60	4.40	-	4.61	4.31	-	4.3	4.64	-	4.91	7.83	4.67	5.62	-	4.79	4.71	4.26	4.20	4.40	4.65	4.30	5.08	4.57	4.63	5.79	4.37	4.44	-	-	
S3	S3*	Perched / Shallow	5.30	7.30	5.90	6.39	6.05	6.30	6.92	6.47	6.31	5.79	-	6.03	6.02	-	6.86	6.09	5.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S4	S4	Shallow	5.70	6.80	5.12	5.33	5.01	5.32	5.69	5.48	5.56	4.76	-	4.39	4.34	-	4.34	4.36	4.41	4.50	4.83	6.15	4.82	-	4.71	4.59	4.46	4.36	4.61	4.56	6.28	5.61	4.93	5.04	4.71	4.63	4.84	4.71	-	
S5	S5	Shallow	5.50	6.90	5.50	5.54	5.16	5.19	5.36	6.32	-	5.52	-	5.50	5.79	-	5.65	6.09	5.76	-	-	5.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S6	S6	Shallow	6.00	7.60	5.15	5.18	5.13	5.41	5.68	6.01	5.92	5.62	-	5.34	5.40	-	5.62	5.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	S7*	Shallow / Deep	6.30	7.60	6.25	5.34	6.25	6.57	6.56	6.60	6.55	6.65	-	6.62	6.84	-	6.45	6.70	6.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S8	S8*	Shallow / Deep	6.40	8.10	5.23	6.45	6.04	6.33	6.39	6.20	6.14	6.19	-	6.08	5.87	-	6.44	6.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.25	-	-	-	-		
S9	S9	Shallow	6.20	8.10	6.31	6.05	5.78	5.46	6.14	5.61	5.96	-	-	5.19	5.40	-	5.76	5.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S12	S12	Shallow	-	-	-	7.13	7.40	7.58	7.61	7.11	7.37	7.12	-	8.39	7.48	-	7.10	7.00	6.95	-	-	-	-	-	-	-	-	-	-	9.11	9.27	9.93	9.84	9.14	8.85	8.83	8.90	8.50	-	-
S13	S13	Shallow	-	-	-	6.92	6.54	6.71	6.87	6.92	6.71	6.70	-	6.91	6.95	-	7.21	6.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S14	S14	Shallow	-	-	-	6.51	7.05	7.14	6.91	6.85	6.99	7.96	-	7.21	6.94	-	7.03	6.79	-	-	-	-	-	-	7.09	-	-	-	-	7.29	6.84	8.01	8.43	6.86	6.98	7.38	7.04	7.00	-	-
S15	S15	Shallow	-	-	-	7.31	6.61	7.36	6.72	-	-	6.93	-	7.02	6.89	-	6.77	7.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S16	S16*	Shallow / Deep	-	-	-	5.74	7.21	6.55	6.20	6.37	6.47	6.57	-	7.10	6.39	-	6.28	6.32	6.65	-	-	-	-	-	7.15	-	-	-	-	7.36	7.66	8.14	8.13	7.25	7.36	7.44	7.00	7.07	-	-
S17	S17	Shallow	-	-	-	6.67	6.66	6.46	7.05	7.35	6.80	6.54	-	6.45	6.53	-	6.53	6.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S18	S18	Shallow	-	-	-	9.47	10.97	9.17	9.35	8.81	8.58	8.27	-	10.84	9.21	-	9.26	9.33	-	-	-	-	-	-	7.34	-	6.67	6.70	-	6.24	6.07	7.72	6.48	6.87	7.01	7.22	7.76	7.45	-	-
S19	S19	Shallow	-	-	-	5.84	6.96	6.69	7.10	6.96	7.03	6.85	-	6.79	6.89	-	6.86	7.22	-	-	-	-	6.71	-	7.11	-	7.01	6.57	-	6.72	6.82	7.38	7.24	7.10	6.90	7.00	7.14	6.86	-	-
S23	S23*	Perched / Shallow	-	-	-	-	-	6.76	-	-	-	-	-	-	-	-	-	5.46	5.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S25	S25	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.46	5.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S28	S28*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	6.64	6.66	6.54	-	6.43	6.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S29	S29*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	6.62	6.65	6.55	-	6.68	6.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S30	S30*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	6.54	6.52	-	6.07	6.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S31	S31	Shallow	-	-	-	-	-	-	-	-	-	-	-	5.85	5.60	5.51	-	5.35	5.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S33	S33	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.38	4.92	4.85	5.39	5.10	7.84	-	4.83	4.89	4.49	4.27	4.25	4.78	5.52	4.79	4.11	4.45	4.95	4.50	4.61	-	-	
S34	S34	Shallow	-	-	-	-	-	-	-	-	-	-	-	5.86	5.14	5.35	-	4.34	4.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S35	S35*	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	4.87	4.66	4.06	-	4.27	4.68	-	5.57	5.35	5.94	6.52	-	5.04	5.31	5.80	5.23	5.16	4.61	5.79	5.06	4.80	6.02	6.04	4.59	5.61	-	-
S37	S37	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	6.20	-	6.17	5.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S41**	S41	Blocked Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.11*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S46	S46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	5.71	5.39	5.84	-	6.28	7.28	6.66	6.90	-	-	6.10	6.16	6.29	-	-	-	-	6.81	6.17	6.13	6.21	7.28	6.07	5.88	-	-
S47	S47	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	5.15	4.86	5.19	-	5.42	6.57	6.11	6.18	-	-	-	-	-	-	-	-	-	4.66	5.76	5.30	5.52	5.43	5.34	5.29	-	-
S48	S48	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	4.74	4.99	4.40	-	4.88	4.80	-	5.09	-	-	5.22	5.54	4.10	5.77	4.75	4.56	4.82	5.47	5.20	5.21	5.32	5.15	4.61	-	-	
S49	S49	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	4.49	5.21	5.79	6.43	-	4.49	5.51	6.79	6.43	-	-	5.70	6.22	-	-	-	5.11	5.78	5.30	5.14	6.49	4.94	4.98	-	-	
S50	S50	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	3.8	4.14	4.88	4.15	-	4.40	4.55	4.92	5.05	-	4.57	4.72	4.42	4.10	4.55	4.54	-	4.66	4.41	4.68	4.61	4.35	4.48	-	-	
S51	S51	Shallow	-	-	-	-	-	-	-	-	-	-	-	4.97	5.1	5.48	-	4.58	6.98	7.04	6.29	-	-	5.54	5.73	5.96	5.76	5.52	5.74	5.75	6.33	5.84	5.75	6.32	6.32	4.98	-	-		
S52	S52	Shallow	-	-	-	-	-	-	-	-	-	-	-	3.13	3.64	3.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S53	S53	Shallow	-	-	-	-	-	-	-	-	-	-	-	5.67	5.41	5.66	-	5.22	6.60	5.13	7.05	-	-	5.35	5.67	5.71	5.06	5.00	5.92	6.79	6.01	4.97	5.20	4.84	4.78	4.95	-	-		
S54	S54	Shallow	-	-	-	-	-	-	-	-	-	-	-	6.22	6.12	6.71	6.31	-	-	-	-	-	-	6.67	-	6.														

Orica Yarwun,
1668104

Well Identification			ORP (Eh) (mV)																																			
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Jul-00	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Jun-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17	
S11	P5	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	412	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	P7	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	388	330	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P8	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	450	401	-	-	-	-	-	-	-	-	-	-	-	-	-	339	-	-	-	-	
	P11	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P12	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	333	415	-	-	-	-	-	-	-	-	-	32	-82	-76	-41	274	3	266	217	200	
	P13	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P14	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	453	-	-	-	-	-	-	-	-	-	454	327	DRY	No data	330	Dry	497	406	463	
	P15	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P16	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	390	406	-	-	-	-	-	-	-	-	-	-	-	DRY	531	455	Dry	464	376	441	
	P18	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	358	358	-	-	-	-	-	-	260	400	-	466	360	425	373	424	334	384	398	-	
P19	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	352	-	-	298	-	292	-	-	226	377	-	353	334	438	375	371	203	347	262	355	
P23	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	445	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P28	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	374	378	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P29	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	283	277	-	-	-	-	-	-	-	-	-	-	-	-	-	330	-	-	-	-	
P31	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	453	495	-	-	-	-	-	-	-	-	-	-	-	-	-	-	204	-	-	419		
P33	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	617	549	549	332	842	442	-	-	602	340	410	545	513	423	491	426	483	340	379	363	358	
P34	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	417	478	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P35	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	430	629	Dry	462	821																	

[illegible]

Legend

- * Well is potentially screened across two groundwater units
- ** Blocked well
- *** Could not be sampled
- Not Analyzed
- ! field sheet missing
- Dry Insufficient water for sampling

Jul-17 Field results gathered during the July 2017 GME should not be regarded as accurate as the water quality measurements were calculated based on platinum and silver chloride probe conversion ($E_h = E_r + 230\text{ mV}$)

Table 5: Field DO

Orica Yarwun,
1668104Table 5
Orica Yarwun - Historical Groundwater Monitoring Data
Groundwater Dissolved Oxygen Concentrations - March 1997 to July 2017

Well Identification			Dissolved Oxygen (mg/L)																																			
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Feb-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17		
Perched Groundwater																																						
S11	P5	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P7	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.0	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P8	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	1.3	-	-	-	-	-	-	-	-	-	-	-	1.6	-	-	-	-	-		
	P11	Perched	-	-	-	-	-	-	-	-	-	-	-	1.9	-	-	-	Dry	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P12	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P13	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P14	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P15	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	P16	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	2.9	-	-	-	-	-	-	-	-	-	-	-	Dry	2.53	Dry	2.89	3.10	4.88	-	
	P18	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	2.26	2.40	Dry	2.61	2.87	1.47	-
P19	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-	-	-	-	2.0	2.9	-	2.4	0.9	2.9	1.4	1.8	1.31	1.55	2.64	1.37	-	
P20	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	2.4	4.2	-	2.0	3.7	4.0	1.7	2.9	0.78	5.10	3.01	6.28	-	
P23	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P28	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.9	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P29	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	-	-	-	
P31	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	4.14	-	-	
S33	P33	Perched	-	-	-	-	-	-	-	-	0.5	-	0.2	-	-	-	1.6	-	0.9	5.7	***	2.0	2.4	0.9	1.1	2.0	1.1	0.9	2.2	1.2	0.9	1.20	1.78	1.65	1.58	-	-	
	P34	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.0	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P35	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8	1.4	Dry	4.4	***	2.8	-	1.3	5.2	1.7	5.1	2.5	Dry	Dry	3.14	Dry	2	1	Dry	-	-	
S43	P43	Perched	-	-	-	-	-	-	-	-	-	-	-	2.4	-	-	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S48	P48	Perched	-	-	-	-	-	-	-	-	-	-	-	-	2.1	-	2.3	-	1.0	2.4	***	3.8	3.3	-	4.6	1.8	2.3	2.6	4.2	0.0	1.9	3.03	1.15	1.02	0.35	-	-	
S50	P50	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	3.8	1.1	1.3	***	3.2	2.5	1.6	3.9	5.6	3.4	1.9	4.5	0.4	2.4	1.03	1.79	1.10	1.15	-	-	
	P53	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	4.7	Dry	4.3	***	10.2	7.6	2.8	5.0	6.1	5.2	3.9	4.8	2.0	3.5	Dry	3.70	6.36	3.01	-	-	
S55	P55	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	-	3.1	1.4	3.5	1.8	***	3.5	2.6	1.3	4.3	3.7	1.6	2.3	3.3	1.4	4.2	1.95	1.85	2.89	1.18	-
S59	P59	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	-	4.8	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S61	P61	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	-	4.3	2.4	0.9	2.2	***	4.4	4.1	1.8	2.9	0.8	1.9	1.8	2.3	1.5	1.4	3.01	4.07	2.47	1.11	-
S62	P62	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	3.0	1.0	2.7	***	6.5	3.0	1.4	5.1	3.1	2.2	3.1	5.7	1.4	2.0	3.22	4.47	3.70	1.84	-	-	
	P64	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P65	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.9	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P66	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P67	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.4	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P68	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.9	2.4	0.8	2.3	***	3.5	4.5	2.1	5.7	3.4	2.7	2.2	5.4	0.8	2.7	2.94	1.61	2.20	1.01	-	-
	P69	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	3.7	0.6	2.3	***	5.5	3.7	2.2	4.2	3.1	5.6	1.8	6.1	0.0	3.4	2.20	1.02	2.95	1.70	-	-
	P70	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	0.5	0.5	1.2	***	2.4	1.6	1.2	3.1	1.3	2.1	3.3	2.3	0.0	2.3	1.78	2.03	1.54	1.19	-	-
	P71	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	0.6	0.4	0.8	***	2.4	2.2	1.7	3.2	2.7	1.7	1.0	4.3	0.0	2.3	0.85	0.46	0.80	0.47	-	-
	P72	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P73	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P74	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P75	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P76	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P77	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	P78	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	2.4	Dry	2.5	***	4.2	5.3	2.5	3.3	2.5	3.0	1.8	6.3	0.0	3.7	2.99	34.50	2.16	1.04	-	-
	P79	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	2.6	Dry	2.8	***	5.0	4.4	1.9	3.1	1.9	3.7	3.2	4.3	1.9	2.6	3.39	***	2.53	0.21	-	-
	P80	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	2.2	0.9	3.4	***	5.2	5.3	2.8	4.6	2.3	4.0	2.4	3.4	1.1	3.1	2.53	3.71	2.52	1.16	-	-
	P81	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	1.8	0.6	1.5	***	3.8	2.0	2.1	3.2	3.1	5.9	4.4	3.8	1.5	2.5	5.05	3.29	4.10	0.88	-	-
	P82	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	P83	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	P84	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.4	Dry	Dry	5.1	***	3.2	5.5	2.0	3.2	5.4	2.8	2.8	6.7	0.1	2.1	1.83	2.60	2.40	2.26	-	-
	P85	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	5.5	0.5	2.4	***	4.5	1.9	1.6	4.1	4.2	3.6	2.0	6.3	0.2	2.4	4.32	3.75	1.56	1.76	-	-
	P86	Perched	-	-	-	-	-	-	-	-</																												

Well Identification		
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Legend	
*	Well is potentially screened across two groundwater units
**	Blocked well
***	DO Measurements considered unreliable and have not been reported
****	Could not be sampled
-	Not Analysed
!	field sheet missing
Jul-17	Field results gathered during the July 2017 GME should not be regarded as accurate as the water quality meter used had internal water damage which affected the results
Dry	Insufficient water for sampling

Well Identification			New Well			EC (mS/cm)																																			
Groundwater Unit			Mar-97	Dec-97	Sep-98	Dec-99	Jul-00	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Jun-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17			
Old Well ID	New ID	Groundwater Unit																																							
Shallow Groundwater																																									
R24	R24	Shallow	-	-	-	-	-	0.5	-	-	-	-	3.6	-	2.4	-	1.3	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
R26	R26	Shallow	-	-	-	-	-	3.9	-	-	-	-	8.4	-	12.0	-	4.1	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R27	R27	Blocked Well	-	-	-	-	-	3.7	-	-	-	-	5.2	-	10.0	-	7.5	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S2	S2	Shallow	7.3	4.3	2.8	3.0	7.6	18.7	25.0	6.9	20.7	18.3	-	2.0	2.3	-	3.2	3.0	-	23.9	10.2	6.0	7.6	-	-	6.8	8.1	9.2	8.9	7.8	8.3	22.1	18.1	21.3	20.3	21.9	10.59	19.61	-	-	
S3	S3*	Shallow	1.2	1.1	7.0	0.6	0.3	0.4	0.8	1.0	1.1	1.4	-	1.6	2.9	-	2.1	1.8	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S4	S4	Shallow	0.7	0.3	2.7	0.3	0.3	0.3	0.5	0.3	0.3	0.9	-	4.5	7.0	-	3.1	1.5	1.6	1.4	1.4	1.6	1.2	-	1.1	2.1	1.7	1.1	1.3	1.2	1.6	1.2	1.3	1.5	1.7	1.65	1.81	-	-		
S5	S5	Shallow	10.9	5.0	2.0	4.3	9.0	13.0	2.6	0.6	0.7	1.6	-	19.0	18.0	-	17.5	9.5	15.9	-	-	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S6	S6	Perched / Shallow	1.0	2.5	3.8	0.3	0.3	0.3	0.5	0.7	0.8	1.8	-	1.7	2.2	-	1.1	0.8	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	S7*	Shallow	6.1	8.8	4.7	7.3	7.0	8.7	9.2	9.1	8.6	7.9	-	8.1	8.8	-	7.9	7.5	8.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S8	S8*	Shallow	4.4	5.6	2.5	0.3	0.6	5.7	7.4	0.6	3.6	3.2	-	1.3	1.0	-	0.7	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S9	S9	Shallow	11.3	1.3	13.3	0.3	0.3	0.3	0.7	0.4	0.4	0.4	-	0.4	0.4	-	0.5	0.7	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S12	S12	Shallow / Deep	-	-	-	0.7	1.0	0.7	0.3	0.9	1.0	1.0	-	1.6	1.3	-	1.3	1.3	-	-	-	-	-	-	1.6	-	-	-	-	-	1.5	1.3	3.6	1.3	0.9	2.6	1.8	2.00	1.99	-	-
S13	S13	Shallow / Deep	-	-	-	1.1	1.2	1.0	1.5	1.0	1.3	1.4	-	2.3	2.5	-	2.0	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S14	S14	Shallow	-	-	-	2.4	3.0	2.0	5.9	2.0	1.7	7.9	-	2.4	2.2	-	2.1	2.5	-	-	-	-	-	-	2.1	-	-	-	-	-	2.4	4.4	5.4	4.7	3						

Table 7: Total Cyanide

Orica Yarrowun,
1668104

Table 7
Orica Yarrowun - Historical Groundwater Monitoring Data
Groundwater Analytical Results - Total Cyanide - March 1997 to July 2017

Well Identification		Groundwater	Total Cyanide (mg/L)																																	
		Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Jun-11	Feb-12	Jun-12	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jun-15	Feb-16	Jul-16	Jan-17	Jul-17		
Old Well ID	New Well																																			
Shallow Groundwater																																				
-	R24	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.064	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R26	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R27	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.045	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S2	S2	Shallow	<0.005	<0.005	0.02	<0.005	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	-	<0.004	0.037	-	<0.005	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S3	S3*	Perched / Shallow	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	-	<0.004	0.051	-	<0.005	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S4	S4	Shallow	<0.005	<0.005	0.02	<0.005	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	-	<0.004	<0.004	-	<0.005	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S5	S5	Shallow	<0.005	<0.005	0.005	0.005	<0.005	<0.005	<0.001	<0.004	-	0.202	-	<0.004	<0.004	-	<0.005	0.005	<0.004	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S6	S6	Shallow	<0.005	<0.005	0.015	<0.005	<0.005	<0.005	<0.001	<0.004	<0.004	0.015	-	0.024*	0.012	-	<0.005	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	S7*	Shallow / Deep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.004	<0.004	2.27	-	0.057	<0.004	-	0.030	0.145	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S8	S8*	Shallow / Deep	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	-	0.281	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S9	S9*	Shallow	<0.005	<0.005	<0.005	0.005	-	<0.005	<0.001	<0.004	<0.004	-	-	1.26*	0.216	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S12	S12	Shallow	-	-	-	2.530	0.56	2.59	0.885	3.82	0.784	0.958	-	3.83	3.48	-	0.970	49.9	0.097	-	-	15.5	-	-	75.1	59.7	59.3	65.5	59.4	28.5	31.7	12.6	18.8	4.3	-	
S13	S13	Shallow	-	-	-	28.8	0.62	1.32	<0.001	4.86	1.68	2.85	-	2.29	5.55	-	1.800	5.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S14	S14	Shallow	-	-	-	4.47	2.15	2.84	8.41	4.39	1.73	142	-	1.64	8.04	-	5.4	6.59	-	-	5.01	-	-	-	2.76	2.10	2.18	2.56	2.47	1.77	4.11	4.07	3.46	4.55	-	
S15	S15*	Shallow	-	-	-	4.31	0.420	0.735	0.886	-	-	2.44	-	0.469	1.64	-	0.96	0.362	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S16	S16*	Shallow / Deep	-	-	-	<0.005	<0.005	0.605	0.003	<0.004	<0.004	0.197	-	0.01	0.013	-	0.01	1.59	<0.004	-	-	0.090	-	-	-	1.9	4.83	5.62	14.8	7.18	3.36	5.41	2.95	2.52	2.2	-
S17	S17	Shallow	-	-	-	0.305	24.400	0.340	3.08	0.121	0.406	0.824	-	0.321	0.048	-	0.02	0.281	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S18	S18	Shallow	-	-	-	<0.005	0.040	0.025	0.014	<0.004	<0.004	<0.004	-	0.540	<0.004	-	<0.005	<0.004	-	-	<0.004	<0.004	<0.004	0.018	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
S19	S19	Shallow	-	-	-	<0.005	0.005	0.005	0.003	<0.004	0.006	0.026	-	1.08	0.020	-	27*	0.012	-	-	<0.004	<0.004	0.005	<0.004	<0.004	0.006	<0.004	0.006	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
S23	S23*	Perched / Shallow	-	-	-	-	0.665	0.215	1.650	2.380	3.820	3.960	-	162*	5.590	-	0.450	637	63.9	-	-	0.071	0.02	-	-	0.066	0.105	0.242	0.346	0.675	2.29	1.46	3.74	2.07	1.77	
S25	S25	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S28	S28*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	<0.004	0.396	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S29	S29*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	<0.004	0.10	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S30	S30*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S31	S31	Shallow	-	-	-	-	-	-	-	-	-	<0.004	-	0.013	0.008	-	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S33	S33	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S34	S34	Shallow	-	-	-	-	-	-	-	-	-	0.421	-	0.246	0.011	-	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S35	S35*	Perched / Shallow	-	-	-	-	-	-	-	-	-	0.004	-	0.061	0.009	-	-	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S37	S37	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S41	S41**	Blocked Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S46	S46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.005	<0.004	-	-	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
S47	S47	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	0.01	<0.004	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
S48	S48	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	0.05	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S49	S49	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S50	S50	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S51	S51	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S52	S52	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S53	S53	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S54	S54	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S55	S55	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Table 8: Free Cyanide

Orica Yanwun,
1668104Table 8
Orica Yanwun - Historical Groundwater Monitoring Data
Groundwater Analytical Results - Free Cyanide - March 1997 to July 2017

Well Identification		Groundwater										Free Cyanide (mg/L)																							
Old Well ID	New Well ID	Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Jun-11	Feb-12	Jun-12	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jun-15	Feb-16	Jul-16	Jan-17	Jul-17	
Shallow Groundwater																																			
-	R24	Perched/ Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R26	Perched/ Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R27	Perched/ Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S2	S2	Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.01	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S3	S3*	Perched / Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.01	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S4	S4	Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.01	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S5	S5	Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	-	0.150	<0.004	<0.004	<0.01	<0.004	<0.004	-	-	<0.004	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	
S6	S6	Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	<0.004	<0.004	<0.01	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	S7*	Shallow / Deep	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	0.007	<0.009	<0.004	<0.01	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S8	S8*	Shallow / Deep	-	-	-	-	-	<0.005	<0.001	<0.004	<0.004	<0.004	<0.004	0.009	<0.004	-	<0.01	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S9	S9*	Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	-	0.006	<0.004	-	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S12	S12	Shallow	-	-	-	-	-	0.195	1.20	0.001	0.016	0.075	0.038	-	1.10	0.011	-	<0.01	29.9	0.03	-	-	0.040	-	-	13.8	3.49	11	2.72	0.325	<0.40*	<0.200*	<0.2*	0.048	0.012
S13	S13	Shallow	-	-	-	-	-	0.225	0.030	<0.001	0.061	0.244	0.234	-	0.256	0.236	-	<0.01	0.078	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S14	S14	Shallow	-	-	-	-	-	0.325	0.170	0.034	0.094	0.158	1.53	-	0.422	0.282	-	<0.01	0.236	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S15	S15*	Shallow	-	-	-	-	-	0.145	0.080	0.002	-	-	0.144	-	0.065	0.075	-	<0.01	0.016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S16	S16*	Shallow / Deep	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.008	0.011	-	0.018	0.008	-	<0.01	0.04	<0.004	-	0.009	-	-	0.069	0.044	<0.040*	0.088	0.098	<0.040*	0.048	0.148	0.044	0.023	
S17	S17	Shallow	-	-	-	-	-	13.20	0.030	<0.001	0.004	0.014	0.017	-	0.011	0.007	-	<0.01	0.098	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S18	S18	Shallow	-	-	-	-	-	0.03	<0.005	0.004	<0.004	<0.004	<0.004	-	0.056	<0.004	-	<0.01	<0.004	-	-	<0.004	<0.004	<0.004	0.012	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
S19	S19	Shallow	-	-	-	-	-	<0.005	<0.005	<0.001	<0.004	<0.004	<0.004	-	0.017	<0.004	-	<0.01	<0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
S23	S23*	Perched / Shallow	-	-	-	-	-	0.09	0.070	<0.001	0.044	0.345	0.308	-	76.0	0.221	-	0.095	154	33	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
S25	S25	Shallow	-	-	-	-	-	0.040	-	-	-	-	-	-	-	-	-	0.039	0.007	-	0.025	0.005	0.010	0.028	0.031	0.089	<0.040*	0.069	0.069	0.045	0.252	0.033	0.09	0.048	
S28	S28*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	<0.004	-	0.013	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S29	S29*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	<0.004	-	0.009	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S30	S30*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	<0.004	-	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S31	S31	Shallow	-	-	-	-	-	-	-	-	-	-	<0.004	-	0.010	0.007	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	S33	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S34	S34	Shallow	-	-	-	-	-	-	-	-	-	-	<0.004	-	<0.004	<0.004	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S35	S35*	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	<0.004	-	<0.004	<0.004	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S37	S37	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S41	S41**	Blocked Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S46	S46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.01	<0.004	-	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
S47	S47	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.01	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S48	S48	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.01	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S49	S49	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S50	S50	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S51	S51	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S52	S52	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S53	S53	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S54	S54	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.01	<0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.01	0.008	<0.01	
-	S55	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S56	S56	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	S59	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S61	S61	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S62	S62	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	S64	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004			

[illegible]

Well Identification		Groundwater	WAD Cyanide (mg/L)																																
Old Well ID	New Well ID	Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Jun-11	Feb-12	Jun-12	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jun-15	Feb-16	Jul-16	Jan-17	Jul-17	
			Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Jun-11	Feb-12	Jun-12	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jun-15	Feb-16	Jul-16	Jan-17	Jul-17	
Shallow Groundwater																																			
-	R24	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R26	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R27	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S2	S2	Shallow	<0.01	<0.01	0.09	0.02	0.08	0.11	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S3	S3*	Perched / Shallow	13.00	35.90	30.70	17.40	31.90	5.72	43.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S4	S4	Shallow	0.16	1.10	0.92	0.32	0.57	14.5	4.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S5	S5	Shallow	0.17	0.08	0.25	<0.01	0.10	<0.01	<0.01	-	-	-	-	-	-	-	-	<0.004	-	-	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	
S6	S6	Shallow	0.84	1.80	1.05	0.73	4.18	0.02	0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S7	S7*	Shallow / Deep	0.91	0.4	0.14	0.01	0.01	0.01	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S8	S8*	Shallow / Deep	5.30	3.63	7.80	0.44	7.23	10.8	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S9	S9*	Shallow	1.35	0.58	0.19	0.36	0.02	0.03	3.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S12	S12	Shallow	-	-	-	18.8	14.1	3.13	21.5	-	-	-	-	-	-	-	0.058	-	-	-	-	0.048	-	-	13.6	3.78	12.1	-	3.18	0.432	<0.400	<0.200	<0.2	0.023	0.01
S13	S13	Shallow	-	-	-	15.7	33.5	39.5	46.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S14	S14	Shallow	-	-	-	55.4	35.9	128	52.9	-	-	-	-	-	-	-	-	-	-	-	-	0.489	-	-	0.100	0.077	<0.040	0.128	0.097	0.061	0.326	0.116	0.16	0.034	
S15	S15*	Shallow	-	-	-	66.5	1.73	44.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S16	S16*	Shallow / Deep	-	-	-	0.46	0.21	0.80	1.71	-	-	-	-																						

N:\Projects\Orical\52877 Yarwun SQP Privileged and Confidential\Report\Appendix D GW Results\Table 7-9 Cyanide
Table 9 - CN WAD

Well Identification			Nitrate as N/Nitrite and Nitrate (Nox) as N (mg/L)																																		
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11*	Oct-11*	Feb-12*	Jun-12*	Feb-13*	Jun-13*	Feb-14*	Jul-14*	Oct-14*	Jan-15*	Jul-15*	Feb-16	Jul-16	Jan-17	Jul-17	
Perched Groundwater			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	P5	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P7	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P8	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28.6	6.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S11	P11	Perched	-	-	-	-	-	-	-	-	-	-	61.8	125	-	100	45.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P12	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.5	6.82	-	-	-	-	-	-	-	-	-	-	-	4.18	-	36.1	0.32	60.7	17.4	14.3	5.82
-	P13	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	34.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P14	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	16.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P15	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P16	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.8	7.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P18	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P19	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P23	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
P28	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29.2	7.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P29	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.8	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P31	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.4	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S33	P33	Perched	-	-	-	-	-	-	-	-	97.6	-	211	378	-	212	238	-	407	365	342	130	129	128	110	139	126	146	144	148	136	136	72.6	61.5	57.2	-	
-	P34	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94.6	166	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	P35	Perched	-	-	-	-																															

Table 10

Orica Yanwun - Historical Groundwater Monitoring Data

Groundwater Analytical Results - Nitrate as N/Nitrite and Nitrate (NOx) as N - March 1997 to July 2017

Well Identification			Nitrate as N/Nitrite and Nitrate (Nox) as N (mg/L)																																			
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11*	Oct-11*	Feb-12*	Jun-12*	Feb-13*	Jun-13*	Feb-14*	Jul-14*	Oct-14*	Jan-15*	Jul-15*	Feb-16	Jul-16	Jan-17	Jul-17		
Shallow Groundwater																																						
-	R24	Perched/ Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	171	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R26	Perched/ Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	R27	Perched/ Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S2	S2	Shallow	<0.01	<0.01	0.09	0.02	0.08	0.11	0.09	0.95	0.077	-	0.059	0.011	-	0.2	0.4	-	0.02	0.05	73	16.2	6.92	7.36	0.97	1.61	0.36	0.36	0.03	0.02	0.16	0.06	0.58	0.05	0.42	0.03		
S3	S3*	Perched / Shallow	13.00	35.90	30.70	17.40	31.90	5.72	43.60	78.80	126	-	194	136	-	1.22	167	214	-	-	-	-	-	-	-	-	-	-	1410	1560	1410	1240	1330	69.2	724	823		
S4	S4	Shallow	0.16	1.10	0.92	0.32	0.57	14.5	4.76	4.45	82.9	-	573	1070	-	309	198	184	178	285	0.12	135	168	158	132	112	132	123	99.2	127	139	164	172	234	228	197		
S5	S5	Shallow	0.17	0.08	0.25	<0.01	0.10	<0.01	<0.01	-	<0.01	-	0.359	0.280	-	0.75	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S6	S6	Shallow	0.84	1.80	1.05	0.73	4.18	0.02	0.59	<0.01	0.06	-	4.46	2.79	-	6.8	6.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S7	S7*	Shallow / Deep	0.01	0.04	0.14	0.14	0.01	0.03	0.49	11.1	-	0.034	0.062	-	113	2.93	<0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S8	S8*	Shallow / Deep	5.30	3.63	7.80	0.44	7.23	10.8	11.9	12.5	14.4	-	88.2	56.3	-	28	26	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-		
S9	S9*	Shallow	1.35	0.58	0.19	0.36	0.02	0.03	3.32	0.56	-	-	5.45	4.38	-	4.35	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S12	S12	Shallow	-	-	-	-	18.8	14.1	3.13	21.5	16.3	38.0	-	8.22	38.4	-	45	38.5	-	-	-	-	-	-	-	-	-	-	-	1.4	-	1.84	1.34	4.48	7.18	7.65	12.1	
S13	S13	Shallow	-	-	-	-	15.7	33.5	39.5	46.8	45.7	53.2	-	59.4	128	-	42	94.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S14	S14	Shallow	-	-	-	-	55.4	36.9	128	52.9	50.5	232.0	-	79.4	122	-	63	65.4	-	-	-	-	-	-	-	-	-	-	45.9	-	79	74	90.5	94.4	81.1	84.7		
S15	S15*	Shallow	-	-	-	-	66.5	1.73	44.0	-	-	31.2	-	18.0	17	-	16	7.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S16	S16*	Shallow / Deep	-	-	-	-	0.46	0.21	0.80	1.71	5.09	0.893	-	3.30	0.457	-	0.82	1.07	-	-	-	-	-	-	-	-	-	-	16.5	22.5	33.3	8.11	13.4	22.6	22.7	14.4		
S17	S17	Shallow	-	-	-	-	14.6	6.13	11.4	5.21	7.90	11.1	-	22.7	44.4	-	1.66	32.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S18	S18	Shallow	-	-	-	-	3.47	5.51	0.99	4.16	3.02	4.42	-	3.32	5.78	-	9	3.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S19	S19	Shallow	-	-	-	-	0.08	0.26	0.11	0.13	0.19	0.166	-	0.868	0.507	-	2.21	0.46	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	0.19	0.02	0.04	0.02	0.02	0.12		
S23	S23*	Perched / Shallow	-	-	-	-	15.8	31.8	17.8	23.1	52.8	-	60.0	66.1	-	2.08	70.3	30.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S25	S25	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S28	S28*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.93	0.366	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-		
S29	S29*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.560	0.308	-	-	-	-	-	-	-	-	-	-	-	-	1.73	-	-	-	-	-		
S30	S30*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.6	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S31	S31	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.17	11.5	23.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S33	S33	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	205	185	342	282	219	85.1	212	122	126	81.9	153	133	158	163	140	142	103	69.2	74.4	102		
S34	S34	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	127	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S35	S35*	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	374	294	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S37	S37	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	310	90.6	-	537	92.6	348	50.7	26.2	43.3	30.1	130	31.4	79.3	126	49.5	47.5	31.5	103	45.5	25.3	26.6	
S41	S41**	Blocked Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.22 ^b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S46	S46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	152	159	160	-	116	39.6	121	20.4	53.1	34.5	69.5	-	50.9	268	131	90.1	265	29	239	8.63		
S47	S47	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	271	143	-	165	168	267	178	**	**	**	**	**	267	757	674	475	566	283	357	56	
S48	S48	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	107	168	-	138	592	-	177	243	304	267	226	579	1040	1760	1660	552	512	367	623	523	
S49	S49	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.54	1.68	0.14	-	2.08	0.42	3.12	0.27	4.64	0.82	**	**	**	0.24	0.05	0.15	0.17	0.36	0.55	1.23	1.2	
S50	S50	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.61	3.72	0.18	0.07	0.25	0.08	0.15	0.94	2.04	0.02	0.05	0.07	0.11	0.09	**	0.1	0.11	0.07	0.33	0.11	0.17	0.06
S51	S51	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33	11	45	-	18.6	0.43	2.44	0.05	6.04	6.33	5.26	4.00	5.61	4.88	11.4	7.63	3.82	5.36	0.91	0.78	0.38	6.12
S52	S52	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.933	0.94	1.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S53	S53	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	172	148	-	218	275	257	140	206	138	158	13	138	122	121	190	227	160	425	281	230	183
S54	S54	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	0.28	34.6	54.1	-	-	-	-	-	-	-	-	-	7.96	13.8	10.5	5.36	11	3.54	4.9	8.02	
S55	S55	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	336	74	502	2180	3000	403	444															

Table 10: Nitrate as N/Nitrite and Nitrate (NOx) as N

Orica Yarwun,
1668104

Table 10
 Orica Yarwun - Historical Groundwater Monitoring Data
 Groundwater Analytical Results - Nitrate as N/Nitrite and Nitrate (NOx) as N - March 1997 to July 2017

Well Identification		Groundwater Unit	Nitrate as N/Nitrite and Nitrate (Nox) as N (mg/L)																																	
Old Well ID	New Well ID		Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11*	Oct-11*	Feb-12*	Jun-12*	Feb-13*	Jun-13*	Feb-14*	Jul-14*	Oct-14*	Jan-15*	Jul-15*	Feb-16	Jul-16	Jan-17	Jul-17
Deep Groundwater																																				
D1	D1	Deep	<0.01	9.57	0.22	0.02	0.03	<0.01	0.06	<0.01	0.036	-	0.049	0.011	-	0.28	< 0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D10	D10	Deep	0.01	0.62	0.19	0.06	0.03	5.70	1.29	0.35	0.016	-	0.033	0.014	-	0.63	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D36	D36	Deep	-	-	-	-	-	-	-	-	-	-	-	0.045	-	0.24	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
D38	D38	Deep	-	-	-	-	-	-	-	-	-	-	-	0.029	-	0.19	0.666	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
D42	D42	Deep	-	-	-	-	-	-	-	-	-	-	-	2.53	-	1.28	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
D44	D44	Deep	-	-	-	-	-	-	-	-	-	-	-	0.210	-	0.82	0.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
D40	D40	Decommissioned	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
D45	D45	Decommissioned	-	-	-	-	-	-	-	-	-	-	-	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S32	S32	Decommissioned	-	-	-	-	-	-	-	-	40.5	-	86.1	97.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
S39	S39	Decommissioned	-	-	-	-	-	-	-	-	-	-	-	5.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Legend
 * Well is potentially screened across two groundwater units
 ** Blocked well
 - Not Analysed
 # The sample collected from S41 is not considered representative, therefore the result has been excluded from interpretation
 DRY Insufficient water for sampling
 Pre Jun-14 data: Exceeds ANZECC 2000 95% guideline for fresh water ecosystems (7.2 mg/L)
 Post Jun-14 data: Exceeds Groundwater Monitoring Plan (JBS&G, 25 October 2016) Assessment Criteria (3.8 mg/L)
 * From February 2011 analysed as Nitrite and Nitrate as NOx

Orica Yarwun,
1668104

[illegible]

Table 11: Ammonia

Orica Yanwun,
1668104Table 11
Orica Yanwun - Historical Groundwater Monitoring Data
Groundwater Analytical Results - Ammonia as N - March 1997 to July 2017

Well Identification			Ammonia as N (mg/L)																																				
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17			
Shallow Groundwater																																							
	R24	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	R26	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	R27	Perched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S2	S2	Shallow	0.19	0.13	0.07	0.24	0.10	0.05	0.06	0.22	0.14	-	0.05	0.198	-	-	0.088	0.07	-	0.38	0.21	0.22	0.26	0.43	<0.10	0.54	0.82	0.42	0.30	0.21	0.2	0.22	0.16	0.19	0.15	0.49	0.24		
S3	S3*	Perched / Shallow	0.03	0.28	0.93	1.99	0.65	0.58	0.16	0.03	3.54	-	31.20	17.6	-	25	6.64	37.3	-	-	-	-	-	-	-	-	-	-	160	967	976	811	706	666	589	615			
S4	S4	Shallow	0.04	0.05	0.05	0.03	<0.01	<0.01	0.01	<0.01	6.66	-	58.5	35.0	-	20	8.03	5.82	5.19	4.48	0.28	4.02	4.88	4.10	4.02	2.19	4.12	4.76	4.09	4.79	3.95	5.58	8.2	8.17	13.5	11			
S5	S5	Shallow	0.13	0.11	0.04	0.06	0.05	0.07	0.06	-	-	-	0.174	-	0.234	0.143	0.221	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S6	S6	Shallow	0.15	0.06	0.03	0.03	<0.01	<0.01	0.07	<0.01	0.10	-	0.774	0.082	-	-	0.055	0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S7	S7*	Shallow / Deep	0.11	0.07	0.05	0.03	0.01	<0.01	0.03	<0.05	<0.01	-	-	-	-	-	4.3	0.11	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S8	S8*	Shallow / Deep	0.13	0.05	0.05	0.04	<0.01	<0.01	0.05	<0.01	0.028	-	-	-	-	-	0.123	0.07	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-			
S9	S9*	Shallow	0.47	0.55	0.10	0.03	<0.01	0.07	0.04	0.02	-	-	29.0	0.295	-	-	0.09	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S12	S12	Shallow	-	-	-	-	11.9	17.6	3.21	6.44	3.03	0.372	-	40.7	16	-	10	26.6	-	-	-	-	-	-	-	-	-	-	90.1	-	35.3	58.8	36.1	32.5	39.3	33.8			
S13	S13	Shallow	-	-	-	-	13.0	1.06	4.43	3.53	1.67	0.955	-	12.0	1.91	-	0.37	2.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S14	S14	Shallow	-	-	-	-	20.4	16.9	14.5	3.43	3.22	277	-	0.113	5.90	-	1.87	3.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S15	S15*	Shallow	-	-	-	-	9.69	37.3	8.45	-	-	-	-	6.99	-	-	0.229	3.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S16	S16*	Shallow / Deep	-	-	-	-	0.03	0.03	<0.01	<0.01	0.03	<0.01	-	-	-	-	0.142	0.11	-	-	-	-	-	-	-	-	-	-	-	8.01	7.86	6.49	4.04	3.12	4.14	2.09	1.55		
S17	S17	Shallow	-	-	-	-	1.94	0.93	2.43	0.03	0.03	<0.01	-	-	-	-	0.067	0.042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S18	S18	Shallow	-	-	-	-	0.07	0.01	0.37	0.04	0.06	0.024	-	0.302	0.879	-	1.05	1.68	-	-	-	-	-	-	-	-	-	-	-	0.17	0.29	0.11	0.12	0.29	0.02	0.09	0.09		
S19	S19	Shallow	-	-	-	-	0.07	<0.01	0.05	0.14	0.01	0.142	-	0.195	0.014	-	0.057	0.04	-	-	-	-	-	-	-	-	-	-	-	0.02	0.01	0.02	0.04	0.1	0.01	0.04	<0.01		
S23	S23*	Perched / Shallow	-	-	-	-	-	0.11	0.10	0.28	2.32	7.92	-	54.9	28.5	-	0.045	< 0.010	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S25	S25	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S28	S28*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	1.42	0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S29	S29*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S30	S30*	Shallow / Deep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.169	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S31	S31	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.11	0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S33	S33	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.9	18.6	52	26.9	27.2	4.20	34.8	22.8	30.9	18.4	22.2	26.6	23.4	30.3	30.4	21	27.1	14.3	17.6	22.7		
S34	S34	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67	48.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S35	S35*	Perched / Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	99.3	31.8	44.8	19.1	17.0	13.1	21.0	44.2	11.8	11.0	63.1	13.4	5.94	13.8	7.19	7.19	7.19	6.14	7.6			
S37	S37	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.036	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S41	S41*	Blocked Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.053*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
S46	S46	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.68	0.048	0.06	-	0.24	0.23	0.09	0.02	0.38	1.33	0.58	-	1.84	2.85	15.8	8.2	14	57.8	6.24	1.48		
S47	S47	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.49	17	17.3	-	71.9	10.2	13.5	19.8	-	-	-	-	-	-	-	-	-	-	-			
S48	S48	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	34	35.6	-	45.2	57.9	-	25.0	97.9	85.2	193	159	265	633	1160	1130	111	56.6	53.4	116	131	135
S49	S49	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.105	0.14	-	0.44	0.34	0.07	0.33	0.11	0.52	-	-	0.12	<0.01	0.22	<0.01	0.07	<0.01	0.12	0.06		
S50	S50	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	0.727	0.28	0.4	0.21	0.46	0.33	0.30	0.52	0.10	0.07	0.12	0.09	0.21	-	0.07	0.13	0.06	0.07	0.06	0.17	0.07
S51	S51	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.077	0.068	0.15	-	18.6	0.61	0.37	0.36	0.06	0.04	0.01	<0.01	0.02	0.02	<0.01	0.04	0.03	0.11	<0.05	0.04	0.04	<0.01
S52	S52	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.087	0.19	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S53	S53	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	11	35.1	-	16.5	23.3	22.1	6.52	17.9	14.2	13.4	18.8	14.6	14.4	13.6	27.6	38.1	19	121	55.3	61.4	39.1
S54	S54	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	0.087	0.09	0.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S55	S55	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	31	57.6	3430	915	258	194	237	283	208	162	229	550	1130	977	550	69.7	281	164	59.5		
S56	S56	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.62	7.2	3.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S59	S59	Shallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
S61	S61	Shallow	-	-	-	-	-	-	-	-	-																												

Table 11
Orica Yarwun - Historical Groundwater Monitoring Data
Groundwater Analytical Results - Ammonia as N - March 1997 to July 2017

Well Identification			Ammonia as N (mg/L)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Old Well ID	New Well ID	Groundwater Unit	Mar-97	Dec-97	Sep-98	Dec-99	Mar-01	May-02	May-03	Jun-04	May-05	Aug-05	Jul-06	Jul-07	Oct-07	Jan-08	Aug-08	Jun-09	Nov-09	Jun-10	Sep-10	Feb-11	Oct-11	Feb-12	Jun-12	Feb-13	Jun-13	Feb-14	Jul-14	Oct-14	Jan-15	Jul-15	Feb-16	Jul-16	Jan-17	Jul-17																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Legend
 * Well is potentially screened across two groundwater units
 ** Blocked well
 - Not Analysed
 # The sample collected from S41 is not considered representative, therefore the result has been excluded from interpretation
 Dry Insufficient water for sampling
 Pre-Jun-14 data: Exceeds ANZECC 2000 95% guideline for fresh water ecosystems (0.9 mg/L)
 Post-Jun-14 data: Exceeds Groundwater Monitoring Plan (JESS&G, 25 October 2016) Assessment Criteria (3.8 mg/L)

Appendix F Summary of Analytical REMP Results

Table 1 - Water Quality Parameters

Project number: 53025

Project name: Orica Yarwun Receiving Environment Monitoring Program



Location ID	Date:Time Measured	Dissolved Oxygen	Electrical Conductivity	ORP	Eh	pH	Temperature	Comments
		(mg/L)	(uS/cm)	(mV)	(mV)		(oC)	
Round 1								
ANP1/2	12/12/14 9:10 AM	NA	179	175	405	8.12	25.0	
CC								No flow
REMP1	12/12/14 9:30 AM	NA	355	191	421	6.67	25.2	
REMP2	12/12/14 9:23 AM	NA	294	237	467	6.90	25.2	
REMP3	12/12/14 9:55 AM	NA	659	210	440	6.65	25.2	
REMP4	12/12/14 9:50 AM	NA	506	210	440	7.03	25.3	
REMP5								No flow
REMP6	12/12/14 9:14 AM	NA	310	206	436	7.73	25.4	Duplicate/triplicate collected
REMP7	12/12/14 9:00 AM	NA	146	162	392	7.80	26.5	
REMP8								
Round 2								
ANP1/2	22/01/15 11:10 AM	NA	147	160	390	8.23	24.4	
CC	22/01/15 9:25 AM	NA	135	145	375	8.35	24.7	
REMP1	22/01/15 9:05 AM	NA	188	165	395	6.82	24.0	
REMP2	22/01/15 9:15 AM	NA	161	177	407	7.04	24.1	
REMP3	22/01/15 10:50 AM	NA	239	188	418	7.38	24.1	
REMP4	22/01/15 10:45 AM	NA	268	189	419	7.42	24.0	
REMP5	22/01/15 10:40 AM	NA	119	186	416	7.49	24.8	
REMP6	22/01/15 11:00 AM	NA	245	176	406	7.75	24.5	Duplicate/triplicate collected
REMP7	22/01/15 11:20 AM	NA	66	199	429	6.75	24.8	
REMP8	22/01/15 9:45 AM	NA	141	198	428	7.12	24.1	
Round 3								
ANP1/2	27/01/16 3:25 PM	5.29	346	NA	NA	7.39	30.3	DO is not accurate. Probe has now been changed and working correctly.
CC	27/01/16 3:40 PM	7.22	202	NA	NA	8.20	28.8	DO is not accurate. Probe has now been changed and working correctly.
REMP1	27/01/16 4:05 PM	4.03	2076	NA	NA	7.66	28.7	Just flowing over base of culvert to mud flats
REMP2	27/01/16 3:42 PM	6.22	205	NA	NA	8.24	28.8	Appeared to be very little flow other than that from CC1
REMP3	27/01/16 4:18 PM	2.14	1209	NA	NA	6.90	27.2	Low flow, and only recent as a couple of hours earlier this point was dry.
REMP4	27/01/16 3:32 PM	2.20	450	NA	NA	6.98	27.7	
REMP5	-	-	-	NA	NA	-	-	No flow in to here
REMP6	27/01/16 3:28 PM	2.95	703	NA	NA	7.12	29.9	
REMP7	27/01/16 3:20 PM	2.71	206	NA	NA	6.87	30.6	Low flow
REMP8	27/01/16 3:55 PM	6.36	258	NA	NA	8.84	31.2	Low flow; deep 'red' in colour.
Round 4								
ANP1/2	07/03/16 10:21 AM	6.65	189	136	366	7.71	24.9	
CC	07/03/16 9:19 AM	6.84	234	161	391	6.73	25.4	
REMP1	07/03/16 9:39 AM	6.43	246	166	396	6.76	24.3	
REMP2	07/03/16 9:50 AM	6.52	249	165	395	6.84	24.7	
REMP3	07/03/16 10:03 AM	5.43	401	164	394	7.00	24.7	
REMP4	07/03/16 10:00 AM	4.86	430	163	393	6.89	24.7	
REMP5	07/03/16 9:55 AM	81.40	321	183	413	6.78	26.2	
REMP6	07/03/16 10:10 AM	6.47	324	159	389	7.34	25.1	
REMP7	07/03/16 10:26 AM	6.33	86	172	402	7.57	24.9	
REMP8	07/03/16 10:38 AM	6.44	368	190	420	7.40	24.8	
Round 5								
ANP1/2	17/03/17 3:55 PM	NA	154	NA	NA	8.66	NA	
CC	17/03/17 4:45 PM	NA	104	NA	NA	8.76	NA	
REMP1	17/03/17 4:25 PM	NA	11700	NA	NA	7.18	NA	Just flowing over base of culvert to mud flats. Would be water from high tides as well as storm.
REMP2	17/03/17 4:35 PM	NA	167	NA	NA	8.40	NA	Appeared to be very little flow other than that from CC1.
REMP4	17/03/17 4:10 PM	NA	464	NA	NA	5.98	NA	
REMP6	17/03/17 4:00 PM	NA	245	NA	NA	8.16	NA	
REMP7	17/03/17 3:50 PM	NA	113	NA	NA	7.84	NA	Low flow
REMP8	17/03/17 5:05 PM	NA	205	NA	NA	8.34	NA	Low flow; deep 'red' in colour.
Round 6								
ANP1/2	19/03/17 12:50 PM	NA	472	NA	NA	7.69	25.5	Low flow
CC	19/03/17 12:35 PM	NA	80	NA	NA	8.77	25.3	CC1 overflowing
REMP1	19/03/17 1:25 PM	NA	702	NA	NA	6.84	24.6	Higher flow than 17 March, but not over complete breadth of cuvert
REMP2	19/03/17 12:40 PM	NA	310	NA	NA	6.74	25.0	Greater flow here than on 17 March, including significant flow in addition to CC1
REMP3	19/03/17 1:10 PM	NA	674	NA	NA	6.57	24.2	
REMP4	19/03/17 1:15 PM	NA	660	NA	NA	6.30	24.2	Higher flow than 17 March.
REMP6	19/03/17 1:00 PM	NA	750	NA	NA	7.38	25.3	
REMP7	19/03/17 12:55 PM	NA	87	NA	NA	7.35	25.1	Low flow, but greater than 17 March
REMP8	19/03/17 1:50 PM	NA	512	NA	NA	9.21	25.9	Low flow; not as much a 'deep red' colour as 17 March.
Round 7								
ANP1/2	22/03/17 11:00 AM	7.61	239	185.2	415	7.54	NA	
CC	22/03/17 12:14 PM	8.30	221	228.9	459	7.47	NA	
REMP1	22/03/17 11:55 AM	7.03	113	221.7	452	6.80	NA	
REMP2	22/03/17 11:40 AM	7.54	166	206.7	437	7.21	NA	
REMP3	22/03/17 11:28 AM	6.92	186	205.1	435	7.24	NA	
REMP4	22/03/17 11:31 AM	6.28	318	221.1	451	6.91	NA	
REMP5	22/03/17 11:21 AM	7.02	276	214.4	444	7.12	NA	
REMP6	22/03/17 11:10 AM	7.66	201	196.2	426	7.47	NA	
REMP7	22/03/17 10:58 AM	7.08	66	204.6	435	6.70	NA	
REMP8	22/03/17 12:24 PM	7.16	218	211.5	442	6.92	NA	

Notes:

ID = identification

mg/L = milligrams per litre

L = litres

uS/cm = microsiemen per centimetre

mV = millivolts

°C = degrees Celsius

NA DO probe not functioning

Table 2 - Summary Laboratory Results

Project number: 53025

Project name: Orica Yarwun Receiving Environment Monitoring Program



Location ID	Sample Date	Suspended Solids	Nitrate/Nitrite (as N)	Ammonia (as N)	Total Cyanide	Free Cyanide	Weak Acid Dissociable Cyanide
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANP1/2	12/12/2014	32	6.60	2.77	NS	NS	NS
	22/01/2015	56	3.08	0.92	<0.004	<0.004	<0.004
	27/01/2016	52	2.01	0.67	<0.004	<0.004	<0.004
	7/03/2016	128	4.90	0.98	0.005	<0.004	<0.004
	17/03/2017	402	3.68	0.78	<0.004	<0.004	<0.004
	19/03/2017	20	5.70	0.84	<0.004	<0.004	<0.004
	22/03/2017	26	5.17	0.89	<0.004	<0.004	<0.004
CC	12/12/2014	No flow	No flow	No flow	No flow	No flow	No flow
	22/01/2015	18	0.45	0.23	<0.004	<0.004	<0.004
	27/01/2016	86	0.38	0.22	<0.004	<0.004	<0.004
	7/03/2016	12	1.05	0.23	0.013	<0.004	<0.004
	17/03/2017	133	0.81	0.41	0.007	<0.004	<0.004
	19/03/2017	54	0.63	0.27	<0.004	<0.004	<0.004
	22/03/2017	11	1.45	0.22	0.590	<0.004	<0.010
REMP1	12/12/2014	481	0.79	0.05	NS	NS	NS
	22/01/2015	69	<0.01	0.02	<0.004	<0.004	<0.004
	27/01/2016	15	1.24	0.24	<0.004	<0.004	<0.004
	7/03/2016	56	0.42	0.06	<0.004	<0.004	<0.004
	17/03/2017	35	0.28	0.27	<0.004	<0.004	<0.004
	19/03/2017	16	11.10	0.25	<0.004	<0.004	<0.004
	22/03/2017	57	<0.01	0.02	<0.004	<0.004	<0.004
REMP2	12/12/2014	429	0.02	0.02	NS	NS	NS
	22/01/2015	38	<0.01	0.03	<0.004	<0.004	<0.004
	27/01/2016	76	0.38	0.12	<0.004	<0.004	<0.004
	7/03/2016	30	1.07	0.05	<0.004	<0.004	<0.004
	17/03/2017	81	0.76	0.27	0.006	<0.004	<0.004
	19/03/2017	48	<0.01	0.13	<0.004	<0.004	<0.004
	22/03/2017	35	0.13	0.05	<0.004	<0.004	<0.004
REMP3	12/12/2014	24	23.0	1.89	NS	NS	NS
	22/01/2015	28	15.80	3.67	<0.004	<0.004	<0.004
	27/01/2016	6	22.60	1.31	<0.004	<0.004	<0.004
	7/03/2016	25	24.60	7.04	<0.004	<0.004	<0.004
	19/03/2017	6	26.70	0.60	<0.004	<0.004	<0.004
	22/03/2017	23	6.71	1.84	<0.004	<0.004	<0.004
REMP4	12/12/2014	32	40.0	7.43	NS	NS	NS
	22/01/2015	31	19.50	2.94	<0.004	<0.004	<0.004
	27/01/2016	17	27.30	3.85	<0.004	<0.004	<0.004
	7/03/2016	16	28.70	6.18	<0.004	<0.004	<0.004
	17/03/2017	10	40.00	7.14	<0.004	<0.004	<0.004
	19/03/2017	5	50.30	8.14	<0.004	<0.004	<0.004
	22/03/2017	20	9.12	2.20	<0.004	<0.004	<0.004
REMP5	12/12/2014	No flow	No flow	No flow	No flow	No flow	No flow
	22/01/2015	7	6.48	1.53	<0.004	<0.004	<0.004
	27/01/2016	No flow	No flow	No flow	No flow	No flow	No flow
	7/03/2016	12	12.80	2.32	<0.004	<0.004	<0.004
	22/03/2017	<5	16.30	1.91	<0.004	<0.004	<0.004
REMP6	12/12/2014	148	14.7	3.58	NS	NS	NS
	22/01/2015	49	17.90	5.81	<0.004	<0.004	<0.004
	27/01/2016	26	53.20	11.80	<0.004	<0.004	<0.004
	7/03/2016	29	18.50	6.30	<0.004	<0.004	<0.004
	17/03/2017	271	8.35	2.70	<0.004	<0.004	<0.004
	19/03/2017	9	48.50	16.60	<0.004	<0.004	<0.004
	22/03/2017	12	9.02	2.94	<0.004	<0.004	<0.004
REMP7	12/12/2014	29	0.66	0.11	NS	NS	NS
	22/01/2015	33	0.03	0.04	<0.004	<0.004	<0.004
	27/01/2016	27	0.02	0.07	<0.004	<0.004	<0.004
	7/03/2016	10	0.01	0.02	<0.004	<0.004	<0.004
	17/03/2017	24	0.03	0.15	<0.004	<0.004	<0.004
	19/03/2017	18	0.16	0.02	<0.004	<0.004	<0.004
	22/03/2017	15	<0.01	<0.01	<0.004	<0.004	<0.004
REMP8	12/12/2014	NS	NS	NS	NS	NS	NS
	22/01/2015	32	0.11	0.02	<0.004	<0.004	<0.004
	27/01/2016	81	0.23	0.22	<0.004	<0.004	<0.004
	7/03/2016	18	0.14	0.05	<0.004	<0.004	<0.004
	17/03/2017	101	0.69	0.14	<0.004	<0.004	<0.004
	19/03/2017	16	0.49	0.02	<0.004	<0.004	<0.004
	22/03/2017	9	0.12	0.02	<0.004	<0.004	<0.004

Notes:

ID = identification

mg/L = milligrams per litre

L = litres

NS = not sampled

Results for major cations/anions, DOC, TOC and COD provided in Laboratory Certificates (Appendix A)

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